Bk5	R: Calculations **C: Experiments and probability** *E: Symmetry*	*Lesson Plan 113*

Activity		***Notes***

1

Factorisation

a) Let's factorise 141 and list its positive factors. Ps dictate what T should write. Class agrees/disagrees.

BB: 141 = 3 × 47 Positive factors: 1, 3, 47, 141

b) Let's define 141 in different ways.

(e.g. 141% of 100, 1.41 × 100, 200 – 59, 1 third of 423, etc.)

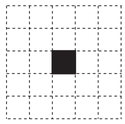
6 min

Notes: Whole class activity. Reasoning, agreement, praising. At a good pace. Ps may use a calculator. Extra praise for creativity.

2

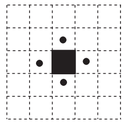
Probability 1

A computer has drawn a unit square on a squared grid. BB:



a) It draws another unit square at random adjacent to one of the sides of the first square.

i) How many possible outcomes are there? BB:

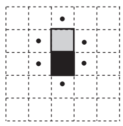


(4) Ps show them on the diagram.

ii) What is the probability of this? BB:  $\left(\frac{1}{4}\right)$

b) It draws another unit square at random adjacent to one of the sides of the 2 squares in a).

i) How many possible outcomes are there? (6) BB:

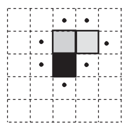


Ps show them on the diagram.

ii) What is the probability of this? BB:  $\left(\frac{1}{6}\right)$

c) It draws another unit square at random adjacent to one of the sides of the 3 squares in b).

i) How many possible outcomes are there? (7) BB:



Ps show them with dots on diagram.

ii) What is the probability of this? BB:  $\left(\frac{1}{7}\right)$

14 min

Notes: Whole class activity. Grid drawn on BB or use enlarged copy master or OHP [or use a computer]. At a good pace. Discussion, reasoning, agreement, praising. Feedback for T. (Possible outcomes are shown by dots on diagrams). Ps can continue the pattern of questioning if there is time.

3

Probability 2

If I toss a 1 p coin and a 2 p coin at the same time, what is the probability of each of these outcomes?

Ps first list all possible outcomes in *Ex. Bks*. before writing each probability on slates or scrap paper and showing to T on command. Ps answering correctly explain to Ps who were wrong.

a) Two Heads $\left(\frac{1}{4}\right)$ [possible outcomes: HH, HT, TH, TT]

b) One Head and one Tail $\left(\frac{2}{4} = \frac{1}{2}\right)$ [HH, HT, TH, TT]

c) At least one Head or at least one Tail (1) [Certain]

d) Two Tails. $\left(\frac{1}{4}\right)$ [HH, HT, TH, TT]

19 min

Notes: Whole class activity. Responses shown in unison. Reasoning, agreement, praising. Demonstrate with 2 coins if disagreement . Agree that if we assume that the coins are fair (unbiased), each outcome has an equal probability. Feedback for T

Bk5

Lesson Plan 113

Activity		*Notes*
4	**Probability 3** If I toss a 1 p coin, a 2 p coin and a 50 p coin at the same time, what is the probability of each of these outcomes? Ps first list the possible outcomes in *Ex. Bks*., then show the probability on command. Ps answering correctly explain to Ps who were wrong. a) Three Tails $\left(\frac{1}{8}\right)$ (As 8 possible outcomes: BB: b) One Tail and two Heads $\left(\frac{3}{8}\right)$ c) One Head and two Tails $\left(\frac{3}{8}\right)$ d) Three Tails. $\left(\frac{1}{8}\right)$	Whole class activity Responses shown in unison Reasoning, agreement, praising Demonstrate with 3 coins if disagreement . Agree that if we assume that the coins are fair (unbiased), each outcome has an equal probability. Extra praise if Ps notice the symmetry of these outcomes. Feedback for T

Outcome

1p	2p	50p
H	H	H
H	H	T
H	T	H
T	H	H
H	T	T
T	H	T
T	T	H
T	T	T

25 min

5 *Book 5, page 113*

Q.1 a) Read: *Toss two equal coins 20 times and note the outcomes in this table.*

Ps have 2 coins of the same type on desks. Set a time limit or keep class together on the tosses. Ps check that their totals sum to 20.

e.g.

Outcome	Tally of 20 throws	Pupil Totals
H H	𝍸 |	6
H and T	𝍸 ||||	9
T T	𝍸	5
		(20)

Notes: Individual (or paired) work, monitored, helped, corrected. Tables drawn on BB or use enlarged copy master or OHP. At a fast pace. Praising, encouragement only

b) Read: *Collect the data for the whole class and fill in the table.*

Elicit that n in the table means the total number of tosses, i.e. no. of Ps in class $\times$ 20. (e.g. for a class of 25 Ps, $n = 25 \times 20 = 500$.) Ps write agreed total in table.

Ps dictate results to T and T writes on BB. Class keep a running total for each outcome in *Ex. Bks*. or on calculators. After checking that the sub-totals sum to 500 (if not, T makes adjustments), Ps write agreed outcome totals in table in *Pbs*.

Set a time limit for Ps to complete the relative frequency column (as a fraction, decimal or percentage).

Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

BB: e.g.

(for a class of 25 Ps)

Outcome	Class Totals	Relative frequency
H H	123	$\frac{123}{500} = 0.246 \rightarrow 24.6\%$
H and T	253	$\frac{253}{500} = 0.506 \rightarrow 50.6\%$
T T	124	$\frac{124}{500} = 0.248 \rightarrow 24.8\%$
	$n = 500$	

Notes: Whole class activity in gathering the data. Discussion, agreement. At a fast pace (or T inputs data on a computer calculator, with running totals visible to class). Individual work, monitored, helped (or whole class calculation of decimals and % if number of Ps in class make the conversions difficult, using calculators if necessary). Reasoning, agreeement, self-correction, praising

Bk5		*Lesson Plan 113*
Activity		***Notes***
5	(Continued) c) Read: *What do you notice about the results? Write a sentence about it.* Allow Ps 2 or 3 minutes to think and write in *Pbs* or *Ex.Bks*. T chooses a P to read his/her sentence. Who agrees? Who wrote something else? etc. Elicit that: •. Relative frequencies of 'HH' and 'TT 'are almost equal and are about half of the relative frequency for 'H and T'. • Relative frequency of 'HH' and of 'TT' is about 25% or $\frac{1}{4}$, and relative frequency of 'a Head and a Tail' is about 50% or $\frac{1}{2}$. T: Even if the two coins look the same to us and we do not take note of which coin had which Head or Tail, in a probability experiment the two coins are really different from each other and the possible outcomes are the same outcomes as when we used two different coins: BB: HH, HT, TH, TT, each with equal probability. Elicit that the probability of each outcome is $\frac{1}{4} = 0.25 \rightarrow 25\%$ which is close to the relative frequencies in the experiment. *33 min*	Individual trial first, monitored Discussion, reasoning, agreement, praising Ask Ps why they think this is. Agree that the frequency for 'a Head and a Tail' in the table is really the sum of the frequency for HT and the frequency for TH. [If possible, T confirms the finding with a computer simulation.]
6	***Book 5, page 113*** Q.2 a) Read: *Toss 3 equal coins 40 times and note the outcomes in this table.* Ps have 3 coins of the same type on desks. Set a time limit or keep class together on the tosses. (Ps could be asked to make predictions first and write at LHS of table.) Ps check that their totals sum to 40. e.g. b) Read: *Collect the data for the whole class and fill in the table.* First elicit the value of n in the table (no. of Ps in class × 40). (e.g. for a class of 25 Ps, $n = 25 \times 40 = 1000$.) Ps write agreed total in table in *Pbs*. Ps dictate results to T and T writes on BB. Class keep a running total for each outcome in *Ex. Bks.* or on calculators. After checking that the sub-totals sum to 1000 (if not, T makes adjustments), Ps write agreed outcome totals in table in *Pbs*. Set a time limit for Ps to complete the relative frequency column (as a fraction, decimal and percentage). Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.	Individual (or paired) work, monitored, helped, corrected Tables drawn on BB or use enlarged copy master or OHP Encourage a fast pace. Checking, praising Whole class activity in gathering the data [or T (P) could input data on a computer calculator, with running totals visible to class] Individual work, monitored, helped in completing table (or whole class calculation of decimals and %, using calculators where necessary) Reasoning, agreeement, (self-correction), praising

Outcome	Tally of 40 throws	Pupil Totals
H H H	𝍸 ||	7
1 H and 2 T	𝍸 𝍸 𝍸 |	16
2 H and 1 T	𝍸 𝍸 ||	12
T T T	𝍸	5
		(40)

Bk5		*Lesson Plan 113*

Activity

6

(Continued)

BB: (e.g. for a class of 25 Ps)

Outcome	Class Totals	Relative frequency
H H H	127	$\frac{127}{1000} = 0.127 \rightarrow 12.7\%$
1 H and 2 T	373	$\frac{373}{1000} = 0.373 \rightarrow 37.3\%$
2 H and 1 T	376	$\frac{376}{1000} = 0.376 \rightarrow 37.6\%$
T T T	124	$\frac{124}{1000} = 0.124 \rightarrow 12.4\%$
	n = 1000	

c) Read: *What do you notice about the results? Write a sentence about it.*

Allow Ps 2 or 3 minutes to think and write in *Pbs* or *Ex. Bks*.
T chooses a P to read his/her sentence. Who agrees? Who wrote esomething else? etc. (If no P is on the right track, T says something and asks Ps what they think about it.) Elicit that:

- The relative frequencies of 'HHH' and 'TTT 'are almost equal and are about 1 third of the relative frequency for '1 Head and 2 Tails' and for '2 Heads and 1 Tail'.
- The relative frequency of 'HHH' and of 'TTT' is between 12% and 13%, and the relative frequency of 'a Head and 2 Tails' and of '2 Heads and a Tail' is each between 37% and 38%.

How could you explain it? T asks several Ps what they think, then summarises in a clear way. e.g.

T: Even if all 3 coins look the same to us and we do not note which coin had which Head or Tail, in a probability experiment the 3 coins are really different from one other and the possible outcomes are the same outcomes as if we had used three different coins :

BB: HHH, HHT, HTH, THH HTT, THT, TTH, TTT,

each with equal probablity.

Elicit that this equal probability is $\frac{1}{8} = 0.125 \rightarrow 12.5\%$

which is very close to the relative outcomes in the experiment.

45 min

Notes

Individual trial first, monitored, helped

Whole class discusion

Involve several Ps.

Agreement, praising

Agree that the frequency for 'a Head and 2 Tails' in the table is really the sum of the frequencies for HTT, THT and TTH, and similarly for '2 Heads and a Tail'.

[If possible, T confirms the finding with a computer simulation.]

Bk5

R: Calculations

C: Experiments and probability

E: Symmetry

Lesson Plan 114

Activity		*Notes*

1

Factorisation

a) Let's factorise 142 and list its positive factors. Ps dictate what T should write. Class agrees/disagrees.

BB: 142 = 2 × 71 Positive factors: 1, 2, 71, 142

b) Let's define 142 in different ways.

(e.g. 142% of 100, 14.2 × 10, 20 × 7 + 2 , 1 fifth of 710, etc.)

6 min

Notes:
Whole class activity
Reasoning, agreement, praising
At a good pace
Ps may use a calculator.
Extra praise for creativity

2

Possible outcomes

a) Imagine that we are throwing a *white* dice and a *red* dice at the same time. Let's list the possible outcomes in these tables.

Ps could list outcomes in *Ex. Bks* (or fill in prepared tables) then dictate results to T in a logical order.

BB:

white	*red*	*white*	*red*	*white*	*red*	*white*	*red*	*white*	*red*	*white*	*red*
1	1	2	1	3	1	4	1	5	1	6	1
1	2	2	2	3	2	4	2	5	2	6	2
1	3	2	3	3	3	4	3	5	3	6	3
1	4	2	4	3	4	4	4	5	4	6	4
1	5	2	5	3	5	4	5	5	5	6	5
1	6	2	6	3	6	4	6	5	6	6	6

Agree that there are 6 × 6 possible outcomes, and each has an equal chance of happening. Discuss the symmetry of the data.

b) What is the probability of throwing:

i) a 2 and a 6 $\left(\frac{2}{36} = \frac{1}{18}\right)$ [Outcomes: (2, 6) or (6, 2)]

ii) a 2 or a 6 $\left(\frac{20}{36} = \frac{5}{9}\right)$ [as 20 of the outcomes include either 2 or 6, or both]

iii) not a 5? $\left(\frac{25}{36}\right)$ [as 25 of the outcomes do not include 5]

10 min

Notes:
Whole class activity
(or short individual trial first, monitored, under a time limit)
Tables drawn on BB or use copy master from *LP 109/3*
(Ps could have copies too.)
Agreement, (self-correction), praising
Feedback for T
Whole class activity
Ps show responses on scrap paper or slates in unison on command.
Ps answering correctly explain to Ps who were wrong.
[or $\frac{36}{36} - \frac{11}{36} = \frac{25}{36}$]

3

Book 5, page 114

Q.1 Read: *Throw two equal dice 72 times and write the data in the table.*

Set a time limit. Ps throw the 2 dice, keeping a tally for each outcome. After checking that they have 72 tally marks, Ps write totals and relative frequencies for their own data.

T could ask some Ps to say what they notice about their data.

Elicit the value of n for the class data, collect the pupil data and check that the totals match n (T makes adjustments if necessary).

Then elicit the relative frequencies as fractions, decimals and percentages. Ps say the fraction, work out the decimal (to 4 decimal places) using a calculator and also give the percentage. Class agrees/disagrees. Ps write agreeed values in table in *Pbs*.

Notes:
Individual (or paired) work, monitored, helped, corrected
Table drawn on BB or use enlarged copy master or OHP
(Ps who do not finish the experiment can do so while class data is collected, with the help of quicker Ps.)
Whole class activity
At a fast pace
Ps keep running totals for each outcome in *Ex. Bks* or on a calculator.

Bk5

Lesson Plan 114

Activity		*Notes*

3 (Continued)

BB: e.g. for a class of 30 Ps:

<table>
<tr><th>Outcome</th><th>Tally of 72 throws</th><th>Pupil Total</th><th>Relative frequency</th><th>Class Total</th><th>Relative frequency</th><th>≈</th></tr>
<tr><td>1 and 1</td><td>|</td><td>1</td><td>$\frac{1}{72}$</td><td>63</td><td>≈ 0.0292</td><td>(2.92%)</td></tr>
<tr><td>1 and 2</td><td>𝍸</td><td>5</td><td>$\frac{5}{72}$</td><td>118</td><td>≈ 0.0546</td><td>(5.46%)</td></tr>
<tr><td>1 and 3</td><td>|||</td><td>3</td><td>$\frac{3}{72}$</td><td>120</td><td>≈ 0.0556</td><td>(5.56%)</td></tr>
<tr><td>1 and 4</td><td>||||</td><td>4</td><td>$\frac{4}{72}$</td><td>123</td><td>≈ 0.0569</td><td>(5.69%)</td></tr>
<tr><td>1 and 5</td><td>||||</td><td>4</td><td>$\frac{4}{72}$</td><td>117</td><td>≈ 0.0542</td><td>(5.42%)</td></tr>
<tr><td>1 and 6</td><td>||</td><td>2</td><td>$\frac{2}{72}$</td><td>121</td><td>≈ 0.0560</td><td>(5.60%)</td></tr>
<tr><td>2 and 2</td><td>|||</td><td>3</td><td>$\frac{3}{72}$</td><td>58</td><td>≈ 0.0269</td><td>(2.69%)</td></tr>
<tr><td>2 and 3</td><td>𝍸 |</td><td>6</td><td>$\frac{6}{72}$</td><td>116</td><td>≈ 0.0537</td><td>(5.37%)</td></tr>
<tr><td>2 and 4</td><td>||||</td><td>4</td><td>$\frac{4}{72}$</td><td>121</td><td>≈ 0.0560</td><td>(5.60%)</td></tr>
<tr><td>2 and 5</td><td>|||</td><td>3</td><td>$\frac{3}{72}$</td><td>120</td><td>≈ 0.0556</td><td>(5.56%)</td></tr>
<tr><td>2 and 6</td><td>𝍸</td><td>5</td><td>$\frac{5}{72}$</td><td>118</td><td>≈ 0.0546</td><td>(5.46%)</td></tr>
<tr><td>3 and 3</td><td>||</td><td>2</td><td>$\frac{2}{72}$</td><td>59</td><td>≈ 0.0273</td><td>(2.73%)</td></tr>
<tr><td>3 and 4</td><td>||||</td><td>4</td><td>$\frac{4}{72}$</td><td>121</td><td>≈ 0.0560</td><td>(5.60%)</td></tr>
<tr><td>3 and 5</td><td>|||</td><td>3</td><td>$\frac{3}{72}$</td><td>121</td><td>≈ 0.0560</td><td>(5.60%)</td></tr>
<tr><td>3 and 6</td><td>||||</td><td>4</td><td>$\frac{4}{72}$</td><td>120</td><td>≈ 0.0556</td><td>(5.56%)</td></tr>
<tr><td>4 and 4</td><td></td><td>0</td><td>0</td><td>60</td><td>≈ 0.0278</td><td>(2.78%)</td></tr>
<tr><td>4 and 5</td><td>𝍸</td><td>5</td><td>$\frac{5}{72}$</td><td>120</td><td>≈ 0.0556</td><td>(5.56%)</td></tr>
<tr><td>4 and 6</td><td>||||</td><td>4</td><td>$\frac{4}{72}$</td><td>119</td><td>≈ 0.0550</td><td>(5.50%)</td></tr>
<tr><td>5 and 5</td><td>|||</td><td>3</td><td>$\frac{3}{72}$</td><td>61</td><td>≈ 0.0282</td><td>(2.82%)</td></tr>
<tr><td>5 and 6</td><td>||||</td><td>4</td><td>$\frac{4}{72}$</td><td>124</td><td>≈ 0.0574</td><td>(5.74%)</td></tr>
<tr><td>6 and 6</td><td>|||</td><td>3</td><td>$\frac{3}{72}$</td><td>60</td><td>≈ 0.0278</td><td>(2.78%)</td></tr>
<tr><td></td><td>n =</td><td>72</td><td>n =</td><td>2160</td><td></td><td></td></tr>
</table>

What do you notice? Ask several Ps. Elicit that:

- The frequencies of pairs of equal numbers are about the same.
- The frequencies of pairs of different numbers are also the same.
- The relative frequency of throwing a pair of equal numbers, e.g. (1, 1), is about half the relative frequency of throwing a pair of different numbers, e.g. (1, 2).

Why do you think that is so? T asks several Ps what they think, then asks other Ps if they agree. T summarises in a clear way. e.g.

T: Even if the two dice look the same to us and we do not make a note of which dice had which number, in a probability experiment we must think of the two dice as being different from each other.

So there is only 1 way of throwing two equal numbers such as (1, 1), but there are 2 ways of throwing two different numbers, for example (1, 6) or (6, 1).

Show the outcomes listed in the previous acitivity and compare them with the table above. Ps could point out those missing. Agree that there are 36 different outcomes, each with equal probability (and not 21, as in table).

Elicit that, e.g.

$$p\,(\text{ throwing two 1s}) = \frac{1}{36} \approx 0.0278 \rightarrow 2.78\%$$

$$\text{e.g. } p\,(\text{throwing a 1 and a 6}) = \frac{2}{36} \approx 0.0556 \rightarrow 5.56\%$$

which are very close to the relative frequencies in the experiment.

35 min

Whole class discusion

Involve several Ps.

Agreement, praising

Extra praise if Ps are on the right track

[If possible, T confirms the findings using a computer simulation.]

Bk5		*Lesson Plan 114*

Activity		*Notes*
4	***Book 5, page 114, Q.2***	Whole class activity

Read: *Using the class data in Question 1, fill in this table where we deal with the* **sum** *of the two numbers thrown.*

Let's fill in the Frequency row in our table first.

Look at the outcomes column in the table in Q.1. Which of them have a total of zero? (None, as it is impossible!) Which of the outcomes give a total of 1? (Again, none as it is impossible!)

Which outcomes give a total of 2? (Only one outcome: 1 and 1) How many times did the class throw it? (63) This is its frequency. Let's write it in the Q.2 table. T wries on BB and Ps write in *Pbs*.

Which outcomes give a total of 3? (Again, only one outcome: 1 and 2) How many times did the class throw it? (118) This is its frequency. Let's write it in the Q.2 table. T writes on BB and Ps write in *Pbs*.

Which outcomes give a total of 4? (1 and 3; 2 and 2) How many times did the class throw them? (120 + 58 = 178) Let's write this frequency in the Q.2 table. T writes on BB and Ps write in *Pbs*.

Continue in this way, with Ps dictating the different ways of making each sum, finding such outcomes in the Q.1 table, adding their frequencies where necessary and writing total in the Q.2 table.

BB:

Sum Outcomes	e.g. Frequencies from sample table:
$4 = 1+3 = 2+2$	$120 + 58 = 178$
$5 = 1+4 = 2+3$	$123 + 116 = 239$
$6 = 1+5 = 2+4 = 3+3$	$117 + 121 + 59 = 297$
$7 = 1+6 = 2+5 = 3+4$	$121 + 120 + 121 = 362$
$8 = 2+6 = 3+5 = 4+4$	$118 + 121 + 60 = 299$
$9 = 3+6 = 4+5$	$120 + 120 = 240$
$10 = 4+6 = 5+5$	$119 + 61 = 180$
$11 = 5+6$	124
$12 = 6+6$	60
13 (Not possible!)	0

How many times did the class throw the 2 dice altogether? (e.g. 2160)

Let's fill in the relative frequency row, writing a fraction first, then we can use our calculators to work it out as a percentage. T helps Ps to round the percentage (to the nearest tenth, i.e. to 1 decimal place) if necessary.

T writes agreed relative frequencies on BB and Ps write in *Pbs*.

If we throw 2 dice at the same time, how many different outcomes are possible? (36) (T could show the 6 tables again as a reminder.)

How many of the outcomes will give a sum of 0 (1, 2, 3, etc.)? What do you think is the probability of throwing this sum? Ps dictate the fraction, then T and Ps use a calculator to work out the percentage. (Divide numerator by denominator and multiply by 100.)

T writes agreed probability as a fraction and as a percentage on the BB and Ps write it in table in *Pbs*.

A sample table for a class of 30 Ps is shown on the following page.

Notes:

Tables drawn on BB or use enlarged copy master or OHP

T leads Ps through each step. Once Ps understand what to do, allow Ps to take over, with T intervening only where necessary.

Discussion, reasoning, agreement, praising

Keep up a good pace.

(Instead of doing one at a time as opposite, Ps could write the different ways of obtaining each sum below the table in their *Pbs* first as individual work, then review with the whole class.)

Ps use own tables of outcomes if they have them.

Reasoning, checking by rest of class, agreement, praising

Bk5		*Lesson Plan 114*

Activity

4

(Continued)

Sample table for a class of 30 Ps:

BB; e.g. $n = 2160$

Sum	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Frequency	0	0	63	118	178	239	297	362	299	240	180	124	60	0
Relative frequency	0	0	$\frac{63}{2160}$ 2.9%	$\frac{118}{2160}$ 5.5%	$\frac{178}{2160}$ 8.2%	$\frac{239}{2160}$ 11.1%	$\frac{297}{2160}$ 13.8%	$\frac{362}{2160}$ 16.8%	$\frac{299}{2160}$ 13.8%	$\frac{240}{2160}$ 11.1%	$\frac{180}{2160}$ 8.3%	$\frac{124}{2160}$ 5.7%	$\frac{60}{2160}$ 2.8%	0
Probability	0	0	$\frac{1}{36}$ 2.8%	$\frac{2}{36}$ 5.6%	$\frac{3}{36}$ 8.3%	$\frac{4}{36}$ 11.1%	$\frac{5}{36}$ 13.8%	$\frac{6}{36}$ 16.7%	$\frac{5}{36}$ 13.8%	$\frac{4}{36}$ 11.1%	$\frac{3}{36}$ 8.3%	$\frac{2}{36}$ 5.6%	$\frac{1}{36}$ 2.8%	0

What do you notice about the table? e.g.

- The relative frequencies are very close to the probabilities.
- The frequencies and relative frequncies for a sum of 2 and a sum of 12, (and for 3 and 11, 4 and 10, 5 and 9, 6 and 8) are very similar.)

Draw Ps' attention to the symmetry of the data if necessary.

45 min

Notes

Of course, the table formed by T and Ps will match the Ps' own experimental data!

Discussion, agreement, praising

[If possible, use a computer simulation to show the symmetry and to confirm that the more times that the experiment is done, the closer the relative frequencies are to the probabilities]

Bk5

R: Calculations
C: Experiments and probability
E: Unfair games

Lesson Plan
115

Activity		*Notes*

1

Factorisation

a) Let's factorise 143 and list its positive factors. Elicit that 114 is not divisible by:

- 2 (as it is an odd number), nor by
- 3 (as 143 = 150 − 7, and 7 is not a multiple of 3), nor by
- 5 (as it does not have units digt 5 or 0), nor by
- 7 (as 143 = 140 + 3, and 3 is not a multiple of 7)

but that it is exactly divisible by 11. (143 ÷ 11 = 13)

BB: 143 = 11 × 13 Positive factors: 1, 11, 13, 114

b) Let's define 143 in different ways. Class checks that definitions are correct and are unique to 143.

(e.g. 143% of 100, 14300 ÷ 100, 1000 – 857, 20 × 7 + 3, etc.)

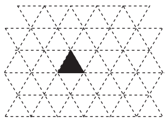
8 min

Notes: Whole class activity. Discussion, reasoning, agreement, praising. Extra praise if Ps remember how to reason for the first few prime numbers, but accept divisions too. At speed, in good humour. Extra praise for creativity!

2

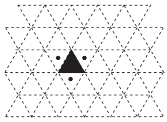
Probability

A computer has drawn a unit triangle on a triangular grid. BB:



a) It draws another unit triangle at random adjacent to one of the sides of the first triangle.

i) How many possible outcomes are there? BB:

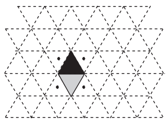


(3) Ps show them on the diagram.

ii) What is the probability of this? BB:  $\left(\frac{1}{3}\right)$

b) It draws another unit triangle at random adjacent to one of the sides of the 2 triangles in a).

i) How many possible outcomes are there? BB:

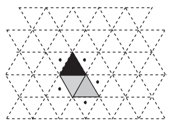


(4) Ps show them on the diagram.

ii) What is the probability of this? BB:  $\left(\frac{1}{4}\right)$

c) It draws another unit triangle at random adjacent to one of the sides of the 3 triangles in b).

i) How many possible outcomes are there? BB:



(5) Ps show them with dots on diagram.

ii) What is the probability of this? BB:  $\left(\frac{1}{5}\right)$

14 min

Notes: Whole class activity. Grid drawn on BB or use enlarged copy master or OHP [or use a computer]. At a good pace. Ps could show responses in unison on scrap paper or slates. Discussion, reasoning, agreement, praising. Feedback for T. Ps can continue the pattern of questioning if there is time.

Bk5		*Lesson Plan 115*

Activity | *Notes*

3

Book 5, page 115

Q.1 Read: *Using the class data in Question 1 on page 114, fill in this table where we deal with the* ***product*** *of the numbers thrown. Calculate in your exercise book.*

Make sure that Ps understand what to do, then set a time limit for filling in the frequencies. Ps list the outcomes which match each product in *Ex. Bks*, find them in the Q.1 table on page 114, add up the frequencies and write their total in the table.

Review with whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes discussed and corrected. e.g.

Product Outcomes	Frequencies (from sample table):
$1 = 1 \times 1$	e.g. 63
$2 = 1 \times 2 = 2 \times 1$	118
$3 = 1 \times 3 = 3 \times 1$	120
$4 = 1 \times 4 = 4 \times 1 = 2 \times 2$	123 + 58 = 181
$5 = 1 \times 5 = 5 \times 1$	117
$6 = 1 \times 6 = 6 \times 1 = 2 \times 3 = 3 \times 2$	121 + 116 = 237
$8 = 2 \times 4 = 4 \times 2$	121
$9 = 3 \times 3$	59
$10 = 2 \times 5 = 5 \times 2$	120
$12 = 2 \times 6 = 6 \times 2 = 3 \times 4 = 4 \times 3$	118 + 121 = 239
$15 = 3 \times 5 = 5 \times 3$	121
$16 = 4 \times 4$	60
$18 = 3 \times 6 = 6 \times 3$	120
$20 = 4 \times 5 = 5 \times 4$	120
$24 = 4 \times 6 = 6 \times 4$	119
$25 = 5 \times 5$	61
$30 = 5 \times 6 = 6 \times 5$	124
$36 = 6 \times 6$	60

How many times did the class throw the 2 dice altogether? (e.g. 2160)

Let's fill in the relative frequency row, writing a fraction first, then we can use our calculators to work it out as a percentage. T helps Ps to round the percentage (to the nearest tenth, i.e. to 1 decimal place) if necessary.

T writes agreed relative frequencies on BB and Ps write in *Pbs*.

If we throw 2 dice at the same time, how many different outcomes are possible? (36) (T could show the 6 tables again as a reminder.)

How many of the outcomes will give a product of 1 (2, 3, 4, etc.)? What do you think is the probability of throwing this sum? Ps dictate the fraction, then T and Ps use a calculator to work out the percentage. (Divide numerator by denominator and multiply by 100.)

T writes agreed probability as a fraction and as a percentage on the BB and Ps write it in table in *Pbs*.

The sample table for a class of 30 Ps is shown on the following page.

Notes:

Individual work, monitored, helped

(or all done as a whole class activity if Ps are unsure)

Table drawn on BB or use enlarged copy master or OHT

Discussion, reasoning, agreement, praising

Keep up a good pace.

(If done as a whole class activity, T leads Ps through each step to start.

Once Ps understand what to do, allow Ps to take over, with T intervening only where necessary.)

Ps use own tables of outcomes if they have them.

Reasoning, checking by rest of class, agreement, praising

Bk5

Lesson Plan 115

Activity		*Notes*

3 (Continued)

Sample table for a class of 30 Ps, each throwing 2 dice 72 times:

BB; e.g.

$n = 2160$

Product	1	2	3	4	5	6	8	9	10	12	15	16	18	20	24	25	30	36
Frequency	63	118	120	181	117	237	121	59	120	239	121	60	120	120	119	61	124	60
Relative frequency	$\frac{63}{2160}$	$\frac{118}{2160}$	$\frac{120}{2160}$	$\frac{181}{2160}$	$\frac{117}{2160}$	$\frac{237}{2160}$	$\frac{121}{2160}$	$\frac{59}{2160}$	$\frac{120}{2160}$	$\frac{239}{2160}$	$\frac{121}{2160}$	$\frac{60}{2160}$	$\frac{120}{2160}$	$\frac{120}{2160}$	$\frac{119}{2160}$	$\frac{61}{2160}$	$\frac{124}{2160}$	$\frac{60}{2160}$
$\approx$	2.9%	5.5%	5.6%	8.4%	5.4%	11%	5.6%	2.7%	5.6%	11.1%	5.6%	2.8%	5.6%	5.6%	5.6%	2.8%	5.7%	2.8%
Probability	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{4}{36}$	$\frac{2}{36}$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{4}{36}$	$\frac{2}{36}$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{2}{36}$	$\frac{2}{36}$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{1}{36}$
$\approx$	2.8%	5.6%	5.6%	8.3%	5.6%	11.1%	5.6%	2.8%	5.6%	11.1%	5.6%	2.8%	5.6%	5.6%	5.6%	2.8%	5.6%	2.8%

Of course, the table formed by T and Ps will match the Ps' own experimental data!

What do you notice about the table? e.g.

- The relative frequencies are very close to the probabilities.
- The frequencies and relative frequncies for a product of 12 and a product of 6 are very similar and are higher than the other products. Why? (They have 4 factors less than 6.)
- The product of 4 is the only one with 3 factors less than 6.
- Numbers missing from table such as 0, 7, 11, 13, 14, etc. are impossible products. (Elicit that their probability is 0.)

Discussion, agreement, praising

[If possible, use a computer simulation to show the symmetry and to confirm that the more times that the experiment is done, the closer the relative frequencies are to the probabilities.]

28 min

4 ***Book 5, page 115***

Q.2 Read: *What is the probability of these events happening?*

What can you tell me about the wheel? (Divided into 6 equal sections, so each outcome has equal probability.)

Deal with one part at a time or set a time limit. Ps write probabilites as fractions in *Pbs*. (More able Ps could also write the fractions in decimal form and/or as a percentage.)

Review with whole class. Ps could show fractions on scrap paper or slates on command. Ps who answered correctly explain at BB. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

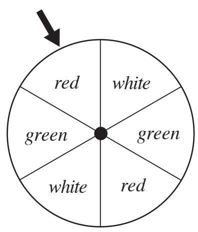
Individual work, monitored, helped

Wheels drawn (stuck) on BB or use enlarged copy master or OHP

Responses shown in unison.

Reasoning, agreement, self-correction, praising

Feedback for T

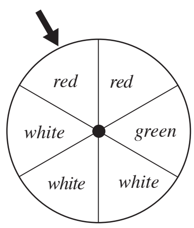


a) i) *Red* wins. $\left(\frac{2}{6} = \frac{1}{3}\right)$

ii) *Red* or *green* wins. $\left(\frac{4}{6} = \frac{2}{3}\right)$

iii) *Green* does not win. $\left(\frac{4}{6} = \frac{2}{3}\right)$

iv) Neither *green* nor *red* wins. $\left(\frac{2}{6} = \frac{1}{3}\right)$



b) i) *Red* wins. $\left(\frac{2}{6} = \frac{1}{3}\right)$

ii) *Red* or *green* wins. $\left(\frac{3}{6} = \frac{1}{2}\right)$

iii) *Green* does not win. $\left(\frac{5}{6}\right)$

iv) Neither *green* nor *red* wins. $\left(\frac{3}{6} = \frac{1}{2}\right)$

Extension

Ps think of other questions to ask or alternative outcomes. e.g.

a) p (*green* wins) $= \frac{1}{3}$

p (*white* wins) $= \frac{1}{3}$

b) p (*green* wins) $= \frac{1}{6}$

p (*white* wins) $= \frac{1}{2}$

36 min

Bk5		Lesson Plan 115

Activity		Notes

5

Book 5, page 115

Q.3 Read: *A cuboid which measured 1.5 cm by 2 cm by 2.5 cm was used as a dice. The cuboid was thrown 1000 times and the frequency of each outcome was noted in the table.*

What is the usual shape of a dice? (a square) What difference will the dice being a cuboid make? (The numbers will not have an equal chance of being thrown.)

a) Read: *Calculate the relative frequency for each outcome and complete the table.*

Set a time limit. Ps write relative frequency as a fraction and as a percentage. (Calculators are not necessary here).

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes dicussed and corrected.

Solution:

Outcome	Frequency	Relative frequency
1	145	14.5%
2	168	16.8%
3	189	18.9%
4	186	18.6%
5	162	16.2%
6	150	15%
	(1000)	

b) Read: *If the sum of the numbers on any two opposite faces is 7, which numbers are written on the two:*
i) largest faces ii) smallest faces?

Allow Ps a minute to think abut it, then Ps could show numbers on scrap paper or slates on command. Ps responding correctly explain reasoning to Ps who were wrong.

Solution: $7 = 1 + 6 = 2 + 5 = 3 + 4$

i) Largest faces have most chance of being thrown, and numbers with highest frequency are 3 and 4.

ii) Smallest faces have least chance of being thrown, and numbers with lowest frequency are 1 and 6.

c) Read: *What is the relative frequency of each of the 3 sizes of face?*

Allow Ps a couple of minutes to think and calculate, then Ps who have answers show on scrap paper or slates on command.

Ps with correct responses explain reasoning at BB.

Solution:

Largest face: (i.e. 4 or 3): *Frequency*: $189 + 186 = 375$

Relative frequency: $\dfrac{375}{1000} = 0.375 \rightarrow 37.5\%$

Middle-sized face: (i.e. 2 or 5): *Frequency*: $168 + 162 = 330$

Relative frequency: $\dfrac{330}{1000} = 0.33 \rightarrow 33\%$

41 min

Notes

Individual trial first, monitored, helped

Table drawn on BB or use enlarged copy master or OHP

Discussion, agreement

Deal with one part at a time.

Reasoning, agreement, self-correction, praising

Percentage can be calculated easily by changing frequency to hundredths first.

e.g. 145 thousandths

= 14.5 hundredths → 14.5%

Individual trial first, then whole class discussion.

Elicit possible addition facts first.

If necessary, demonstrate by showing a model cuboid with the appropriate dimensions.

Individual trial first, monitored

Responses shown in unison.

Reasoning, agreement, praising

Ps write agreed relative frequencies in *Pbs*.

Smallest face: (i.e. 1 or 6):

Frequency: $145 + 150 = 295$

Relative frequency:

$\dfrac{295}{1000} = 0.295 \rightarrow 29.5\%$

Bk5

Lesson Plan 115

Activity

6

Problem

Listen carefully, note the data and think about what we should do.

On a fortune teller's lucky wheel there are 4 colours: *yellow*, *green*, *pink* and *blue*. After 3600 spins, these are the number of times (frequency) each colour came to rest in front of the pointer.

BB: *yellow*: 900 times *green*: 1350 times
pink: 450 times *blue*: 900 times

a) If this is the fortune wheel (BB), how can we work out what part should be coloured in which colour?

Ps suggest what to do first and how to continue. If nobody is on the right track, T gives hints or directs Ps' thinking, or makes a suggestion and asks Ps what they think about it.

Solution: e.g.

1 whole circle is $360°$.

Using the frequencies, the part coloured:

BB: *yellow* could be: $\dfrac{900}{3600} = \dfrac{90}{360} \rightarrow 90°$

green could be: $\dfrac{1350}{3600} = \dfrac{135}{360} \rightarrow 135°$

pink could be: $\dfrac{450}{3600} = \dfrac{45}{360} \rightarrow 45°$

blue could be: $\dfrac{900}{3600} = \dfrac{90}{360} \rightarrow 90°$

T (Ps) draw the sections using BB protractor and colour them.

b) If we use this wheel and spin it once more. What is the probability that when the wheel stops, the arrow will be pointing to:

i) *yellow* ($\dfrac{1}{4} \rightarrow$ 25%) ii) *green* ($\dfrac{3}{8} \rightarrow$ 37.5%)

iii) *pink* ($\dfrac{1}{8} \rightarrow$ 25%) iv) *blue* ($\dfrac{1}{4} \rightarrow$ 25%)

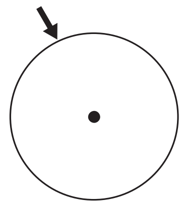
45 min

Notes

Whole class activity

Circle drawn on BB or SB or OHT

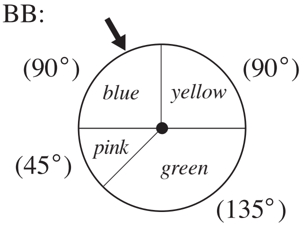
BB:



Involve several Ps in the discussion.

Extra praise if Ps think of doing this without T's help.

BB:



Ps shout out in unison.

T chooses Ps to explain their reasoning.

Praising only

Bk5	R: Calculations **C: Experiments: Probability: fair and unfair games** *E: Problems. Pyramid-shaped dice*	*Lesson Plan 116*

Activity		*Notes*

1

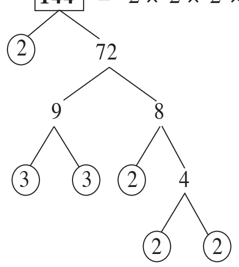
Numbers

a) Find the prime factors of 116 in your *Ex. Bks.* and write it as the product of its prime factors, then list all its positive factors using the prime factors to help you.

Set a time limit. Ps come to BB or dictate to T. Class agrees or disagrees. Mistakes discussed and corrected.

BB: e.g.

$\boxed{\mathbf{144}} = 2 \times 2 \times 2 \times 2 \times 3 \times 3$ (prime factors)



or

144	2
72	2
36	2
18	2
9	3
3	3
1	

T could show this quick way too.

Factors: 1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 36, 48, 72, 144

What special kind of number is 144?

(It is a square number. BB: $144 = 12 \times 12 = 12^2$)

b) Let's define 144 in different ways. Class checks that definitions are correct and are unique to 144.

(e.g. $100 + 44$, $14400 \div 100$, $1000 - 856$, $29 \times 5 - 1$, etc.)

Notes:

Individual work in *Ex. Bks.* monitored, helped

Reasoning, agreement, self-correction, praising

Ps may use a calculator to work out all the factors.

Ps can join up the factor pairs as a check.

Extra praise for Ps who remember this.

Whole class activity

T chooses Ps at random.

At speed, in good humour

Praising, encouragement only

8 min

2

Problem

Listen carefully, note the data and calculate in your *Ex. Bks.* Show me your answer when I say.

In a hotel, there is an equal chance of guests arriving at any time betwen mid-day and midnight.

What is the probability that a guest will arrive:

a) between 1200 hours and 1400 hours $\left(\dfrac{2}{12} = \dfrac{1}{6}\right)$

b) between 1.00 pm and 6.00 pm $\left(\dfrac{5}{12}\right)$

c) between 17:00 and 18:00 $\left(\dfrac{1}{12}\right)$

d) between 11.00 pm and 23:30? $\left(\dfrac{1}{24}\right)$ etc.

Notes:

Whole class activity

T could write some times on BB rather than saying them.

Responses shown on scrap paper or slates in unison.

Ps responding correctly explain reasoning to Ps who were wrong.

Elicit that there are 12 hours and 24 half hours between mid-day and midnight.

Demonstrate on a real clock if necessary.

Ps can say some times too.

14 min

Bk5		*Lesson Plan 116*

Activity		***Notes***

3 **Experiment**

Ps and T have a pyramid-shaped dice, with 5 written on its square base and 1, 2, 3, and 4 written on its triangular sides.

Ps throw the dice e.g 20 times and keep a tally of which number it lands on (i.e. the number facing the floor or desk). Keep Ps together on the throws. Ps check that they have 20 tally marks, then count up their totals for each number.

Collect the class data and write it in the table on BB. Ps dictate their data to T and class keeps running totals in *Ex. Bks* or on a calculator. Check that the totals add up to 20 times the number of Ps in the class.

Ps dictate the relative frequencies as fractions, then calculate the decimals or percentages using a calculator.

BB: e.g. For a class of 20 Ps:

$n = 400$

Outcome	1	2	3	4	5
Frequency	70	68	69	71	122
Relative frequency	$\frac{70}{400}$ 17.5%	$\frac{68}{400}$ 17%	$\frac{69}{400}$ 17.25%	$\frac{71}{400}$ 17.75%	$\frac{122}{400}$ 30.5%

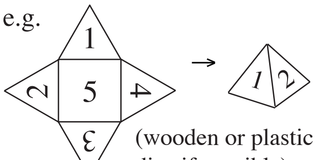
What do you notice? (The outcome 5 occurred nearly twice as often as the other numbers, which had almost equal frequency.)

If we threw the dice once more, what chance would you give to each number? (e.g. 1, 2, 3 and 4: 1 sixth; 5: 2 sixths)

Notes:

Whole class activity

e.g.



(wooden or plastic dice if possible)

Table drawn on BB or use enlarged copy master or OHP

Ps could have copies of table on desks too (or draw in *Ex Bks*).

At a good pace

Discussion, reasoning, agreement, checking, praising

Discuss why the frequencies of 1 to 4 are similar (equal triangles) and the frequency of 5 is greater (larger surface area/heavier on square side).

25 min

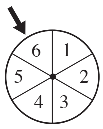
4 ***Book 5, page 116***

Q.1 Read: *If the wheel is spun, what is the probability of these outcomes? Complete the table.*

Set a time limit. Ps write the probabilities as fractions.

Review quickly with whole class. Ps come to BB or dictate to T, explaining reasoning. (Wheel divided into 6 equal sections, so if the wheel is unbiased, each number has an equal chance.) Class agrees/disagrees. Mistakes discussed and corrected.

Solution:



Outcome	1	2	3	4	5	6	At least 5	At most 5
Probability	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{2}{6} = \frac{1}{3}$	$\frac{5}{6}$

Notes:

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

If time, elicit decimals and percentages with whole class.

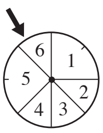
$[\ \frac{1}{6} = 0.1\dot{6} \rightarrow \approx 16.7\%$

$\frac{1}{3} = 0.\dot{3} \rightarrow \approx 33.3\%$, etc.]

Extension

If the wheel looked like this, what would the probabilities be? Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees.

BB:



Outcome	1	2	3	4	5	6	At least 5	At most 5
Probability	$\frac{2}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{2}{8}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{7}{8}$

Notes:

Whole class activity

Drawn on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, praising

$[\ \frac{1}{8} = 0.125 \rightarrow 12.5\%$, etc.]

30 min

Bk5

Lesson Plan 116

Activity		Notes

5

Book 5, page 116

Q.2 Read: *A marble is dropped into this maze and has an equal chance of falling to the left or to the right.*

a) In how many ways can the marble come out at: A, B, C, D, E and F?

b) How many routes are there altogether?

c) What is the probability of each outcome?

Deal with one part at a time or set a time limit.

Review with whole class. Ps could show number of routes on scrap paper or slates on command. (If disagreement, Ps show their different routes on the diagram.) When number of routes is agreed, Ps come to BB to complete the probability table, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

a) Number of ways: A (1), B (5), C (10), D (10), E (5), F (1)

b) Total number of routes: 1 + 5 + 10 + 10 + 5 + 1 = 32

c)

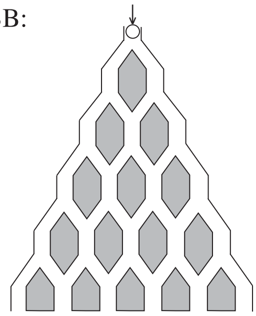
Outcome	A	B	C	D	E	F
Probability	$\frac{1}{32}$	$\frac{5}{32}$	$\frac{10}{32}$	$\frac{10}{32}$	$\frac{5}{32}$	$\frac{1}{32}$

Notes:

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

BB:



A B C D E F

Discussion, reasoning, agreement, self-correction, praising

Extra praise if Ps notice the symmetry of the diagram and thus the data.

39 min

6

Book 5, page 116

Q.3 Read: *Sue used this hexagon-based pyramid as a dice.*

It has 7 written on its hexagon base and 1, 2, 3, 4, 5 and 6 written on its triangular faces.

Sue threw the dice 100 tmes and noted the nmmbers it landed on. She wrote how many times (frequency) the dice landed on each number (outcome) in this table.

If possible, T has such a dice to demonstrate throws to class.

What do you notice about the frequencies? (Numbers 1 to 6 were thrown about the same number of times, and 7 was thrown roughly twice as often Why do you think that is so? (1 to 6 are congruent triangles, but 7 is a hexagon and has a greater surface area, so is more likely to land face down as it is heaviest at that side.)

a) Read: *Fill in the bottom row of the table to show the ratio of the number of times a number was landed on to the total number of throws (relative frequency).*

Set a time limit. Ps write relative frequencies as fractions and as percentages (below the table).

Review quickly with the whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

Outcome	1	2	3	4	5	6	7
Frequency	11	12	13	10	12	14	28
Relative frequency	$\frac{11}{100}$	$\frac{12}{100}$	$\frac{13}{100}$	$\frac{10}{100}$	$\frac{12}{100}$	$\frac{14}{100}$	$\frac{28}{100}$

Notes:

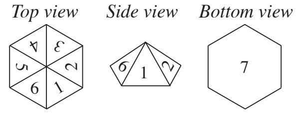
Individual trial, monitored, helped for part a)

(or all done as a whole class activity)

Drawn on BB or use enlarged copy master or OHP

BB:

Top view *Side view* *Bottom view*



(or wooden or plastic model)

Discussion, reasoning, agreement, (self-correction), praising

Do b) with the whole class.

i) *How many times did Sue throw at a least a 4?*

Show me . . . now! (64)
(10 + 12 + 14 + 28 = 64)

ii) *How many times did Sue throw at most a 4?*

Show me . . . now! (46)
(11 + 12 + 13 + 10 = 46)

45 min

Bk5

R: Calculations

C: Collecting and analysing data. Graphs of discrete and continuous data

E: Problems

Lesson Plan
117

Activity		*Notes*

1

Numbers

a) Let's factorise 146 and then list all its positive factors.

Ps come to BB or dictate to T. Class agrees/disagrees.

BB: $146 = 2 \times 73$; Factors: 1, 2, 73, 146

b) Let's define 146 in different ways. Class checks that definitions are correct and are unique to 146.

(e.g. 1H + 46U, $146000 \div 1000$, 200% of 73, $12^2 + 2$, etc.)

Notes: Whole class activity. Reasoning, agreement, praising. At a good pace. Extra praise for clever definitions. Feedback for T

6 min

2

Probability graph 1

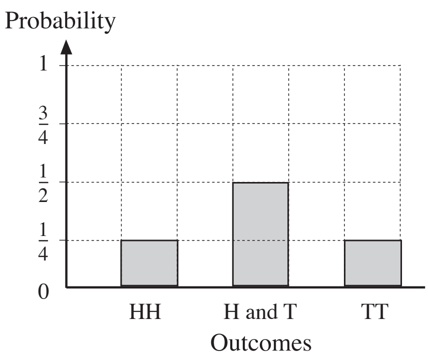
Let's draw a graph to show the probability of each of these outcomes (BB) if we toss two coins at the same time. Ps first dictate the probabilities.

BB: HH $(\frac{1}{4})$, H and T $(\frac{1}{4} + \frac{1}{4} = \frac{1}{2})$, TT $(\frac{1}{4})$

Elicit/remind Ps that the outcome 'a Head and a Tail ' is really the sum of 'HT' and 'TH'.

T draws the vertical and horizontal axes on BB, and Ps dictate the scales. (y-axis: probability scale 0 to 1, with a tick at every quarter; x-axis: outcomes HH, H and T, TT) Ps come to B to draw the appropriate lines or rectangles.

BB:
e.g.



Notes: Whole class activity. Discussion, reasoning, agreement, praising. (If necessary refer back to Q.1 on page 141 of *Pbs*.)

Ps can draw the graph in *Ex. Bks*. too.

Ask for the probability of other events. e.g.

p (at least one Head) $= \frac{3}{4}$

p (a Head or a Tail) $= 1$

Accept other types of graph if Ps suggest them (e.g. using vertical lines or dots).

Feedback for T

11 min

3

Book 5, page 117

Q.1 Read: *Three equal coins are tossed. Draw a graph to show the probability of each outcome.*

First Ps list all the different possible outcomes in *Pbs*. Elicit/remind Ps that they must think of the 3 coins as being different, even if all the individual outcomes are not asked for in the question. (Refer back to Q.2 on page 141 of *Pbs* if necessary.)

Elicit that the possible outcomes are:

BB: HHH, HHT, HTH, THH, HTT THT, TTH, TTT

and that each has an equal chance of happening. (i.e. 1 eighth)

Set a time limit for drawing the graph. (P finished first could draw his or her graph on BB.)

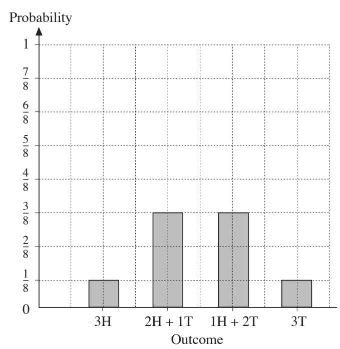
Review with whole class. Ps compare their graphs with that on BB and agree/disagree. Mistakes discussed and corrected.

T (Ps) asks for the probability of other events too.

e.g. p (at least 1H) $= \frac{7}{8}$; p (at least 2T) $= \frac{4}{8} = \frac{1}{2}$

Notes: Individual work, monitored, helped. Drawn on BB or use enlarged copy master or OHP. Accept any form of graph. Discussion, reasoning, agreement, self-correction, praising

Solution:



16 min

Bk5		*Lesson Plan 117*

Activity		*Notes*

4 **Probability graph 2**

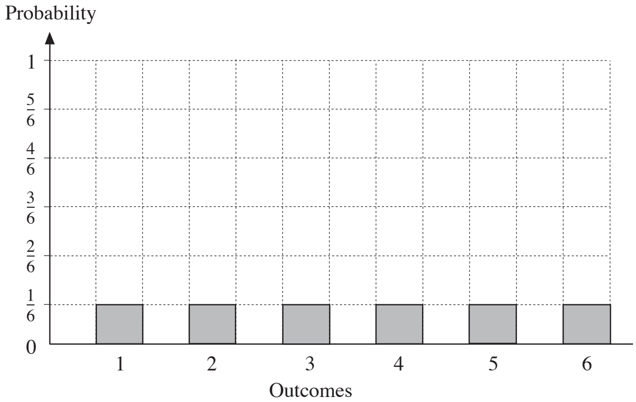
Let's draw a graph to show the probability of each outcome if we throw a fair dice. Ps dictate the outcomes and probabilities.

BB: Outcomes: 1, 2, 3, 4 5, 6 (each with equal probability: $\frac{1}{6}$)

T draws the vertical and horizontal axes on BB, and Ps dictate the scales. (y-axis: probability scale 0 to 1, with a grid line at every sixth; x-axis: outcomes 1, 2, 3, 4, 5 and 6) Ps come to B to draw rectangles (or lines or dots) on the diagram. Class agrees/disagrees.

BB:

e.g.



T (Ps) asks for the probability of other events too. e.g.

p (even number) $= \frac{3}{6} = \frac{1}{2}$; p (number $\leq$ 5) $= \frac{5}{6}$; p (0) $=$ 0, etc.

Notes: Whole class activity

At a good pace

Discussion, reasoning, agreement, praising

Ps could draw graph in *Ex.Bks.* too.

Extra praise if Ps think of them without T's help.

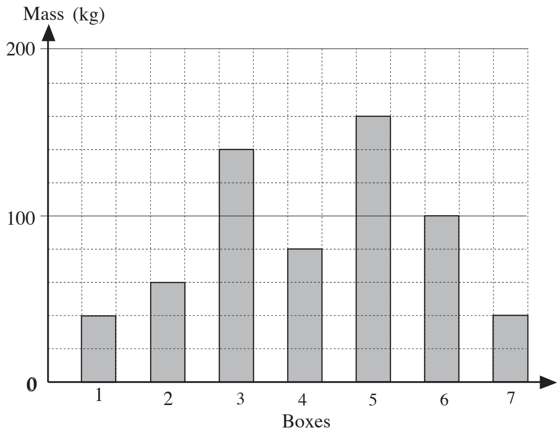
21 min

5 **Revision of mode, mean and median**

a) What does this graph tell us? (The mass in kg of each of 7 boxes)

Elicit that the y-axis shows the mass, with a grid line at every 20 kg, and the x-axis shows the 7 boxes as rectangles, with the height of each rectangle showing the mass of the box.

BB:



b) Let's show the data in a table. Ps come to BB or dictate what T should draw. Class agrees/disagrees.

BB:

Box	1	2	3	4	5	6	7
Mass (kg)	40	60	140	80	160	100	40

Notes: Whole class activity

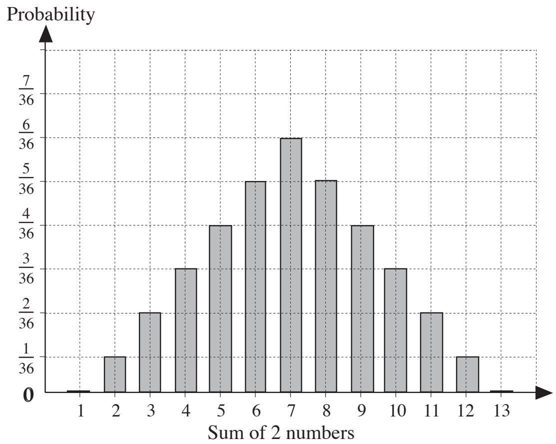
Drawn on BB or use enlarged copy master or OHP

T asks about any important piece of information not mentioned by Ps.

Discussion, agreement, praising

At a good pace

Agreement, praising

Bk5		*Lesson Plan 117*
Activity		***Notes***
5	(Continued) c) Let's write the amounts in increasing order. Ps come to BB or dictate to T. Class points out errors. BB: 40 kg, 40 kg, 60 kg, 80 kg, 100 kg, 140 kg, 160 kg Let's see if you remember the 3 different names we give to certain values in a set of data. (T reminds Ps where necessary and writes names on BB.) i) Which is the the middle value? (80 kg) Who remembers what we call the middle value in a set of ordered data? (the median) ii) Which value occurs most often? (40 kg) Who remembers what we call the most frequent value in a set of data? (the mode) iii) How can we work out what the average value of a set of data is? (Add up all the values, then divide by the number of pieces of data.) P comes to BB to do the calculation, explaining reasoning. Class points out errors. BB: $\dfrac{40 + 40 + 60 + 80 + 100 + 140 + 160}{7} = \dfrac{620}{7} = 88\dfrac{4}{7}$ Elicit that the average mass is $88\dfrac{4}{7}$ kg. Who remembers the name for the average value in a set of data? (the mean) What does average really mean? Elicit that the average or mean value shows what each box would weigh if the light and heavy weights were evened out and all the boxes weighed the same. *30 min*	Agreement, praising BB: median middle value mode most frequent value BB: $7 \overline{\smash{)}620}$ = 88, 6 (4) (or Ps use a calculator and write as a recurring decimal or round it to 2 d.p.) BB: mean average value
6	***Book 5, page 117*** Q.2 Read: *Two equal dice are thrown. Draw a graph to show the probability of each possible sum of the two numbers thrown. Use the probability data from Question 2, page 115.* Review the data first, reminding/eliciting from Ps about what was done in the experiment and what was found out. Set a time limit for drawing the graph. Ps may use any form. Review with whole class. Ps come to BB to draw the graph, explaining reasoning. Who did the same? Who did it a different way? etc. Mistakes discussed and corrected. *Solution:* e.g.  *38 min*	Individual work, monitored, helped, after initial whole class discussion Drawn on BB or use enlarged copy master or OHP Discussion, reasoning, agreement, self-correction, praising Show all forms used by Ps. Extra praise if Ps point out the symmetry of the graph (and thus of the data). Feedback for T

Bk5

Lesson Plan 117

Activity		*Notes*

7

Book 5, Page 117

Q.3 Read: *Paul is walking from A to B and Mike from B to A. The graph shows their positions during that time.*

Who can show us Mike's (Paul's) graph? Ps come to BB to trace the appropriate lines with their fingers. Class agrees/ disagrees. Let's see how well you understand the graph.

Set a time limit. Ps study the graph and try to visualise what is happening. Ps read the questions themselves and write answers in *Pbs*.

Individual trial first, monitored, helped

(or whole class activity if time is short)

Graph drawn on BB or use enlarged copy master or OHP

Allow only 2 or 3 minutes.

Review with whole class. Ps could show responses to a) to c) on slates or scrap paper on command. Ps answering correctly explain reasoning and show on the graph. Class agrees/ disagrees. Mistakes discussed and corrected.

Responses shown in unison

Reasoning, agreement, self-correction, praising

A, what did you write for d)? Who agrees? Who wrote something different? After agreement, Ps who did not write anything or Ps who were wrong, write correct answer in *Pbs*.

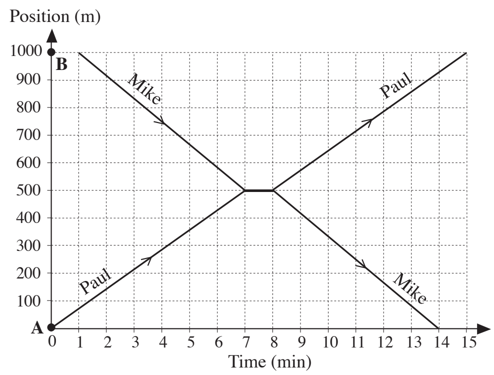
Praising, encouragement only

T could choose 2 Ps who understand the graph to act out the story and rest of class follows what is happening on their graphs.

Demonstration under T's direction – in good humour!

Solution:

BB:



Stress that the 2 Ps walk towards each other in a straight line (as in diagram above the graph) and that each P ends up in the same place as the other started from (and not like the diagonal lines in the graph)!

a) *Who started first?* (Paul – 1 minute earlier than Mike)

b) *Who arrived first?* (Mike – 1 minute before Paul arrived)

c) *How long did:*

i) Paul take (15 minutes) *ii) Mike take?* (13 minutes)

d) W*hat happened during the 7th and 8th minutes?*

(They met, stopped and probably chatted for a minute.)

Accept any valid explanation!

Extension

Who can think of other questions to ask about the graph? (T asks some if no P can think of any.) e.g.

- How far apart are A and B? (1000 m)
- What part of the distance had they gone when they met? (half the distance, i.e. 500 m)
- What was Mike's (Paul's) average speed?

  (Mike: 13 min → 1000m

  1 min → 1000 m ÷ 13 ≈ 76.9 m

  So Mike's average speed was about 76.9 m per minute.

  Paul: 15 min → 1000m

  1 min → 1000 m ÷ 15 ≈ 66.7 m

  So Mike's average speed was about 66.7 m per minute.)

Whole class activity

Extra praise for clever questions

Discussion, reasoning, agreement, praising

[Elicit that average speed means as if they had walked at the same speed all the time without stopping.]

45 min

Bk5

R: Calculations
C: Collecting and analysing data (discrete and continuous)
E: Problems

Lesson Plan 118

Activity		*Notes*

1

Numbers

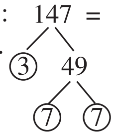
a) Let's factorise 147 and list all its positive factors.

Ps come to BB or dictate to T, explaining reasoning. (e.g. 147 is odd, so 2 is not a factor. 147 = 120 + 27, and both numbers are multiples of 3, so 3 is a factor.)

T reminds Ps of another way to check quickly that 3 is a factor of 147. If the sum of its digits is a multiple of 3, then 3 is a factor. (1 + 4 + 7 = 12,which is a multiple of 3).

BB: 147 = 3 × 7 × 7

e.g.



Positive factors: 1, 3, 7, 21, 49, 147

b) Let's define 147 in different ways. Ps dictate their definitions and class checks that they are correct and unique to 147.

(e.g. 21 × 7, 1.47 × 100, 500 – 353, 1 tenth of 1470, etc.)

6 min

Notes: Whole class activity. Reasoning, agreement, praising. At speed round class. Extra praise for clever definitions. Feedback for T

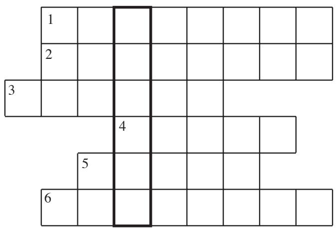
2

Crossword

Let's fill in the rows using these clues then read the word in the vertical box.

T reads out each clue, Ps make suggestions and class checks which word is correct (meaning and number of letters).

BB:



1. This word describes numbers less than zero. (negative)
2. This word describes two straight lines in a plane which have no common point. (parallel)
3. A quadrilateral with equal sides and equal angles. (square)
4. A positive number which has exactly two positive factors. (prime)
5. The number of vertices in a triangle. (three)
6. This word describes numbers greater than zero. (positive)

Let's read out the word in the box. (GRAPHS)

15 min

Notes: Whole class activity. Drawn/written on BB or use enlarged copy master or OHP (or Ps have copies of copy master on desks and try it individually under a time limit first, then review with whole class). At a good pace. In good humour! Agreement, praising. Ask Ps to give (or draw) examples for each row. In unison. Praising

3

Book 5, page 118

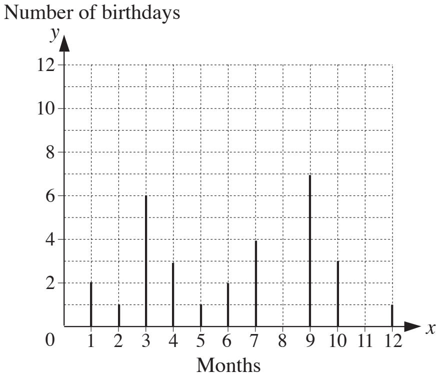
Q.1 a) Read: *Write in the table how many pupils in your class have birthdays in each month.*

Let's do it together! T says each month in turn and Ps who have birthdays in that month stand up. T writes number in table on BB and Ps write in *Pbs*.

BB: e.g. for a class of 30 Ps

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2	1	6	3	1	2	4	0	7	3	0	1

Notes: Whole class collection of data. Table drawn on BB or use enlarged copy master or OHP. At a fast pace. Ps check own table against numbers on BB and that the total equals the number of Ps in the class.

Bk5		*Lesson Plan 118*
Activity		***Notes***
3	(Continued) Read: *b) Show the data in a graph.* *c) Write the data in increasing order.* *d) What are these values?* *i) Mode ii) Median iii) Mean* Deal with one part at a time. Set a time limit. Ps can use any form of graph (rectangles, vertical lines or dots) Elicit meanings of mode, median and mean before Ps attempt the question. Calculation for mean can be done in *Ex. Bks*. Review with whole class. Ps come to BB to draw graph, dictate order of data to T then show mode, median and mean one at a time on scrap paper or slates on command. Class agrees/disagrees. Mistakes discussed and corrected. *Solutions:* e.g. using sample data for 30 Ps: b)  c) 0, 0, 1, 1, 1, 2, 2, 3, 3, 4, 6, 7 d) i) Mode: 1 (most frequent data) ii) Median: 2 (middle data) (As there are 12 numbers in increasing order, there is no obvious middle number, so we take the average of the 6th and 7th numbers. In this case they are both 2: 2 + 2 ÷ 2 = 2) iii) Mean: (average data: sum of data ÷ no. of data) $\dfrac{0+0+1+1+1+2+2+3+3+4+6+7}{12} = \dfrac{30}{12} = 2.5$ *27 min*	Individual work, monitored, helped Grid drawn on BB or use enlarged copy master or OHP BB: mode most frequent data median middle data mean average data Discussion, reasoning, agreement, self-correction, praising N.B. Sample graph and data! Graph and mode, etc should match the class data There might be more than one number as the mode (e.g. If 1 and 2 occur an equal number of times, the mode would be '1 and 2') . Extra praise if Ps remember what to do with an even number of data without T's help

Bk5

Lesson Plan 118

Activity		*Notes*

4

Book 5, page 118

Q.2 Read: *Show in a graph the probability of each possible product when 2 dice are thrown. (Use the probability data from Question 1, page 115.)*

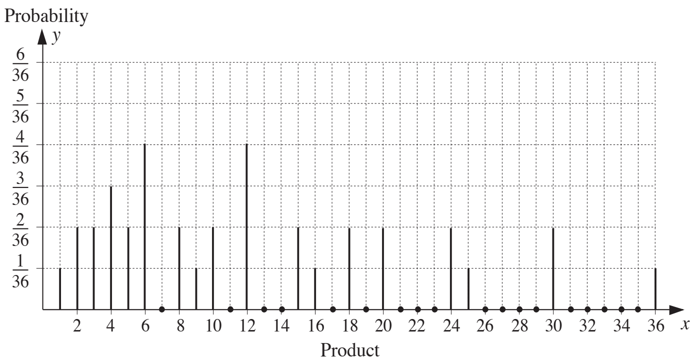
Review the data first, reminding/eliciting from Ps about how the probabilities were determined.

Ask Ps to explain the graph if they can, relating the 2 vertical lines already drawn to the data in the table. T helps where necessary.

Set a time limit. Encourage Ps to use rulers to draw the lines.

Review with whole class. Ps come to BB to complete the graph, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:



Notes: Individual work, monitored, helped, corrected, after initial whole class discussion

Drawn on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, self-correction, praising

Extension

a) Let's write the data in increasing order. Agree that as all the probabilities are 36ths, we need only order the numerators. Ps dictate what T should write.

BB: 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 4, 4 (36ths)

b) What is the mode of the data? (0, as 18 zeros)

c) What is the median of the data? ($0 + 1 \div 2 = 0.5$ [36ths] or $\frac{1}{72}$)

d) Let's calculate the mean of the data. How could we do it? Ps make suggestions. T suggests this way if no P does so and asks if it is correct.

e.g. BB: $\left(18 \times \frac{0}{36} + 5 \times \frac{1}{36} + 10 \times \frac{2}{36} + \frac{3}{36} + 2 \times \frac{4}{36}\right) \div 36$

$$= \left(\frac{0 + 5 + 20 + 3 + 8}{36}\right) \div 36 = \frac{36}{36} \div 36 = \frac{1}{36}$$

What does it really mean? (As if all the probabilities were evened out and each number from 1 to 36 had an equal chance (one 36th) of being thrown as the product, including all the impossible products too!)

Notes: Whole class activity

Involve as many Ps as possible.

T directs Ps' thinking if necessary.

(Shorter than writing lots of 36ths)

Show where it would be on the graph.

Discussion, reasoning, agreement, praising

(Easier and quicker than writing an addition with 36 fractions!)

Agreement, praising

37 min

Bk5

Lesson Plan 118

Activity		*Notes*

5

Book 5, Page 118

Q.3 Read: *Henry cannot make up his mi8d which cinema, B or C, to go to from his house at A.*
The graph shows what Henry did.

Who can explain the graph? Ps come to BB to point to the two cinemas and to Paul's house and to explain what the axes mean.

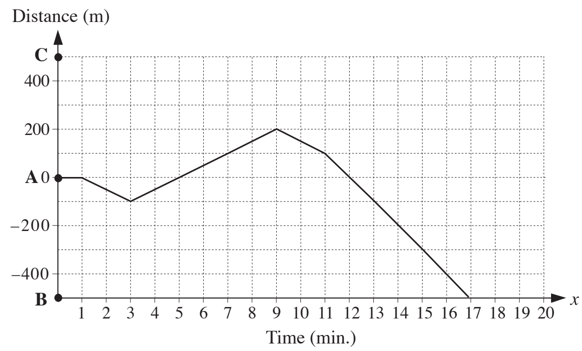
Let's see how well you understand the graph.

Set a time limit. Ps study the graph and try to visualise what is happening. Ps read the questions themselves and write answers in *Pbs*.

Review with whole class. Ps could show responses on slates or scrap paper on command. Ps answering correctly explain reasoning and show on the graph. Class agrees/ disagrees. Mistakes discussed and corrected.

Solution:

BB:



a) *Which cinema* ***did*** *Henry go to?* (B)

b) *When did he change his mind?* (at 3 min. and 9 min)

c) *When did he start to run?* (at 11 min)

T could choose a P who understands the graph to tell the story, while rest of Ps follow the graph line in *Pbs*. e.g.

'Henry thought about which cinema to go to for a minute, then he decided to go to cinema B and walked towards it for 2 minutes. Then he changed his mind and started walking towards cinema C for 6 minutes. Then he changed his mind again and started walking back towards cinema B. After 2 minutes, he realised that he would be late for the performance and started to run. He ran all the way to cinema B.'

Notes:

Individual trial first, monitored, helped

(or whole class activity if time is short)

Graph drawn on BB or use enlarged copy master or OHP

Allow only 2 or 3 minutes.

Responses shown in unison

Reasoning, agreement, self-correction, praising

Praising, encouragement only

Demonstration under T's direction if necessary. In good humour!

Praising

Extension

Who can think of other questions to ask about the graph? (T asks some if Ps cannot think of any.) e.g.

- How far apart are the two cinemas? (1000 m)
- What was Henry's speed when he first walked towards B? (100 m in 2 minutes, so his speed was 50 m per minute)
- What was Henry's speed when he was running back to B?

  6 min $\rightarrow$ 600 m

  1 min $\rightarrow$ 600 m $\div$ 6 $=$ 100 m

  So he ran at a speed of 100 m per minute (twice as fast as his walking speed).

Notes:

Whole class activity

Extra praise for clever questions

Discussion, reasoning, agreement, praising

T could point out that Henry walked and ran at steady speeds, as the relevant parts of the graph are straight lines.

45 min

Bk5

R: Calculations

C: Organising and interpreting data. Mode, median, mean

E: Problems

Lesson Plan

119

Activity | ***Notes***

1

Numbers

a) Let's factorise 148 and then list all its positive factors.

Ps come to BB or dictate to T. Class agrees/disagrees.

BB: $148 = 2 \times 2 \times 37$

148 → 2, 74

74 → 2, 37

Positive factors: 1, 2, 4, 37, 74, 148

b) Let's define 148 in different ways. Class checks that definitions are correct and are unique to 148.

(e.g. 14T + 8U, 296 000 ÷ 2000, 400% of 37, $12^2 + 4$, etc.)

Notes: Whole class activity

Reasoning, agreement, praising

At a good pace

Extra praise for clever definitions.

Feedback for T

6 min

2

True or false?

Listen to the statement. If you think it is true, clap you hands once and if you think it is false, hold your ears. Show me when I say.

a) The greatest natural number is 1 hundred billion. (F – ears)
[Natural numbers are endless.]

b) Zero is a whole number. (T – clap)
[Whole numbers: . . ., –2, – 1, 0, 1, 2, . . .]

c) Two thirds is a natural number. (F – ears)
[Natural numbers are positive, whole numbers.]

d) Twelve quarters is a natural number. (T – clap)
[$\frac{12}{4} = 3$]

etc.

Notes: Whole class activity

(or Ps decide on appropriate actions or write T or F on slates or scrap paper)

Responses shown in unison.

Ps with differing responses explain reasoning and class decides who is correct.

Praising, encouragement only

If time, Ps can think of own statements to say to class.

12 min

3

Book 5, page 119

Q.1 Read: *Two groups of pupils are in a competition to see which of them does better in a maths test out of 8 marks.*

Both groups contain 8 pupils but their marks are similar. They need one overall mark for each group to make the comparison easier and decide to use the mean value.

Calculate the mean mark for each group and compare them. Fill in the missing sign.

Group A: 8, 8, 7, 5, 6, 8, 6, 7

Group B: 6, 6, 6, 7, 6, 7, 8, 8

Elicit that to find the mean, add up the data and divide the total by the number of data there are. Set a time limit.

Review with whole class. Ps could show the mean of each group on slates or scrap paper on command.

Ps responding correctly explain at BB to Ps who were wrong. Class agrees/disagrees. Mistakes discussed and corrected. Class shouts out the missing sign in unison.

Solution:

Group A mean: $\dfrac{8+8+7+5+6+8+6+7}{8} = \dfrac{55}{8} = 6.875$

Group B mean: $\dfrac{6+6+6+7+6+7+8+8}{8} = \dfrac{54}{8} = 6.75$

Notes: Individual work, monitored, helped

Ps do necessary calculations in *Ex.Bks.*, then check with calculators.

Dsicussion, reasoning, agreement, self-correction, praising

BB: Mean of A $\boxed{>}$ Mean of B

T: We can say that on average Group A did better in the maths test than Group B.

22 min

Bk5		*Lesson Plan 119*
Activity		***Notes***
4	***Book 5, page 119*** Q.2 Read: *Solve the problem in your exercise book and write the answer here.* *Two groups of children collected blackberries. There were 6 children in Group A and 8 children in Group B.* *The members of Group A collected these amounts of blackberries:* *1.2 kg, 0.8 kg, 1.6 kg, 2.4 kg, 0.6 kg, 0.9 kg.* *The members of Group B collected these amounts of blackberries:* *0.9 kg, 1.4 kg, 1.2 kg, 0.6 kg, 2 kg, 1 kg, 0.45 kg, 0.7 kg.* *Which group worked harder?*	Individual work, monitored, helped T writes amounts for each group on BB or SB or OHT
	Can you tell just by looking at the amounts which group worked harder? (Very difficult as there are more people in Group B) How could we work it out? (Calculate the mean value for each group, i.e. the average amount each person collected, and then compare them.) Elicit that to find the mean for a group, add up the amounts and divide the total by the number of children in the group. Set a time limit.	Discussion, agreement on the method of solution T gives hints if necessary. If Ps are not very able, deal with one step at a time and review before doing next step.
	Review with whole class. Ps could show the mean for each group on scrap paper or slates on command. Ps responding correctly explain at BB to Ps who were wrong. Class agrees/disagrees. Mistakes discussed and corrected. Which group worked harder? Class shouts out in unison. (A) Elicit that although Group B gathered more blackberries in total, Group A gathered more blackberries per person on average, so the children in Group A worked harder.	Reasoning, agreement, self-correction, praising (or Ps show on scrap pape or slates) Discuss what the results actually mean.
	Solution: Mean of *Group A*: $\dfrac{1.2 + 0.8 + 1.6 + 2.4 + 0.6 + 0.9}{6} = \dfrac{7.5}{6} = 1.25$ (kg) Mean of *Group B*: $\dfrac{0.9 + 1.4 + 1.2 + 0.6 + 2 + 1 + 0.45 + 0.7}{8}$ (kg) $= \dfrac{8.25}{8}$ (kg) $= 1.03125$ kg ≈ 1.03 kg *Answer:* The children in Group A worked harder as they gathered more blackberries per person on average than those in Group B.	Ps who did not give a reason in their answer, write one in *Pbs* now.
	32 min	

Bk5

Lesson Plan 119

Activity		*Notes*

5

Book 5, page 119

Q.3 Read: *Draw graphs to show the data from Question 2.*

Draw a red horizontal line at each mean.

First ask Ps to explain how the graphs relate to the data.

Set a time limit or deal with one graph at a time. Ps can use any form (rectangles, lines or dots). Ps should use rulers to mark the means. Ps finished first could complete graphs on BB.

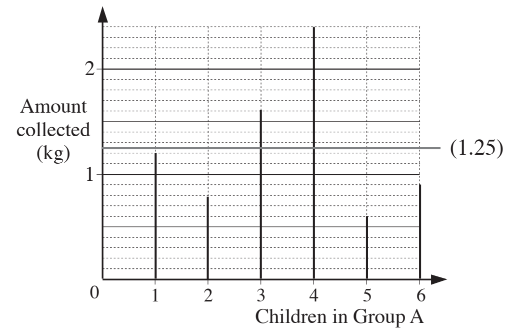
Review with whole class. Ps compare their graphs to those on BB and point out any errors. Agree on where the mean should be drawn. Mistakes discussed and corrected.

Which way of showing the data do you think is best – listing the amounts as in Q.2 or showing in graphs? Why?

Solution:

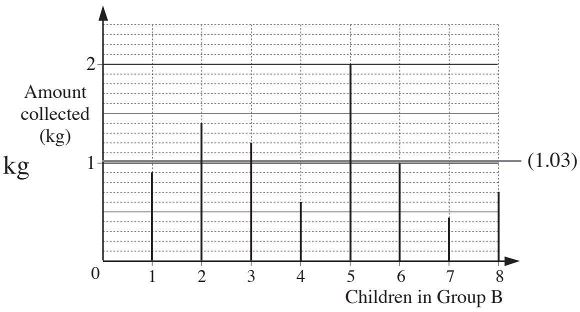
Group A

Mean: 1.25 kg



Group B

Mean: 1.03 kg



Notes: Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

T could take a vote, then ask one or two Ps with opposing views their reasons.

42 min

6

Mode and median

Let's look at the marks for the 2 groups in *Question 1* again to see whether it would make any difference to which group did better if we used the mode or the median for comparing them.

BB: *Group A:* 8, 8, 7, 5, 6, 8, 6, 7

Group B: 6, 6, 6, 7, 6, 7, 8, 8

What should we do first? (Write them in increasing order.) Ps come to BB or dictaate to T.

T points to each group and asks for the mode and median. Ps come to BB to write and explain. Class agrees/disagrees.

BB: *Group A*: 5, 6, 6, 7, 7, 8, 8, 8

Mode: 8; Median: $(7 + 7) \div 2 = 14 \div 2 = 7$

Group B: 6, 6, 6, 6, 7, 7, 8, 8

Mode: 6; Median: $(6 + 7) \div 2 = 13 \div 2 = 6.5$

Agree that all 3 measures (mean, mode and median) show that *Group B* did better in the test.

Notes: Whole class activity

Written on BB or SB or OHT

Ps suggest what to do first and how to continue.

T intervenes only if necessary.

Reasoning, agreement, praising

or, e.g. $\dfrac{7 + 7}{2} = \dfrac{14}{2} = 7$

Feedback for T

45 min

Bk5

R: Calculations
C: Organising and interpreting data. Mode, median, mean
E: Problems

Lesson Plan
120

Activity		*Notes*

1

Numbers

a) Let's factorise 149 and then list all its positive factors.

Ps try out the prime numbers 2, 3, 5, 7, 11 as divisors and dictate their findings. e.g.

- 2 is not a factor because 149 is odd;
- 3 is not a factor because $1 + 4 + 9 = 14$, which is not a multiple of 3;
- 5 is not a factor because the units digit is not 0 or 5;
- 7 is not a factor because $149 \div 7 = 21$, r 2
- 11 is not a factor because $149 \div 11 = 13$, r 6

What is the next prime number? (13) Should we try 13? (No, as $13 \times 13 = 169$, which is more than 149.)

Agree that 149 is a prime number and has only 2 factors: 1 and 149.

b) Let's define 149 in different ways. Class checks that definitions are correct and are unique to 149.

(e.g. 1H + 4T + 9U, $1.49 \div 100$, $7^2 + 10^2$, $600 - 400 - 51$, etc.)

Notes:
Whole class activity
Involve several Ps
Reasoning, agreement, checking, praising
(Calculators are not needed.)
At a good pace
Extra praise for clever definitions.
Feedback for T

8 min

2

Crossword

Let's fill in the rows using these clues, then read the word in the vertical box.

T reads out each clue, Ps come to BB to write the appropriate words. Class agrees/disagrees.

BB:

1. $100\,000 \times 10$
2. A quadrilateral with equal angles.
3. $1 \div 4$
4. $810 \div 90$

		[1]m	i	l	l	i	o	n	
	[2]r	e	c	t	a	n	g	l	e
[3]q	u	a	r	t	e	r			
[4]n	i	n	e						

Let's read out the word in the box. (MEAN)

Notes:
Whole class activity
Puzzle drawn on BB or use enlarged copy master or OHP
Clues written on BB or SB or OHT
At a good pace
In good humour!
Agreement, praising

Extension

If the word in the box was mode, think of suitable clues and draw a suitable grid.

12 min

3

Average heartbeat

Put your hand over your heart so that you can feel your heartbeat. Close your eyes and concentrate. Start counting your heartbeats from . . . now! . . . Stop! I have timed exactly 1 minute. Write down the number of heartbeats you had. Repeat another 4 times.

You should all have 5 numbers written down. How could you work out your average heartbeat per minute? (Calculate the mean by adding up the numbers and dividing by 5.) Ps do so in Ex. *Bks.*

Show me your average heartbeat . . . now! Ps show on slates or scrap paper on command (e.g. 63.4, 70.5, etc.)

If you did lots of exercise, then counted your heartbeats again 5 times and worked out the mean, do you think there would be any change? (More heartbeats per minute as the heart would beat faster.)

Ps could try it at home or at break or lunch or in their next PE lesson.

Notes:
Whole class activity
Use a stopwatch or kitcher timer or watch the second hand of a watch or clock.
Agreement, praising
In unison. T gently teases Ps with unrealistic heartbeats!
T talks about the 'normal' range (60/min to 90/minute) and 'average' heartbeat (70/min) or asks Ps to find it out.

22 min

Bk5		*Lesson Plan 120*
Activity		***Notes***
4	***Book 5, page 120*** Q.1 Read: *The ages of the members of the Cabbage family are:* *1 year, 3 years, 33 years, 34 years and 65 years.* *The ages of the members of the Parsnip family are:* *10 years, 12 years, 19 years,, 21 years, 42 years and 43 years.* *a) Calculate the mean age of each family.* *b) Both families are working in their gardens. Which family do you think will be able to do more work? Give a reason for your answer.* Deal with part a) first and review, with mistakes discussed and corrected, before Ps attempt part b). Set a time limit for each part. Ask several Ps to read out their answer to part b). Who agrees? Who disagrees? Why? *Solution:* a) Mean age of *Cabbage* family: $\dfrac{1+3+33+34+65}{5} = \dfrac{136}{5} = 27.2$ (years) Mean age of *Parsnip* family: $\dfrac{10+12+19+21+42+43}{6} = \dfrac{147}{6} = 24.5$ (years) b) Elicit that although the *Cabbage* family are older on average, 2 of them are too young to do any gardening and one of the remaining adults would need to keep an eye on them. *Answer:* The *Parsnip* family would be able to do more work in the garden because all of them can work. *30 min*	Individual work, monitored, helped Revise how to calculate the mean. (Add up the ages and divide by the number in the family.) Ps do necessary calculations in *Pbs* or *Ex. Bks*. Discussion, reasoning, agreement, self-correction, praising (Or Ps could write C or P on slates or scrap paper and show in unison. T asks Ps with different answers to explain their reasoning.) Extra praise for Ps who realised this. Ps who were wrong or did not give a reason, correct or amend their sentences.
5	***Book 5, page 120*** Q.2 Read: *One summer's day in Budapest, the temperature was noted every two hours and recorded in this table.* *a) Calculate the mean of the temperatures on that day from the given data.* *b) Write the data in increasing order then find the mode and median.* What time of day was it hottest (coldest)? (hottest: 4 pm, coldest: 4 am) Deal with one part at a time. Set a time limit. Ps write operations in *Ex. Bks*. but can use a calculator to work out the results if they wish. Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.	Individual work, monitored helped Table drawn on BB or use enlarged copy master or OHP Ps shout out in unison. Compare the temperatures with today's temperature. Discussion, reasoning, agreement, self-correction, praising

Bk5		*Lesson Plan 120*

Activity | **Notes**

5 (Continued)

Solution:

BB:

Time (hours)	0	2	4	6	8	10	12	14	16	18	20	22	24
Temperature (°C)	10.6	10.0	9.5	11.1	15.2	20.9	25.0	28.3	29.0	26.1	21.0	17.4	13.0

a) Mean temperature:

$$\frac{10.6 + 10.0 + 9.5 + 11.1 + 15.2 + 20.9 + 25.0 + 28.3 + 29.0 + 26.1 + 21.0 + 17.4 + 13.0}{13}$$

$$= \frac{237.1}{13} \approx 18.2 \; (°\,\text{C})$$

b) 9.5, 10.0, 10.6, 11.1, 13.0, 15.2, 17.4, 20.9, 21.0, 25.0, 26.1, 28.3, 29.0

Mode: Any or all of these temperatures (as each occurs once)

Median: 17.4 °C

38 min

Notes:

Extension

Ps draw a graph of the data as homework.

(T could have axes already prepared on worksheets, or use enlarged copy master, for less able Ps)

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6 ***Book 5, page 120***

Q.3 Read: *One winter's day in Budapest, the temperature was noted every two hours and recorded in this table.*

a) Calculate the mean of the temperatures on that day from the given data.

b) Write the data in increasing order then find the mode and median.

What was the temperature at mid-day (midnight)? (1 °C, – 8 °C)

Deal with one part at a time. Set a time limit. Ps write operations in *Ex. Bks.* but can use a calculator to work out the results if they wish.

Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

BB:

Time (hours)	0	2	4	6	8	10	12	14	16	18	20	22	24
Temperature (°C)	– 10	–11	– 11	– 10	– 8	– 3	1	4	5	2	0	– 4	– 8

a) Mean temperature:

$$\frac{-10 + (-11) + (-11) + (-10) + (-8) + (-3) + 1 + 4 + 5 + 2 + 0 + (-4) + (-8)}{13}$$

$$= \frac{-65 + 12}{13} = \frac{-53}{13} \approx -4 \; (°\text{C})$$

b) – 11, – 11, – 10, – 10, – 8, – 8, – 4, – 3, 0, 1, 2, 4, 5

Mode: – 11 or – 10 or – 8

Median: – 4 °C

45 min

Notes:

Individual work, monitored helped

Table drawn on BB or use enlarged copy master or OHP

Ps shout out in unison.

Compare with British winter temperatures.

Discussion, reasoning, agreement, self-correction, praising

Extension

Ps draw a graph of the data as homework or in *Lesson 150*.

(T could have axes already prepared on worksheets, or use enlarged copy master, for less able Ps)

Bk5	R: Calculations with and without calculators **C: Revision: Numbers. Roman numerals. Negative numbers** *E: Problems*	*Lesson Plan 121*
Activity		***Notes***
1	**Numbers** a) Let's factorise 151 and then list all its positive factors. Ps try out the prime numbers 2, 3, 5, 7, 11 as divisors and dictate their findings. e.g. • 2 is not a factor because 151 is odd; • 3 is not a factor because 1 + 5 + 1 = 7, which is not a multiple of 3; • 5 is not a factor because the units digit is not 0 or 5; • 7 is not a factor because 151 ÷ 7 = 21, r 4 • 11 is not a factor because 151 ÷ 11 = 13, r 8 What is the next prime number? (13) Should we try 13? (No, as 13 × 13 = 169, which is more than 151.) Agree that 151 is a prime number and has only 2 factors: 1 and 151. b) Let's define 151 in different ways. Class checks that definitions are correct and are unique to 151. (e.g. 15T + 1U, 15.1 × 10, $7^2 + 10^2 + 2$, 500 − 349, etc.) *6 min*	Whole class activity Involve several Ps Reasoning, agreement, checking, praising (Calculators are not really needed.) At a good pace Extra praise for clever definitions. Feedback for T
2	**Sequences** T writes first few terms of a sequence on BB. Ps agree on the rule, then come to BB to write and say the following terms. Class points out errors. T decides when to stop. BB: a) 30 100, 29 200, 28 300, (27 400, 26 500, 25 600, 24 700, 23 800, 22 900, 22 000, . . .) [*Rule*: Decreasing by 900, or – 900] b) – 32, – 25, – 18, (–11, –4 , 3, 10, 17, 24, 31, . . .) [*Rule*: Increasing by 7, or +7] Revise negative numbers and show on a number line if necessary. c) XXII, XLIII, LXIV, LXXXV, (CVI, CXXVII, CXLVIII, 22 43 64 85 106 127 148 CLXIX, CXC, CCXI, . . .) 169 190 211 [*Rule*: Increasing by XXI, or + 21] *15 min*	Whole class activity Discussion, agreement on the rule At a fast pace In good humour! Reasoning, agreement, correcting, praising Elicit/revise the Roman numerals first if necessary. (V = 5, X = 10, L = 50, C = 100, D = 500, M = 1000)
3	***Book 5, page 121*** Q.1 Read: *Write in the missing numbers.* I wll give you 2 minutes to do it. Start . . . now! . . . Stop! Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. If correct, Ps circle the mark. If wrong, Ps cross out their mistake in *red* and correct it. All mistakes discussed with the class. *Solution:* a) (4 × 3) + 5 = 17 as 17 − 12 = 5 b) (5 × 5) − 3 = 22 as 25 − 22 = 3 *19 min*	Individual work, monitored Written on BB or SB or OHT Reasoning, e.g. a) 17 – 12 = 5 b) 25 − 22 = 3 Agreement, self-correction, praising

Bk5

Lesson Plan 121

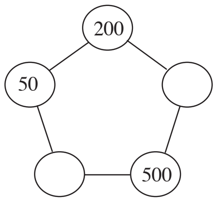
Activity		*Notes*

4

Problem

Listen to the question and study the diagram. Do not use a calculator! Show me your answer when I say. I will give you 2 minutes.

BB:



Write 2 more numbers so that the total of all the numbers is 1000.

Show me 2 numbers . . . now! (e.g. 200 and 50, 100 and 150, etc.)

T chooses a P to explain their reasoning. ($1000 - 750 = 250$, so any 2 numbers which sum to 250 are possible.)

Notes: Whole class activity. Drawn on BB or use enlarged copy master or OHP. Encourage mental calculation, but Ps may work in *Ex. Bks* if necessary. Responses shown on scrap paper or slates in unison. Reasoning, agreement, praising

24 min

5

Book 5, page 121

Q.2 Read: *Calculate 459 × 6*

Allow 2 minutes. Ps do working in *Pbs*.

Show me the product . . . now!

P answering correctly explains at BB. Who did the same? Who did it another way? etc. Ps circle '1 mark' if correct or cross out their mistake in *red* and correct it.

Solution:

$459 \times 6 = 2400 + 300 + 54 = 2754$ or

$$\begin{array}{r} 4\,5\,9 \\ \times\ 6 \\ \hline 2\,7\,5\,4 \\ \hline {\scriptstyle 3\ 5} \end{array}$$

Notes: Individual work, monitored. Responses shown on slates or scrap paper in unison. Reasoning, agreement, self-correction, praising. Accept any valid method. Feedback for T

27 min

6

Calculation practice

T has operations written on BB. Work out the missing numbers in your *Ex. Bks*. I will give you 3 minutes! Start . . . now! . . . Stop!

Ps come to BB or dictate to T, explaining reasoning. Who agrees? Who did it another way? etc. Mistakes discussed and corrected.

BB:

a) $100 - \boxed{64} = 36$ [as $100 - 36 = 64$]

b) $\boxed{5} \times \boxed{13} = 65$ Allow 1×65 or exclude it in advance.

c) $250 \div \boxed{5} = 50$ [as $250 \div 50 = 25 \div 5 = 5$]

Elicit the general methods of solution.

(subtrahend = reductant – difference; divisor = dividend ÷ quotient

Notes: Individual work, monitored. Written on BB or SB or OHT. Discussion, reasoning, agreement, self-correction, praising. (as units digit is 5, so 5 must be a factor, and $65 \div 5 = 13$)

32 min

7

Book 5, page 121

Q.3 Read: *Write the number that is the nearest to 5000 which uses all the digits 4, 5, 6 and 8.*

Although a calculator was allowed in the KS2 Test, encourage Ps to work it out logically rather than using trial and error. Allow 1 minute.

Ps show number on scrap paper or slates on command. (4865)

Ps responding correctly explain reasoning. Who thought the same? Who did it another way? etc.

Notes: Individual work, monitored. Responses shown in unison. Reasoning: e.g. 4Th or 5Th possible but 4800 is nearer to 5000 than 5400 is, so nearest number is 4865.) Agreement, self-correction, praising

35 min

Bk5

Lesson Plan 121

Activity		Notes

8

Book 5, page 121

Q.4 Read: *Practise calculation.*

Set a time limit of 3 minutes. Encourage Ps to check their results (adding in different directions and using reverse operations).

Review with whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes discussed and corrected. If too many mistakes were made, ask Ps to reason with place-value details.

Solution:

a)

		2	0	8	1	7
			4	0	5	3
	1	0	4	1	0	4
+		5	0	5	0	5
	1	7	9	4	7	9
			1		1	

b)

		10	10		10	
	2	2	0	8	1	7
−	$_1$	6_1	7	0_1	9	2
	1	5	3	7	2	5

c)

		8	3	6	0	5
				×	1	4
	3	3	4	4	2	0
+	8	3	6	0	5	0
1	1	7	0	4	7	0
		1				

- T points to a digit and Ps say what its place-value is.
- T asks Ps to say the answers in increasing order.

Notes:

Individual work, monitored

Written on BB or use enlarged copy master or OHP

Quick checking, agreement, self-correction, praising

Feedback for T

At speed round class

In unison. Praising

40 min

9

Book 5, page 121

Q.5 Read: *We have 80 books altogether. They are arranged on 3 shelves.*

If we moved 7 books from the top shelf to the middle shelf and took 8 books away from the bottom shelf, there would be an equal number of books on each shelf.

How many books are on each shelf?

Allow 3 minutes for Ps to try to solve the problem, working individually or in pairs. T advises Ps to read the problem carefully and try to picture it in their heads.

Review with whole class. Who has an answer? Come and tell us how you did it. Who agrees? Who did it another way? etc.
If nobody had the correct answer, T helps class to solve it together.

Solution: e.g.

Number of books: 80 Number of books to be moved: 7
Number of books to be taken away completely: 8

Number of books left: $80 - 8 = 72$

Number of books on each of 3 shelves if equal: $72 \div 3 = 24$

Actual number of books on: top shelf: $24 + 7 = 31$
middle shelf: $24 - 7 = 17$
bottom shelf: $24 + 8 = 32$

Check: $31 + 17 + 32 = 80$ ✓

and $31 - 7 = 24$ ✓; $17 + 7 = 24$ ✓; $32 - 8 = 24$ ✓

Answer: There are 31 books on the top shelf, 17 books on the middle shelf and 32 books on the bottom shelf.

Notes:

Individual (paired) trial first, monitored

[If Ps say that it is impossible, as 80 is not exactly divisible by 3, tell them to read the problem again!]

Discussion, reasoning, agreement, checking, self-correction, praising

or

BB:

$(80 - 8) \div 3 = 72 \div 3 = 24$

$$\left.\begin{array}{|c|}\hline 24 + 7 = 31 \\ \hline 24 - 7 = 17 \\ \hline 24 + 8 = 32 \\ \hline \end{array}\right\} 80$$

Extra praise for Ps who solved it without help from T.

45 min

Bk5

R: Calculations, with and without calculators

C: Review: Numbers and calculations. Fractions and decimals

E: Problems

Lesson Plan 122

Activity		*Notes*

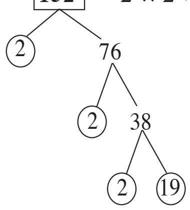
1

Numbers

a) Let's factorise 152 and then list all its positive factors.

Ps come to BB to draw the factor tree. Class agrees/disagrees.

BB: $\boxed{\mathbf{152}} = 2 \times 2 \times 2 \times 19$



Positive factors: 1, 2, 4, 8, 19, 38, 76, 152

b) Let's define 152 in different ways. Class checks that definitions are correct and are unique to 152 and that there are no repeats.

(e.g. 400% of 38, 152 000 ÷ 1000, 8 × 19, 2000 –□1848, etc.)

Notes:
Whole class activity

Reasoning, agreement, praising

At a good pace

Extra praise for clever definitions.

Feedback for T

6 min

2

Crossword

Let's fill in the rows using these clues then read the word in the vertical box.

T reads out each clue, Ps make suggestions and class checks which word is correct (meaning and number of letters).

BB:

					1 h	a	l	**f**							
						2 t	h	**r**	e	e					
					3 t	r	i	**a**	n	g	l	e			
4 d	i	f	f	e	r	e	n	**c**	e						
					5 q	u	o	**t**	i	e	n	t			
							6 k	**i**	l	o	m	e	t	r	e
					7 c	u	b	**o**	i	d					
						8 c	e	**n**	t	i	m	e	t	r	e

1. $\frac{1}{2}$
2. $\frac{12}{4}$
3. A polygon with 3 vertices. (triangle)
4. The result of a subtraction. (difference)
5. The result of a division. (quotient)
6. 1000 metres. (kilometre)
7. Geometric name for a brick shape. (cuboid)
8. $\frac{1}{100}$ of a metre. (centimetre)

Let's read out the word in the box. (FRACTION)

Who can explain what a fraction is? (Part of a whole; bottom number is the denominator and shows into how many equal parts the whole has ben divided; top number is the numerator and shows how many of these parts we are dealing with.)

Notes:
Whole class activity

Grid drawn BB or use enlarged copy master or OHP

Clues could be written on BB or SB or OHT.

(or Ps could have copies of copy master on desks and try it individually under a time limit first if they wish, then review with whole class)

At a good pace

In good humour!

Agreement, praising

Elicit further information on each item, e.g.

half = 0.5 = 50%

Triangle: 3 sides, 3 angles, types, sum of angles = 180°

Name the other components of a subtraction and division, etc.

In unison. Praising

Discussion, agreement, praising

BB: $\frac{1}{2}$ ← numerator / ← denominator

12 min

Bk5

Lesson Plan 122

Activity		*Notes*

Activity 3

Book 5, page 122

Q.1 Read: *Circle two numbers which add up to 160.*

Allow 2 minutes. Ps circle 1 pair in diagram then list as many other pairs as they can. (Only 1 pair was required in KS2 Test.)

Review with whole class. **A**, how many pairs did you find? Who found more than *A*? Let's check them. Ps come to BB to show pairs on diagram and write on BB. Class agrees/ disagrees and points out any pairs missed.

Deal with all possibilities and encourage Ps to list in a logical order, as shown. Mistakes/omissions corrected.

Solution:

63 + 97, 64 + 96, 65 + 95, 66 + 94, 67 + 93,

73 + 87, 74 + 86, 75 + 85, 76 + 84, 77 + 83

16 min

Notes:

Individual work, monitored

Diagram drawn on BB or use enlarged copy master or OHP

BB:

63	64	65	66	67
73	74	75	76	77
83	84	85	86	87
93	94	95	96	97

Reasoning, checking (with calculators), agreement, self-correction, praising

T points out that such an ordered listing ensures that no pairs are missed.

Activity 4

Book 5, page 122

Q.2 Read**:** *A shop sells these flowers.*

a) John buys 4 bunches of daisies.
How much does he pay altogether?

b) Karpal has £5.00 to spend on roses.
How many roses can she buy for £5.00?

Set a time limit of 3 minutes. Ps write operations and write the results in the boxes.

Review with whole class. Ps could show result for each part on slates or scrap paper on command. Ps answering correctly explain reasoning at BB to Ps who were wrong. Class agrees/ disagrees. Ps circle each mark in *red* if correct, or cross out their mistake and correct it.

T asks Ps to say each answer in a sentence.

Solution:

a) 99 p × 4 = 100 p × 4 – 4 p = 400 p – 4 p = 396 p = £3.96

or = £1 × 4 – 4 p = £4 – 4 p = £3.96

Answer: John paid £3.96 for 4 bunches of daisies.

b) £5 ÷ 50 p = 500 p ÷ 50 p = 50 p ÷ 5 p = 10 (times)

Answer: Karpal can buy 10 roses.

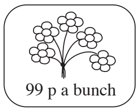
21 min

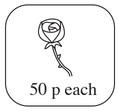
Notes:

Individual work, monitored

Drawn (stuck) on BB or use enlarged copy master or OHP (or real flowers in vases)

BB: Daises Roses





Responses shown in unison.

Reasoning, agreement, self-correction, praising

or

	9	9	
	×	4	
3	9	6	(p)
	3		

If time, Ps think of other questions to ask about the flowers.

Bk5

Lesson Plan 122

Activity		*Notes*

5

Book 5, page 122

Q.3 Let's see how many of these you can do in 3 minutes!
Start . . . now! . . . Stop!

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Encourage Ps to use the correct terminology (numerator, denominator, simplify, expand, mixed number, equivalent fractions, lowest common multiple, etc.).
Draw area diagrams on BB if necessary.

Class agrees/disagrees. Mistakes discussed and corrected.

Who had all 6 correct? Let's give them a clap!

Solution:

a) $\frac{3}{4} + \frac{2}{4} + \frac{1}{4} = \left(\frac{6}{4} = \frac{3}{2} = 1\frac{1}{2}\right)$ b) $2\frac{4}{5} - 1\frac{1}{5} = \left(1\frac{3}{5}\right)$

c) $3\frac{2}{3} + \frac{1}{6} = \left(3\,\frac{4}{6} + \frac{1}{6} = 3\,\frac{5}{6}\right)$

d) $\frac{7}{8} - \frac{1}{5} = \left(\frac{35-8}{40} = \frac{27}{40}\right)$ e) $\frac{2}{7} \times 3 = \left(\frac{6}{7}\right)$

f) $\frac{8}{9} \div 4 = \left(\frac{2}{9}\right)$ (or $= \frac{8}{36} = \frac{4}{9}$)

28 min

Notes:

Individual work, monitored, (helped)

Written on BB or SB or OHT

Discussion, reasoning, agreement, self-correction, praising

Quick revision of the concept of a fraction. Elicit that:

- to find the lowest common multiple of two numbers, list the multiples of the greater number until you reach a common multiple;
- to multiply a fraction by a natural number, either multiply the numerator or divide the denominator;
- to divide a fraction by a natural number, either divide the numerator or multiply the denominator.

6

Book 5, page 122

Q.4 Read: *Circle the two numbers which add up to 1.*

Set a time limit of 1 minute.

Review with whole class. Ps could show the two numbers on slates or scrap paper on command. P answering correctly comes to BB to explain reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

0.11 0.85 0.9 0.25 0.15

as $0.85 + 0.15 = \frac{85}{100} + \frac{15}{100} = \frac{100}{100} = 1$

31 min

Notes:

Individual work, monitored

Written on BB or SB or OHT

Reasoning, agreement, self-correction, praising

Ps say all the numbers as fractions.

Ps say what should be added to each of the other numbers to make 1.

Feedback for T

7

Book 5, page 122

Q.5 Set a time limit of 3 minutes. Encourage Ps to estimate result first and to check their answers with reverse operations (mentally or in *Ex. Bks.* or on scrap paper or slates).

Review with whole class. Ps come to BB or dictate to T, explaining reasoning with place-value detail. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

a) $\begin{array}{r} 10.2 \\ 103.45 \\ +\ \ 62.97 \\ \hline 176.62 \\ {\scriptstyle 1\ 1} \end{array}$ b) $\begin{array}{r} {\scriptstyle 10} \\ 36.82 \\ -\ 14.5_{1}9 \\ \hline 22.23 \end{array}$ c) $\begin{array}{r} 4.3 \\ \times\ 7 \\ \hline 30.1 \\ {\scriptstyle 2} \end{array}$ d) $4\,\overline{)\,6.8} = 1.7$, ${\scriptstyle 2}$

36 min

Notes:

Individual work, monitored

Written on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

T points to a digit and Ps say its actual value.

T asks Ps to say each number as a fraction.

Bk5		*Lesson Plan 122*

Activity | *Notes*

8

Missing number

How can we work out the missing number?

BB: $950.4 \div \boxed{} = 49.5$

We have not learned this yet but can you think of a way of doing it from what you know already? If Ps have ideas, allow them to explain and ask rest of class what they think about it.

If nobody has an idea, T gives hints or directs Ps' thinking.

e.g. Using an easier division on BB (e.g. $50 \div \boxed{} = 5$) elicit that to find an unknown divisor, divide the dividend by the quotient.

BB: $\boxed{} = 950.4 \div 49.5$

$= 9504 \div 495$ (as increasing the dividend and divisor by the same number of times does not change the value of the quotient)

You know how to do long division, so let's do it together. Ps come to BB or dictate what T should write. Class points out errors. (BB)

Ps write the missing number in the original division. How can we check that we are correct? (By doing the division again, or with the inverse operation –□multiplication, on a calculator)

BB: $950.4 \div 19.2 = 49.5$ ✓

Check: $49.5 \times 19.2 = 950.4$ ✓

Elicit the general rules for working out an unkown component in a division.

Notes:

Whole class activity

Written on BB or SB or OHT

This type of operation will be covered properly in Book 6.

Involve several Ps.

Extra praise for good suggestions.

Discussion, reasoning, agreement, praising only

T might need to remind Ps about this.

BB:

					1	9.	2
4	9	5	9	5	0	4.	0
		–	4	9	5		
			4	5	5	4	
		–	4	4	5	5	
					9	9	0
				–	9	9	0
							0

Quotient = dividend ÷ divisor

Divisor = dividend ÷ quotient

Dividend = quotient × divisor

40 min

9

Book 5, page 122

Q.6 Read: *In this addition, different letters stand for different digits and the same letters stand for the same digits. A is not less than 3.*

a) Which digit could each letter stand for? Find different solutions in your exercise book.

b) What is: i) the smallest ii) the greatest possible sum?

Set a time limit. Ps work individually (or in pairs) in *Ex. Bks.* Encourage a logical listing rather than trial and error.

Review with whole class. **A**, how many did you find? Who found more than **A**? How did you do it? etc.

Solution:

a) **AB** + **BC** = **DA**

31 + 12 = 43; 32 + 21 = 53; 34 + 49 = 83; 35 + 58 = 93; 41 + 13 = 54; 43 + 31 = 74; 51 + 14 = 65;

52 + 23 = 75; 53 + 32 = 85; 54 + 41 = 95; 61 + 15 = 76; 62 + 24 = 86; 71 + 16 = 87; 72 + 25 = 97; 81 + 17 = 98

Possible values for each letter can be shown in a table.

A	3	3	3	3	4	4	5	5	5	5	6	6	7	7	8
B	1	2	4	5	1	3	1	2	3	4	1	2	1	2	1
C	2	1	9	8	3	1	4	3	2	1	5	4	6	5	7
D	4	5	8	9	5	7	6	7	8	9	7	8	8	9	9

b) Smallest sum: 43 c) Greatest sum: 98

Notes:

Individual (paired) trial first, monitored

(or whole class activity if time is short or Ps are not very able)

T and Ps could use grids and table on copy master.

Agreement, checking, praising

T could have solution already prepared and uncover the relevant additions as dictated by Ps.

If no P found all 15, Ps dictate those they did find and then they could be asked to complete the task for homework.

45 min

Bk5

R: Calculations, with ane without a calculator

C: Numbers and calculations with integers

E: Problems

Lesson Plan
123

Activity		*Notes*

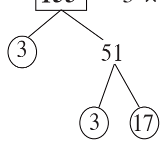
1

Numbers

a) Let's factorise 153 and then list all its positive factors.

Ps come to BB to draw the factor tree. Class agrees/disagrees.

BB: $\boxed{153} = 3 \times 3 \times 17$



Positive factors: 1, 3, 9, 17, 51, 153

b) Let's define 153 in different ways. Class checks that definitions are correct and are unique to 153 and that there are no repeats.

(e.g. 1H + 53U, 15.3 × 10, 1 fifth of 765, 300% of 51, etc.)

6 min

Notes: Whole class activity

Reasoning, agreement, praising

(3 is a factor of 153, as 1 + 5 + 3 = 9, which is a multiple of 3)

At a good pace

Extra praise for clever definitions.

Feedback for T

2

True or False?

Listen to the statement. If you think it is true, knock once on your desk; if you think it is false, put your hands on your head. Show me what you think when I say.

a) The sum of 2 positive numbers is always positive. (T)

b) The sum of 3 negative numbers is always negative. (T)

c) The sum of a positive and a negative number is always positive. (F)
[e.g. $+5 + (-5) = 0$, or $+5 + (-7) = -2$]
When is the sum positive? (When the positive number has a greater absolute value [i.e. numerical value disregarding the sign] than the negative number.)

d) The sum of 4 positive numbers is greater than any of the 4 terms. (T)

e) The sum of 2 negative numbers is greater than any of the 2 terms. (F)
[e.g. $-2 + (-5) = -7$ and $-7 < -2$, $-7 < -5$]
The sum of 2 negative numbers is smaller than any of the 2 terms.

f) The difference between two positive numbers can be – 1. (T)
[e.g. $+3 - (+4) = -1$]

15 min

Notes: Whole class activity

(or Ps decide on appropriate actions or write T or F on slates or scrap paper)

Responses shown in unison.

Ps with differing responses explain reasoning, giving examples or counter examples as necessary.

Note that only one counter example is needed to prove a statement wrong.

Class agrees on correct answer.

Praising, encouragement only

If time, Ps can think of own statements to say to class.

3

Book 5, page 123

Q.1 Read: *Practise addition.*

Set a time limit. Encourage Ps to calculate mentally if possible, and to look out for easy combinations of terms.

Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/ disagrees or suggests an easier way. Mistakes discussed and corrected.

Solution:

a) i) $3 + 2 = 5$ ii) $3 + 0 = 3$ iii) $3 + (-2) = 1$
iv) $3 + (-4) = -1$ v) $3 + (-6) = -3$

b) i) $-3 + (-2) = -5$ ii) $-3 + 0 = -3$ iii) $-3 + 2 = -1$
iv) $-3 + 4 = 1$ v) $-3 + 6 = 3$

c) i) $25 + (-41) + 12 + (-10) = 37 + (-52) = -14$

ii) $-100 + (-30) + 78 + (-48) = -100 + 78 + (-78) = 100$

iii) $5000 + (-2000) + (-3000) = 5000 + (-5000) = 0$

iv) $-85\,000 + (-15\,000) + (-20\,000) = -100\,000 + (-20\,000)$ $= -120\,000$

v) $-236\,700 + 0 = -236\,700$

25 min

Notes: Individual work, monitored, (helped)

Written on BB or use enlarged copy master or OHP

Reasoning, if necessary on class number line or with model, e.g. cash and debt for a) and b), and using height above/below sea level and/or vertical number line for c)

Agreement, self-correction, praising

Feedback for T

Bk5

Lesson Plan 123

Activity		Notes
4	***Book 5, page 123**, Q.2* Read: *Write an operation and calculate the answer.* Deal with one part at a time. Teacher chooses a P to read the question, Ps calculate in *Ex. Bks* then show result on scrap paper or slates on command. P answering correctly explains at BB to Ps who were wrong. Class agrees/disagrees. Mistakes discussed and corrected. Ps write agreed operation in *Pbs*. *Solution:* a) *Ian had £1500 in cash and was £400 in debt, then £300 of his debt was cancelled. What is his balance now?* *Plan:* $1500 + (-400) - (-300) = 1500 + (-100) = 1400$ *Answer:* Ian's balance is £1400. b) *Lucy had £1500 in cash and was £400 in debt. She went on holiday and spent £1200. What is her balance now?* *Plan*: $1500 + (-400) + (-1200) = 300 + (-400) = -100$ *Answer:* Lucy's balance is – £100. *31 min*	Whole class activity but individual calculation under a short time limit. Responses shown in unison. Reasoning, agreement, self-correction, praising Demonstrate with cash and debt cards on BB if necessary. T chooses a P to say the answer in a sentence. Feedback for T
5	***Book 5, page 123*** Q.3 Read: *Practise calculation.* How many calculations are there? ($2 \times 8 = 16$) Let's see how many of them you can do in 5 minutes! It might help if you picture the operations on an imaginary number line in your head. Start . . . now! . . . Stop! Review with whole class. What sign could be written between part a) and part b)? Show me . . . now! (=) Ps come to BB or dictate what T should write, explaining reasoning with cash and debt model or in the case of subtractions, by comparison. Show on number line too if problems or disagreement. Class agrees/ disagrees. Mistakes discussed and corrected. Who had all 16 correct? Who made just 1 mistake? Let's give them 3 cheers! *Solution:* a) i) $20 - (+14) = 6$ b) i) $20 + (-14) = 6$ ii) $20 - (+36) = -16$ ii) $20 + (-36) = -16$ iii) $40 - (+40) = 0$ = iii) $40 + (-40) = 0$ iv) $35 - (-20) = 55$ iv) $35 + (+20) = 55$ v) $-30 - (-10) = -20$ v) $-30 + (+10) = -20$ vi) $-30 - (-30) = 0$ vi) $-30 + (+30) = 0$ vii) $-20 - (-50) = 30$ vi) $-20 + (+50) = 30$ viii) $-20 - (+30) = -50$ viii) $-20 + (-30) = -50$ Elicit that: • subtracting a positive number is the same as adding the opposite negative number; • subracting a negative number is the same as adding the opposite positive number. *40 min*	Individual work, monitored, helped Written on BB or use enlarged copy master or OHP Differentiation by time limit Reasoning, agreement, self-correction, evaluation, praising Responses shown in unison. Reasoning, e.g. by comparion: a) i) 20 is 6 more than 14, so $20 - 14 = 6$ ii) 20 is 16 less than 36, so $20 - 36 = -16$ or by checking with reverse operation. e.g. a) iv) $35 - (-20) = 55$, as $55 + (-20) = 35$ Feedback for T

Bk5		*Lesson Plan 123*
Activity		***Notes***
6	***Book 5, page 123*** Q.4 Read: *What is the smallest possible, 3-digit, positive integer which fulfils these conditions?* • *If it is multiplied by 3, the result is also a 3-digit number.* • *If it is multiplied by 4, the result is a 4-digit number.*	Individual (paired) trial, monitored
	Ps can work individually or in pairs. When a P has an answer, he or she whispers it in the T's ear and T tells them whether they are correct or not. When majority of class have solved it, discuss method of solution with the whole class. Accept and praise trial and error but also show the solution below. [Ps who are correct can be given an extension question to give rest of class more time to solve the problem on their own.] *Solution:* e.g. Smallest possible 4-digit number: 1000. $1000 \div 4 = 250$ *Check:* $3 \times 250 = 750$, which is a 3-digit number *Answer:* The smallest possible 3-digit number which fulfils the conditions is 250.	In good humour! Praise Ps who are correct and encourage Ps who are still trying. Discussion, reasoning, checking, agrement If nobody finds the solution in the time available, T could set it (and/or the extension) for homework and review before the start of *Lesson 124*.
Extension	What is the greatest possible 3-digit number which fulfils the same conditions? *Solution:* Greatest possible 3-digit number: 999. $999 \div 3 = 333$ *Check:* $4 \times 333 = 1332$, which is a 4-digit number *Answer:* The greatest possible 3-digit number which fulfils the conditions is 333. *45 min*	

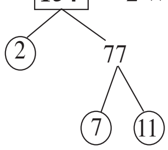
Bk5

R: Calculations with and without calculators

C: Numbers and calculations. Rounding integers and decimals

E: Problems. Coordinates

Lesson Plan 124

Activity		*Notes*
1	**Numbers** a) Let's factorise 154 and then list all its positive factors. Ps come to BB to draw the factor tree. Class agrees/disagrees. BB: $\boxed{\mathbf{154}} = 2 \times 7 \times 11$  Positive factors: 1, 2, 7, 11, 14, 22, 77, 154 b) Let's define 154 in different ways. Class checks that definitions are correct and are unique to 154 and that there are no repeats. (e.g. 200% of 77, 1 tenth of 1540, 14×11, $-50 + 204$, etc.) *6 min*	Whole class activity Reasoning, agreement, praising At a good pace Extra praise for clever definitions. Feedback for T
2	**Rounding** T has sentences written on BB. T reads one sentence at a time, saying 'something' instead of the missing word or number. What would make the sentence true? Ps come to BB or dictate what T should write, then read the whole sentence again. Who thinks it is correct? Who thinks we should write something else? Why? etc. BB: a) 56 437 rounded to the nearest hundred is $\boxed{56\,400}$. b) 3620 is 3615 rounded to the nearest $\boxed{\text{tenth}}$. c) $46.5 \approx 47$ shows that $\boxed{5}$ rounds up to the next greater place-value. d) The inequality $2055 \le x < 2065$ shows the possible values of x which round to $\boxed{2060}$ as the nearest ten. e) The inequality $\boxed{10.35 \le x < 10.45}$ shows the possible values of x which round to 10.40 as the nearest hundredth. What are the rules of rounding? e.g. • 5 rounds up to next whole ten, 50 rounds up to next whole hundred, 500 round up to next whole thousand; 0.5 rounds up to next unit, 0.05 rounds up to next tenth, etc. • When rounding, the complete number must be rounded at once, not 1 digit at a time. *14 min*	Whole class activity Written on BB or use enlarged copy master or OHP (or Ps could show on scrap paper or slates in unison on command) Reasoning agreement, self-correction, praising Feedback for T

Bk5

Lesson Plan 124

Activity		*Notes*
3	***Book 5, page 124***	Individual work, monitored, helped
	Q.1 Read: *Practise rounding: a) to the nearest 10* *b) to the nearest 100* *c) to the nearest tenth.*	Written on BB or use enlarged copy master or OHP
	Set a time limit of 5 minutes.	
	Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.	Reasoning, agreement, self-correction, praising Show on relevant segments of number line drawn on BB if problems or disagreement. Feedback for T
	Solution:	

a) to nearest 10	b) to nearest 100	c) to nearest tenth
6208 ≈ 6210	6208 ≈ 6200	62.08 ≈ 62.1
14 035 ≈ 14 040	14 035 ≈ 14 000	140.35 ≈ 140.4
90 455 ≈ 90 460	90 455 ≈ 90 500	904.55 ≈ 904.6
383 ≈ 380	383 ≈ 400	3.83 ≈ 3.8
9 999 ≈ 10 00	9 999 ≈ 10 000	99.99 ≈ 100.0

22 min

4 ***Book 5, page 124***

Q.2 *Calculate 538 – 396.*

Set a time limit of 1 minute. Ps estimate mentally first by rounding, do the calculation, then check against estimate and with the reverse operation.

Review with whole class. Ps show result on scrap paper or slates on command. T chooses one of the Ps responding correctly to explain reasoning at BB to Ps who were wrong. Who did the same? Who did it a different way? Mistakes discussed and corrected.

Elicit the correct mathematical names for the components of subtraction. (reductant, subtrahend and difference)

Solution:

e.g. 538 – 396 = 238 – 96 = 148 – 6 = 142 or

or 542 – 400 = 142 (Adding equal amounts to reductant and subtrahend does not change the difference.)

Notes:

Individual work, monitored

e.g. Estimating to nearest:

100: 500 – 400 = 100

10: 540 – 400 = 140

Responses shown in unison.

Reasoning, agreement, self-correction, praising

Deal with all methods used by Ps.

T writes the names on BB.

$$\begin{array}{r} 5\,\overset{10}{3}\,8 \\ -\ 3_{1}9\,6 \\ \hline 1\,4\,2 \end{array} \quad \text{or} \quad \begin{array}{r} \overset{4}{\cancel{5}}\,\overset{10}{3}\,8 \\ -\ 3\,9\,6 \\ \hline 1\,4\,2 \end{array}$$

26 min

5 ***Book 5, page 124***

Q.3 Read: *Write in the* ***four missing digits.***
Put ***one*** *digit in each box.*

In the KS2 test, Ps were allowed to use a calculator to help them but it can done just as easily without one. Why not try it?

Allow 1 minute. Remind Ps to check their solution.

Review with whole class. P comes to BB or dicates to T. Who agrees? Who wrote something different? How did you work it out? (e.g. trial and error with a calculator) Who did the same? Who worked it out without a calculator? Tell us what you did.

Solution:

e.g. Reasoning: e.g. 198 ≈ 200, and 100 + 100 = 200

198 is 2 less than 200, so subtract 2 from LHS also, i.e. 1 from each of the 100s.

$$\boxed{99 + 99 = 198}$$

Notes:

Individual work, monitored

Written on BB or SB or OHT

A challenge for more able Ps to think logically!

Discussion, reasoning, checking, agreement, self-correction, praising

or 198 ÷ 2 = 99

so 99 + 99 = 198

30 min

Bk5

Lesson Plan 124

Activity		Notes

6

Book 5, page 124

Q.4 Read: *Here is a graph.*

a) The points A, B and C are ***equally spaced****.*
What are the ***coordinates*** *of point B?*

b) Point D is directly below point C.
What are the ***coordinates*** *of the point D?*

Elicit what the given coordinates beside A and C really mean. Ps come to BB to explain and point, with T's help if necessary.

(1st number is the x-coordinate and shows how far the point is along the x-axis, i.e. its distance from the y-axis;

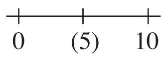
2nd number is the y-coordinate and shows how far the point is along the y-axis, i.e. its distance from the x-axis)

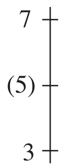
Set a time limit. Review with whole class. Ps could show the coordinates of each point on slates or scrap paper on command. Ps answering correctly explain reasoning at BB to Ps who were wrong. Mistakes discussed and corrected.

Solution:

a) B is half-way between A and C, so

x-coordinate of C: y-coordinate of C:





Coordinates of C: (5, 5)

b) x-coordinate of D = x-coordinate of C = 10,
y-coordinte of D = 0 (as on the x-axis),
so coordinates of D: (10, 0)

Notes:

Individual work, monitored, helped

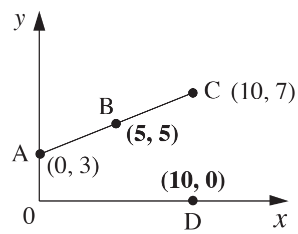
Drawn on BB or use enlarged copy master or OHP

Quick revision of the Cartesian coordinate system

Discussion, reasoning, agreement, self-correction, praising

Feedback for T

BB:



37 min

7

Book 5, page 124, Q.5

Read: *In a race, the runners are started 1 minute after each other. The first runner covers 174 m each minute and the second runner covers 182 m each minute.*

What distance will be between the two runners:

a) 10 minutes after the first runner started

b) 30 minutes after the first runner started?

Allow 4 minutes for Ps to think about it, discuss with their neighbours or try to work out a method of solution in their *Ex.Bks*.

Then Ps who have ideas tell them to class, with T's help or guidance if necessary. If Ps have no ideas, T gives hints or directs Ps' thinking. e.g.

- Write their distances in a table. T starts and Ps come to BB to continue it. Extra praise if Ps realise that they do not need to write every minute in the table! Discuss what the results actually mean.

BB:

Time (minutes)		0	1	2	3	4	. . .	10	. . .	30
Distance from start (km)	1st runner	0	174	348	522	696	. . .	1740	. . .	5220
	2nd runner	0	0	182	364	546	. . .	1638	. . .	5278
Difference (km)		0	174	166	158	150	. . .	102	. . .	–□58

Elicit that after 10 minutes the first runner is still ahead by 102 m but by 30 minutes, the 2nd runner has overtaken the 1st runner and is now leading by 58 m.

Notes:

Individual (paired) trial first, then whole class discussion on methods of solution

(or allow more time for individual solution if Ps wish)

Recommend that Ps use calculators to save time on calculations.

Discussion involving several Ps, reasoning, agreement, praising

- or

Distance apart after 10 min:

174 m × 10 – 182 m × 9

= 1740 m – 1638 m = 102 (m)

Distance apart after 30 min:

174 m × 30 – 182 m × 29

= 5220 m – 5278m = – 58 m

[T could demonstrate problem in a graph or by using computer graphics.]

Bk5

Lesson Plan 124

Activity

Notes

7 **Extension**

(Continued)

When and where did the 2nd runner overtake the 1st runner?

Set as a challenge for more able Ps, or as optional homework, or use in current lesson if Ps were able to solve the first question quickly.

Whole class activity under T's guidance

(or individual or paired

Solution: e.g.

Let t be the time in minutes from the start of the 1st runner.

[or for T's information only in case a P asks about it.]

At the time of overtaking:

1st runner's position: $174\,t$ (metres)

Note that: $174\,t = 174 \times t$

2nd runner's position: $182\,(t - 1)$ (metres)

At point of overtaking:

$$182\,(t - 1) = 174\,t$$
$$182\,t - 182 = 174\,t$$
$$182\,t - 174\,t = 182$$
$$8\,t = 182$$
$$t = 182 \div 8 = 22\frac{6}{8} = \underline{22\frac{3}{4}} \text{ (minutes)}$$

Do not expect Ps to think of this method but T could show it and Ps might be able to follow the reasoning!

(= 22 minutes 45 seconds)

1st runner's position from starting line at time of overtaking:

$$174\,t = 174 \times 22\frac{3}{4} = 174 \times 22.75 = 3958.5 \text{ (metres)}$$

(= 3 km 958 m 50 cm)

Answer:

The 2nd runner overtook the 1st runner after 22 minutes 45 seconds and at a distance of 3 km 958 m 50 cm fromthe starting line.

45 min

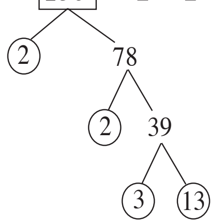
Bk5

R: Calculations with and without a calculator

C: Order of operations. Brackets

E: Problems

Lesson Plan *125*

Activity		*Notes*
1	**Numbers** a) Let's factorise 156 and then list all its positive factors. Ps come to BB to draw the factor tree. Class agrees/disagrees. BB: $\boxed{156} = 2 \times 2 \times 3 \times 13$  Positive factors: 1, 2, 3, 4, 6, 12, 13, 26, 39, 52, 78, 156 b) Let's define 156 in different ways. Class checks that definitions are correct and are unique to 156 and that there are no repeats. (e.g. 300% of 52, 1 sixth of 936, 12×13, $12^2 + 12$, etc.) *8 min*	Whole class activity Reasoning, agreement, praising Ps could join up the factor pairs. At a good pace Extra praise for clever definitions. Feedback for T
2	**Calculation practice 1** Which number does the letter stand for? T dictates the equation and Ps write it in *Ex. Bks*., do the calculation and show answer on slates or scrap paper on command. Ps with correct answers explain at BB to Ps who were wrong. Who did the same? Who did it a different way? etc. Mistakes discussed/corrected. BB: e.g. a) $a = 25 \times 6 \times 125 \times 4 \times 8 = [100 \times 1000 \times 6 = 600\,000]$ (as $25 \times 4 = 100$ and $125 \times 8 = 1000$) b) $b = 25 \times 42 \times 125 \times 4 \times 8 = [600\,000 \times 7 = 4\,200\,000]$ (same terms as a except for 42 instead of 6, and $42 = 6 \times 7$) c) $c = 40 \times 50 \times 9 \times 2 \times 25 = [1000 \times 100 \times 9 = 900\,000]$ (as $40 \times 25 = 1000$ and $50 \times 2 = 100$) d) $d = 40 \times 50 \times 3 \times 2 \times 25 = [900\,000 \div 3 = 300\,000]$ (same terms as c except for 3 instead of 9, and $3 = 9 \div 3$) e) $e = \underbrace{250 \div 5}_{(50)} \times 13 \times \underbrace{8 \div 4}_{(2)} = [50 \times 2 \times 13 = 100 \times 13 = 1300]$ f) $f = 250 \div 50 \times 13 \times 8 \div 4 = [1300 \div 10 = 130]$ (same terms as e except for 50 instead of 5, and $5 = 50 \div 10$) *16 min*	Individual work, monitored T could write the equations on BB too. Responses shown in unison. Discussion, reasoning, agreement, self-correction, praising Extra praise for Ps who noticed easy ways of doing the calculations T points them out if no P noticed and ask Ps what they think of them.
3	**Calculation practice 2** Do these calculation in at least two different ways in your *Ex Bks*. BB: a) $84 - 41 + 29 - 19 + 16$ b) $84 \div 5 \times 15 \div 12 \times 10$ Set a time limit. Review with whole class. Ps come to BB to write and explain their calculations. Who did the same? Who used a different calculation? Deal with all cases. Mistakes discussed and corrected. *Solutions:* e.g. from left to right, or grouping terms in an easier way: a) $84 - 41 = 43$, $43 + 29 = 72$, $72 - 19 = 53$, $53 + 16 = 69$ (or $84 \xrightarrow{-41} 43 \xrightarrow{+29} 72 \xrightarrow{-19} 53 \xrightarrow{+16} \underline{69}$) or $\overbrace{84 + 16}\overbrace{-41 - 19} + 29 = 100 - 60 + 29 = 40 + 29 = 69$	Individual work, monitored Written on BB or SB or OHT Discussion, reasoning, agreement, self-correction, praising Extra praise for clever ideas. Elicit that if only + and –, it is usual to work from left to right unless there is an easier combination of terms.

Bk5		*Lesson Plan 125*
Activity		***Notes***
3	(Continued) b) From left to right, or combining easy terms: $84 \div 5 = 16\frac{4}{5}$, $16\frac{4}{5} \times 15 = 160 + 80 + 12 = 252$, $252 \div 12 = 21$, $21 \times 10 = 210$ (or $84 \xrightarrow{\div 5} 16.8 \xrightarrow{\times 15} 252 \xrightarrow{\div 12} 21 \xrightarrow{\times 10} \underline{210}$) or $\overbrace{84 \div 12} \times \overbrace{15 \div 5} \times 10 = 7 \times 3 \times 10 = 210$ *24 min*	Elicit that if only $\times$ and $\div$, it is usual to calculate from left to right unless there is an easier combination of terms. BB: $5 \overline{)84.0}$ = 16.8 (carries 3 4) 16.8×15: 8 4 0, 1 6 8 0, 2 5 2.0 (carries 1 1)
4	***Book 5, page 125*** Q.1 Read: *Practise calculation.* Set a time limit of 5 minutes. Ps do necessary calculations in *Ex. Bks.* Review with whole class. Ps come to BB tor dictate what T should write, explaining reasoning. Class agrees/disagrees or suggests an easier method of calculation. Mistakes discussed and corrected. *Solution:* e.g. a) $37 - 80 + 43 + 64 - 44 = (37 + 43 - 80) + (64 - 44)$ $= 0 + 20 = 20$ b) $3.7 - 8 + 4.3 + 6.4 - 4.4 = 20 \div 10 = 2$ (as each term in b) is 1 tenth of corresponding term in a). c) $5 \times 31 \times 25 \times 20 \times 4 = (5 \times 20) \times (25 \times 4) \times 31$ $= 100 \times 100 \times 31 = 310\,000$ d) $2 \times 50 \div 4 \times 27 = 100 \times 27 \div 4 = 2700 \div 4 = 675$ *32 min*	Individual work, monitored, helped Written on BB or SB or OHT Discussion, reasoning, agreement, self-correction, praising (If disagreement, check correct result with a calculator.) If no P noticed these easy methods, accept any correct calculation, then T points them out. BB: $4 \overline{)2700}$ = 675 (carries 3 2)
5	***Book 5, page 125*** Q.2 Read: *Practise calculation.* What do you notice about these calculations? (They include all 4 operations.) Who can tell us in which order they should be done? (Multiplication and division first, then addition and subtraction) Set a time limit. Review with whole class. Ps could show results on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Mistakes discussed and corrected. *Solution:* a) $30 - 16 \div 4 + 9 \times 5 + 15 = 30 - 4 + 45 + 15 = 26 + 60 = 86$ b) $72 \div 8 - 20 \times 6 \div 5 + 300 \div 100 = 9 - 120 \div 5 + 3$ $= 12 - 24 = -12$ c) $20 \div 8 \times 6 + 3 \times 12 \div 9 + 15 \div 5 - \boxed{}5$ $= 120 \div 8 + 36 \div 9 + 3 - \boxed{}5 = 15 + 4 + 3 - 5 = 17$ *37 min*	Individual work, monitored, helped Written on BB or SB or OHT Discussion, reasoning, agreement, self-correcting, praising (If disagreement, check result on a calculator.) Feedback for T

Bk5

Lesson Plan 125

Activity		*Notes*
6	***Book 5, page 125***	

Q.3 Read: *Do each calculation in two different ways.*

Do part a) with whole class first. **A**, come and show us one way of doing the calculation. Is **A** correct? Who can think of another way to do it? Class points out errors. Point out that the operation outside the brackets applies to each number inside the brackets.

Let's see if you can do the others on your own. Tick the calculation you think is easiest. Deal with one at a time or set a time limit.

Review with whole class. Ps come to BB or dictate what T should write. Class agrees/disagrees. Mistakes discussd and corrected. Ask Ps which method they like best and why. (Agree that both methods give the correct answer but doing the operation in brackets first is usually quicker and easier.)

Solution:

a) $650 - (450 + 120) = 650 - 570 = 80$
or $650 - 450 - 120 = 200 - 120 = 80$

b) $650 - (450 - 120) = 650 - 330 = 320$
or $650 - 450 + 120 = 200 + 120 = 320$

c) $50 \times (12 + 38) = 50 \times 50 = 2500$
or $50 \times 12 + 50 \times 38 = 600 \times 1900 = 2500$

d) $(200 - 180) \times 7 = 20 \times 7 = 140$
or $200 \times 7 - 180 \times 7 = 1400 - 1260 = 140$

e) $(90 + 72) \div 18 = 162 \div 18 = 81 \div 9 = 9$
or $90 \div 18 + 72 \div 18 = 5 + 4 = 9$

f) $600 \div (25 \times 6) = 600 \div 150 = 60 \div 15 = 4$
or $600 \div 25 \div 6 = 100 \div 25 = 4$

42 min

Notes:

Whole class activity to start, then individual work, monitored, helped

(or continue as a whole class actvity if Ps are unsure)

Written on BB or use enlarged copy master or OHT

Discussion, reasoning, agreement, self-correction, praising

(If problems or disagreement, Ps can use calculators to check results.)

Feedback for T

7 ***Book 5, page 125*, Q.4**

Read: *Which positive, whole numbers make all three inequalities true at the same time?*

Allow 1 minute for Ps to think about it and discuss with their neighbours.

Who thinks they know what to do? Come and explain it to us. Who agrees? Who thinks something else? If no P has an idea, T directs Ps' thinking and class solves it together.

Solution:

$3 \times (5 + \square) < 35 \quad \rightarrow \quad 5 + \square < 12$ (as $\square$ is a whole number)

so $1 \leq \square < 7$ (as $\square$ is a positive number)

$8 + \square > 11 \quad \rightarrow \quad \square > 3$

$20 - 3 \times \square \leq 9 \quad \rightarrow \quad 11 \leq 3 \times \square$, so again $3 < \square$

From all the above: $3 < \square < 7$

Possible numbers: $\square$: 4, 5, 6

45 min

Notes:

Whole class activity

(or individual trial if Ps wish, leaving the question open for finishing at home if Ps are on the right track)

Written on BB or SB or OHT

Discussion, reasoning, agreement, checking by inserting possible solutions in the inequalities to see if they are true, praising

Involve as many Ps as possible.

Agree that the 3rd inequality does not give any additional information – it merely confirms the 2nd inequality.

Bk5	R: Calculations with and without calculators **C: Revision: numbers and operations (integers, fractions, decimals)** *E: Problems*	*Lesson Plan* *126*
Activity		***Notes***
1	**Numbers** a) Let's factorise 157 and then list all its positive factors. Ps try each of the prime numbers 2, 3, 5, 7 and 11. Elicit hat there is no need to try 13, as $13 \times 13 = 169$ and $169 < 157$. Agree that 157 is a prime number so its positive factors are 1 and 157. b) Let's define 157 in different ways. Class checks that definitions are correct and are unique to 157 and that there are no repeats. (e.g. 1H + 5T + 7U, 1 third of 471, $15 \times 10 + 7$, 1.57×100, etc.) *8 min*	Whole class activity At a good pace Ps explain reasoning or do divisions at side of BB. Class agrees/disagrees At speed round class In good humour. Praising, encouragement only
2	**Calculation practice** Write this calculation in your *Ex. Bks*, work out the result and show it to me when I say. It looks difficult but if you do one step at a time it is quite easy! (Allow 3 minutes.) BB: $\frac{3}{4} + 2 \times 0.8 + 4.5 \div 2 - \left(1\frac{1}{2} + 2.5\right) =$ If you have an answer, show me . . . now! (0.6 or $\frac{6}{10}$ or $\frac{3}{5}$) Ps with different forms of correct answer come to BB to do the calculation, explaining reasoning. Ps who were wrong tell class when they made their mistake and what it was. Ps write both forms of the calculation in *Ex. Bks*. *Solution:* e.g. $\frac{3}{4} + 2 \times 0.8 + 4.5 \div 2 - \left(1\frac{1}{2} + 2.5\right)$ $= 0.75 + 1.6 + 2.25 - (1.5 + 2.5) = 4.6 - 4 = 0.6$ or $= \frac{3}{4} + 2 \times \frac{8}{10} + 4\frac{1}{2} \div 2 - (1\frac{1}{2} + 2\frac{1}{2})$ $= \frac{3}{4} + \frac{16}{10} + 2\frac{1}{4} - 4 = 3 + 1\frac{6}{10} - 4 = 4\frac{6}{10} - 4 = \frac{6}{10}$ $(= \frac{3}{5})$ *13 min*	Individual work in *Ex. Bks,* monitored, helped (or whole class activity if class is not very able, with Ps coming to BB or dictating what T should write) Written on scrap paper or slates and shown in unison Discussion, reasoning, agreement, self-correction, praising Feedback for T
3	**Sequences** T has first few terms of sequences written on BB. Ps copy them in *Ex. Bks* then continue the sequences for 5 more terms. Allow 4 minutes. Review with whole class. Ps come to BB or dictate terms to T and give the rule. Who agrees? Who used a different rule? etc. Mistakes discussed and corrected. Revise Roman numerals if necessary. BB: a) -200, -145, -90, (-35, 20, 75, 130, 185, . . .) [+ 55] b) 10. 8.5, 7, 5.5, (4, 2.5, 1, -0.5, -2, . . .) [– 1.5] c) $\frac{3}{8}$, $\frac{3}{4}$, $\frac{3}{2}$, (3, 6, 12, 24, 48, . . .) [× 2] d) 99, 33, 11, $\left(\frac{11}{3}, \frac{11}{9}, \frac{11}{27}, \frac{11}{81}, \frac{11}{243}, \ldots\right)$ [÷ 3] e) CXI, CCXXII, CCCXXXIII, (CDXLIV, DLV, DCLXVI, DCCLXXVII, DCCCLXXXVIII, . . .) [+ CXI, i.e. + 111] *21 min*	Individual work, monitored, helped Discussion, reasoning, agreement, self-correction, praising Accept other rules too if explained correctly. Part e) could be optional or set as extra work for quicker or more able Ps.

Bk5

Lesson Plan 126

Activity		*Notes*
4	***Book 5, page 126*** Q.1 Read: *Megan makes a sequence of numbers starting with* ***100****.* *She* ***subtracts 45*** *each time.* *Write the next* ***two*** *numbers in the sequence.* Set a time limit of 1 minute. Review with whole class. Ps could show the numbers on slates or scrap paper on command. Ps answering correctly explain reasoning. Mistakes discussed and corrected. Show sequence on number line if necessary. *Solution:* 100, 55, 10, -35, -80 (*Rule*: -45) What can you tell me about positive and negative numbers? (e.g. Positive numbers are greater than zero, negative numbers are less than zero; each positive number has an opposite negative number which is the same distance from zero but in the opposite direction; the distance of a number from zero, without its positive or negative sign, is its absolute value.) *25 min*	Individual work, monitored Responses shown in unison. Reasoning, agreement, self-correction, praising Ps circle '1 mark' for each correct number. Quick revision: Ps tell what they remember and T prompts where necessary.
5	***Book 5, page 126*** Q.2 Read: *Eggs are put in* ***trays of 12****. The trays are packed in boxes.* *Each box contains* ***180 eggs****.* *How many trays are in each box?* *Show your* ***working****. You may get a mark.* Set a time limit of 2 minutes. Remind Ps to check their answer. Review with whole class. Ps could show result on scrap paper or slates on command. P anwering correctly explain at BB to Ps who were wrong. Who agrees? Who did the calculation a different way? Mistakes discussed and corrected. *Solution:* *Plan:* $180 \div 12$ $(= 30 \div 2 = 15)$ or $12\overline{)180}$ = 15 (carry 6) *Check:* 15×12: 30, 150, 180 ✓ *Answer:* There are 15 trays in each box. *29 min*	Individual work, monitored Reasoning, agreement, self-correction, praising (Elicit that reducing the dividend and divisor by the same number of times does not change the quotient.) Feedback for T
6	***Book 5, page 126*** Q.3 Read: *Calculate 7 eighths of 7000.* Set a time limit of 2 minutes. Ps may use their *Ex. Bks.* if they need more space. Review with whole class. Ps could show result on scrap paper or slates on command. P anwering correctly explain at BB to Ps who were wrong. Who agrees? Who did it a different way? Mistakes discussed and corrected. *Solution:* e.g. $\frac{8}{8} \rightarrow 7000$ $\frac{1}{8} \rightarrow 7000 \div 8 = 875$ ($8\overline{)7000}$ = 875, carries 6 4) $\frac{7}{8} \rightarrow 875 \times 7 = 6125$ ($875 \times 7 = 6125$, carries 5 3) or $7000 \div 8 \times 7 = 875 \times 7 = 6125$ *34 min*	Individual work, monitored Discussion, reasoning, checking, agreement, self-correction and marking, praising Accept any valid method. Feedback for T or $\frac{7}{8}$ of 1000 $= 1000 \div 8 \times 7$ $= 125 \times 7 = 875$ $\frac{7}{8}$ of 7000 $= 875 \times 7 = 6125$

Bk5

Lesson Plan 126

Activity		*Notes*
7	***Book 5, page 126***	Individual trial first, monitored

Q.4 Read: *Mr. Jones has two sizes of square paving stones. He uses them to make a path.*

*The path measures **1.55 metres** by **3.72 metres**.*

*Calculate the **width** of a **small paving stone**.*

*Show your **method**. You may get a mark.*

Set a time limit of 3 minutes. Ps work in *Pbs* or *Ex. Bks*.

Review with whole class. Ps could show the width on slates or scrap paper on command. Ps answering correctly explain reasoning at BB to Ps who were wrong. Who did the same? Who did it a different way? Deal with all methods used and class decides which is the simplest. Mistakes discussed and corrected.

Solution: e.g.

Length of path = 4 sides of a large paving stone = 3.72 m

Width of large paving stone: 3.72 m $\div$ 4 = 0.93 m

Width of small paving stone: 1.55 m $-$ 0.93 m = 0.62 m

or: Length of path = 6 sides of a small paving stone = 3.72 m

Width of small paving stone: 3.72 m $\div$ 6 = 0.62 m

or: Let the width of the small paving stone be x and the width of the large paving stone be y.

Then in cm: $x + y$ = 155 cm,

and $2x + 3y$ = 372 cm

We can see from the diagram that y = 372 cm $-$ 2 $\times$ $(x + y)$

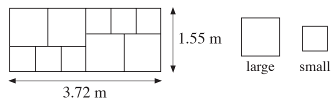
so y = 372 cm $-$ 2 $\times$ 155 cm = 372 cm $-$ 310 cm = 62 cm

Answer: The width of a small paving stone is 0.62 m or 62 cm.

Notes:

Drawn on BB or use enlarged copy master or OHP

BB:



Responses shown in unison.

Discussion, reasoning, agreement, self-correction and marking, praising

$$4 \overline{)\,3.72\,} = 0.93$$

This is the simplest method $-$ extra praise for Ps who used it.

$$6 \overline{)\,3.72\,} = 0.62$$

If no P used this method, T could show it, involving Ps where possible and referring to the diagram to ensure that Ps understand.

T asks a P to say the answer in a sentence.

40 min

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8 ***Book 5, page 126, Q.5***

Read: *Solve this problem in your exercise book.*

Some children and their Dads went on a journey by train. There were 10 Dads with 1 child each, 10 Dads with 2 children each and 10 Dads with 3 children each.

The group took up the 3 coaches at the front of the train and each child was in the same coach as his or her father.

How could they sit so that that the number of Dads and the number of children were the same in each of the 3 coaches?

Who thinks that they know what to do? Who has another idea? If no P can suggest anything, T helps class to solve it together.

Solution:

No of Dads = 30, so 10 Dads in each coach

No of children = 10 $\times$ 1 + 10 $\times$ 2 + 10 $\times$ 3 = 10 + 20 + 30 = 60 so 20 children in each coach. (i.e. 30 people in cach coach)

BB: e.g.

Coach 1	Coach 2	Coach 3
D D D D D D D D D D C C C C C C C C C C C C C C C C C C C C	D D D D D D D D D D C C C C C C C C C C C C C C C C C C C C	D D D D D D D D D D C C C C C C C C C C C C C C C C C C C C
5 $\times$ 3 + 5 $\times$ 1	5 $\times$ 3 + 5 $\times$ 1	10 $\times$ 2

Notes:

Whole class activity

(or individual or paired trial first if Ps wish and if Ps run out of time, T might leave the question open for solution, or finding a further solution, as optional homework)

Discussion involving several Ps. Ps decide what to do and how to continue if they can. T intervenes only if necessary.

Reasoning, agreement, praising

Extra praise for Ps who realise that there is more than one solution.

or

C1: 4 $\times$ 3 + 2 $\times$ 2 + 4 $\times$ 1

C2: 4 $\times$ 3 + 2 $\times$ 2 + 4 $\times$ 1

C3: 2 $\times$ 3 + 6 $\times$ 2 + 2 $\times$ 1

45 min

Bk5

R: Calculations with and without a calculator

C: Revision: Numbers and calculations; sum and difference

E: Word problems

Lesson Plan 127

Activity		*Notes*

1

Numbers

a) Let's factorise 158 and then list all its positive factors.

Ps come to BB to draw the factor tree. Class agrees/disagrees.

BB: $\boxed{158} = 2 \times 79$

$$\begin{array}{c} 158 \\ \swarrow \quad \searrow \\ 2 \qquad 79 \end{array}$$

Positive factors: 1, 2, 79, 158

b) Let's define 158 in different ways. Class checks that definitions are correct and are unique to 158 and that there are no repeats.

(e.g. 200% of 79, $160 - 2$, $124 + 34$, $10^2 + 7^2 + 3^2$, etc.)

6 min

Notes: Whole class activity

Reasoning, agreement, praising

At a good pace

Extra praise for clever definitions.

Feedback for T

2

What is the rule?

Deal with one table at a time. What could the rule be? Agree on one form of the rule in words using the columns already completed.

Then Ps come to BB to choose a column and fill in the missing number, or dictate to T, explaining reasoning. Class agrees/disagrees.

Who can write the rule in a mathematical way? Who can write it another way? Class checks mentally with values from the table.

BB:

a)

a	-1301	$73\frac{1}{2}$	-2.4	584	**-0.9**	$-\frac{4}{5}$	**-155**	$1\frac{1}{8}$
b	-1297 7	$77\frac{1}{2}$	1.6	**588**	3.1	$\mathbf{3\frac{1}{5}}$	-11	$\mathbf{5\frac{1}{8}}$

Rule: $a = b - 4$, $b = a + 4$, $b - a = 4$

b)

u	1248	0	-9	$\frac{6}{10}$	-102	$3\frac{3}{20}$	**-630**)	6.9	$\mathbf{4\frac{1}{2}}$
v	416	0	-3	$\frac{2}{10}$	**-34**	$\mathbf{1\frac{1}{20}}$	-210)	**2.3**	$1\frac{1}{2}$

Rule: $u = v \times 3$, $v = u \div 3$, $(u \div v = 3,\ v \div u = \frac{1}{3})$

16 min

Notes: Whole class activity

Drawn on BB or use enlarged copy master or OHP

Agreement on the rule

At a good pace

Reasoning, agreement, praising

T asks Ps to give other pairs of values for each table.

Feedback for T

3

Book 5, page 127

Q.1 Read: *Fill in the missing numbers and signs. 843 + 157 = 1000*

Think about why you have been given the sum of 843 and 157!

Set a time limit. Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

a) $843 + (157 + 36) = 1000 + \boxed{36}$

b) $843 + (157 + k) = 1000 \boxed{+} k$

c) $(843 + 41) + 157 = 1000 \boxed{+} 41$

d) $(843 + n) + 157 = 1000 + \boxed{n}$

e) $843 + (157 - 69) = 1000 \boxed{-} 69$

f) $843 + (157 - t) = 1000 - \boxed{t}$

g) $(843 - 55) + 157 = 1000 - \boxed{55}$

h) $(843 - u) + 157 = 1000 \boxed{-} u$

Notes: Individual work, monitored, (helped)

Written on BB or use enlarged copy master or OHP

Differentiation by time limit.

Reasoning, agreement, self-correction, praising

Extra praise for Ps who realised the implication of the given sum:

843 + 157 is on LHS of each equation and 1000 is on RHS, so whatever extra is done to LHS, the same must be done to RHS to keep the equation true.

Bk5

Lesson Plan 127

Activity		*Notes*

3 (Continued)

i) $(843 + 16) + (157 + 16) = 1000 \boxed{+} \boxed{32}$

j) $(843 + x) + (157 + x) = 1000 \boxed{+} \boxed{2 \times x}$

k) $(843 + 72) + (157 - 72) = \boxed{1000}$

l) $(843 + y) + (157 - y) = \boxed{1000}$

Discuss how the sum of the two numbers changes. T asks several Ps what they think, then generalises in a clear way.

- The sum increases if we increase any term by a positive number.
- The sum decreases if we reduce any term by a positive number.
- If we increase one term and reduce the other term by the same number, the sum does not change.

Notes: Elicit that:
$+72 - 72 = 0$
$+y - y = 0$

Discussion, agreement, praising

26 min

4 ***Book 5, page 127***

Q.2 Read: *Fill in the missing numbers and signs. 685 – 185 = 500*

Let's see how quickly you can do these by thinking in the same way as we did in Q.1.

Set a time limit. Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/disagrees. Mistakes discussed/corrected.

Solution:

a) $(685 + 15) - \square 185 = 500 + \boxed{15}$

b) $(685 + a) - \square 185 = 500 \boxed{+} a$

c) $685 - (185 + 23) = 500 \boxed{-} 23$

d) $685 - (185 + b) = 500 - \boxed{b}$

e) $(685 - 45) - \square 185 = 500 \boxed{-} 45$

f) $(685 - c) - 85 = 500 \boxed{-} c$

g) $685 - (185 - 30) = 500 \boxed{+} 30$

h) $685 - (185 - d) = 500 + \boxed{d}$

i) $(685 + 51) - (185 + 51) = \boxed{500}$

j) $(685 + e) - (185 + e) = \boxed{500}$

k) $(685 + 4) - (185 - 4) = 500 \boxed{+} \boxed{8}$

l) $(685 + f) - (185 - f) = 500 \boxed{+} \boxed{2 \times f}$

m) $(685 - 10) - (185 + 10) = 500 \boxed{-} \boxed{20}$

n) $(685 - g) - (185 + g) = 500 \boxed{-} \boxed{2 \times g}$

Discuss how the difference between the two numbers changes. T asks several Ps what they think, then generalises in a clear way.

- The difference increases if we increase the reductant or reduce the subtrahend by a positive number
- The difference decreases if we reduce the reductant or increase the subtrahend by a positive number.
- If we increase or decrease both the reductant and the subtrahend by the same amount, the difference does not change.

Notes:

Individual work, monitored, (helped)

Written on BB or use enlarged copy master or OHP

Differentiation by time limit.

Reasoning, agreement, self-correction, praising

Elicit that a negative sign in front of the brackets applies to every number inside the brackets, so. e.g. in:

c) $685 - (185 + 23)$
$= 685 - 185 - (+23)$
$= 685 - 185 - 23$
$= 500 - 23$

g) $685 - (185 - 0)$
$= 685 - 185 - (-30)$
$= 685 - 185 + 30$
$= 500 + 30$

Discussion, agreement, praising

36 min

Bk5		*Lesson Plan 127*
Activity		***Notes***
5	***Book 5, page 127*** Q.3 Read: *a) Nicola has **£50**. She buys **3 flowerpots** and a **spade.** How much money does she have left?* *b) Seeds are **£1.49** for a packet. Stephen has **£10** to spend on seeds. What is the **greatest number** of packets he can buy?* Set a time limit of 3 minutes. Ps write operations in *Pbs* or *Ex. Bks*. and write the results in the boxes. Review with whole class. Deal with one part at a time. Ps could show result on scrap paper or slates on command. P answering correctly explains at BB to Ps who were wrong. Who did the same? Who did it another way? Mistakes discussed and corrected. T chooses a P to say the answer in a sentence. *Solution:* e.g. a) *Plan:* $50 - (11.75 \times 3 + 9.55) = 50 - (35.25 + 9.55) = 50 - 44.80 = 5.20$ (£) *Answer:* Nicola has £5.20 left. b) *Plan:* £10 ÷ £1.49 = 1000 p ÷ 149 p $1000 \div 149 \approx 6.71$ (to 2 d.p.) or 1000 p ÷ 149 p = 6 (times), r 106 p $\begin{array}{r} 6 \\ 149\overline{)1000} \\ -\ 894 \\ \hline 106 \end{array}$ *Answer:* The greatest number of packets of seeds that Stephen can buy is 6. (He will have £1.06 left.) *41 min*	Individual work, moniitored, less able Ps helped BB: | *Rakes* £7.70 each | *Spades* £9.55 each | *Flowerpots* £11.75 each | Ps use a calculator if they wish or do the calculations in *Ex. Bk*s if they prefer. Reasoning, agreement, self-correction and marking, praising Show calculations on BB to check that Ps understand what the calculator is doing . $\begin{array}{r} 11.75 \\ \times\ 3 \\ \hline 35.25 \\ {\scriptstyle 2\ 1} \end{array}$ $\begin{array}{r} 35.25 \\ +\ 9.55 \\ \hline 44.80 \\ {\scriptstyle 1\ \ 1} \end{array}$ $\begin{array}{r} 50.00 \\ -\ 44.80 \\ \hline 5.20 \\ \hline \end{array}$ N.B. Dividing by a decimal or a fraction will be taught in Y6 – but Ps could solve this problem using a calculator, or by changing £s to pence, or by trial and error.
6	***Book 5, page 127*** Q.4 Read: *How many positive 3-digit numbers less than 500 are there in which the middle digit is half of the sum of the two outside digits?* Set a time limit of 3 minutes then review with whole class. Ps come to BB or dictate to T. Encourage a logical listing. Class points out any missed. Mistakes or omissions corrected. *Solution:* 210, 420 111, 222, 321, 432 123, 234, 333, 444 135, 246, 345, 456 147, 258, 357, 468 159, 369 [20 numbers] *45 min*	Individual (or paired) trial, monitored (or whole class activity if time is short or Ps are not very able) Reasoning, agreement, self-correction, praising Class applauds Ps who found all 18 without help. [Or T may leave the problem open for Ps to finish at home, then review before the start of *Lesson 128.*]

Bk5	R: Calculations with and without a calculator C: **Revision: Numbers and calculations; product and quotient** E: *Word problems*	*Lesson Plan 128*

Activity		*Notes*

1 **Numbers**

a) Let's factorise 159 and then list all its positive factors.

Ps come to BB to draw the factor tree. Class agrees/disagrees.

BB: $\boxed{\mathbf{159}} = 3 \times 53$

3 53

Positive factors: 1, 3, 53, 159

b) Let's define 159 in different ways. Class checks that definitions are correct and are unique to 159 and that there are no repeats.

(e.g. 300% of 53, $13^2 - 10$, 15.9×10, 15T + 9U, etc.)

Notes: Whole class activity

Reasoning, agreement, praising

At speed. T chooses Ps at random.

Extra praise for clever definitions.

Feedback for T

6 min

2 **What is the rule?**

Deal with one table at a time. What could the rule be? Agree on one form of the rule in words using the columns already completed.

Then Ps come to BB to choose a column and fill in the missing number, or dictate to T, explaining reasoning. Class agrees/disagrees.

Who can write the rule in a mathematical way? Who can write it another way? Class checks mentally with values from the table.

BB:

a)

u	4	1.5	0.6	-2	**6.5**	$3\frac{1}{6}$	$\mathbf{\frac{13}{5}}$	105	$\mathbf{6\frac{3}{4}}$
v	1	3.5	4.4	7	-1.5	$\mathbf{1\frac{5}{6}}$	$\frac{12}{5}$	$\mathbf{-100}$	$-1\frac{3}{4}$

Rule: $u = 5 - v$, $v = 5 - u$, $u + v = 5$

b)

s	5000	100	400	1	**1250**	10	50	**20 000**	2.5
t	2	100	25	**10 000**	8	**1000**	**200**	$\frac{1}{2}$	**4000**

Rule: $s = 10\,000 \div t$, $t = 10\,000 \div s$, $s \times t = 10\,000$)

Reasoning:

For 2nd column from the right: $10\,000 \div \frac{1}{2}$

e.g. $1 \times 10\,000 = \frac{1}{2} \times \underline{20\,000}$ (× 2, ÷ 2) or $10\,000 \div \frac{1}{2} = 20\,000 \div 1 = \underline{20\,000}$ (× 2, × 2)

or $\frac{1}{2}$ is contained in 10 000 20 000 times.

For last column on the right: $10\,000 \div 2.5$

e.g. $25 \times 400 = 2.5 \times \underline{4000}$ (× 10, ÷ 10) or $10\,000 \div 2.5 = 20\,000 \div 5 = \underline{4000}$ (× 2, × 2)

c)

x	0	1	2	3	4	7	8	13	50	100	**5**	**10**
y	**1**	**2**	5	10	17	50	**65**	**170**	**2501**	**10 001**	26	101

Notes: Whole class activity

Drawn on BB or use enlarged copy master or OHP

Agreement on the rule

At a good pace

Reasoning, agreement, praising

T asks Ps to give other pairs of values for each table.

As dividing by a fraction or a decimal has not been taught yet, T might need to help Ps to reason in other ways, as shown.

Extra praise if Ps think of any of these strategies by themselves.

Rule: $y = x \times x + 1$

$[\, x \times x = y - \,]$

$[\, y - x \times x = 1 \,]$

18 min

Bk5

Lesson Plan 128

Activity		*Notes*
3	***Book 5, page 128***	
	Q.1 Read: *Fill in the missing numbers and signs. 60 × 20 = 1200*	Individual work, monitored, (helped)
	Think about why you have been given the product of 60 and 20!	Written on BB or use enlarged copy master or OHP
	Set a time limit. Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.	Differentiation by time limit. Reasoning, agreement, self-correction, praising
	Solution: a) $(60 \times 3) \times 20 = 1200 \boxed{\times} 3$ b) $(60 \times n) \times 20 = 1200 \times \boxed{n}$ c) $60 \times (20 \times 4) = 1200 \boxed{\times} 4$ d) $60 \times (20 \times m) = 1200 \times \boxed{m}$ e) $(60 \div 3) \times 20 = 1200 \div \boxed{3}$ f) $(60 \div s) \times 20 = 1200 \boxed{\div} s$ g) $60 \times (20 \div 4) = 1200 \boxed{\div} 4$ h) $60 \times (20 \div t) = 1200 \div \boxed{t}$	Extra praise for Ps who realised the implication of the given product: 60 × 20 is on LHS of each equation and 1200 is on RHS, so whatever extra is done to LHS, the same must be done to RHS to keep the equation true.
	i) $(60 \times 2) \times (20 \times 2) = 1200 \times \boxed{4}$ j) $(60 \times u) \times (20 \times u) = 1200 \times \boxed{u \times u}$ k) $(60 \div 4) \times (20 \div 4) = 1200 \div \boxed{16}$ l) $(60 \div v) \times (20 \div v) = 1200 \div \boxed{v \times v}$	T might show that: $2 \times 2 = 2^2$ '2 squared' $u \times u = u^2$ '*u* squared' etc.
	m) $(60 \times 5) \times (20 \div 5) = \boxed{1200}$ n) $(60 \times a) \times (20 \div a) = \boxed{1200}$	Elicit that multiplying by 5, then dividing by 5 is the same as doing nothing, i.e. the product stays the same,
	Discuss how the product of the two numbers changes. T asks several Ps what they think, then generalises in a clear way.	Discussion, agreement, praising
	• If we multiply a factor of a product by a positive whole number, then the product is multiplied by that number. • If we divide a factor of a product by a positive whole number, then the product is divided by that number. • If we multiply one factor of a product by a positive whole number and divide another factor by the same number, the product does not change.	Feedback for T
	27 min	

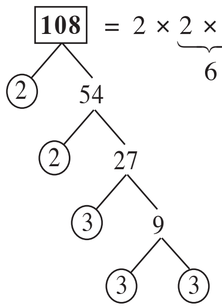
Bk5

Lesson Plan 128

Activity		*Notes*
4	***Book 5, page 128***	
	Q.2 Read: *Fill in the missing numbers and signs. 1500 ÷ 30 = 50*	Individual work, monitored, helped
	Let's see how quickly you can do these by thinking in the same way as we did in Q.1.	Written on BB or use enlarged copy master or OHP
	Set a time limit. Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/ disagrees. Mistakes discussed and corrected.	Differentiation by time limit. Discussion, reasoning, agreement, self-correction, praising
	Solution:	
	a) $(1500 \times 2) \div \square 30 = 50 \times \boxed{2}$	
	b) $(1500 \times a) \div \square 30 = 50 \boxed{\times} a$	
	c) $1500 \div (30 \times 2) = 50 \boxed{\div} 2$	
	d) $1500 \div (30 \times a) = 50 \div \boxed{a}$	
	e) $(1500 \div 2) \div 30 = 50 \div \boxed{2}$	
	f) $(1500 \div a) \div 30 = 50 \boxed{\div} a$	
	g) $1500 \div (30 \div 2) = 50 \boxed{\times} 2$	
	h) $1500 \div (30 \div a) = 50 \times \boxed{a}$	
	i) $(1500 \times 2) \div (30 \div 2) = 50 \boxed{\times} \boxed{4}$	
	j) $(1500 \times a) \div (30 \div a) = 50 \boxed{\times} \boxed{a \times a}$	
	k) $(1500 \div 2) \div (30 \times 2) = 50 \boxed{\div} \boxed{4}$	
	l) $(1500 \div a) \div (30 \times a) = 50 \boxed{\div} \boxed{a \times a}$	
	m) $(1500 \times 2) \div (30 \times 2) = 50 \boxed{} \boxed{}$	Agree that the boxes are not needed for m) to p) as the quotient does not change.
	n) $(1500 \times a) \div (30 \times a) = 50 \boxed{} \boxed{}$	
	o) $(1500 \div 2) \div (30 \div 2) = 50 \boxed{} \boxed{}$	
	p) $(1500 \div a) \div (30 \div a) = 50 \boxed{} \boxed{}$	
	Discuss how the quotient of the two numbers changes. T asks several Ps what they think, then generalises in a clear way.	
	• If we multiply the dividend or the divisor by a positive whole number, then the quotient is multiplied by that number.	Discussion, agreement, praising
	• If we divide the dividend or divisor by a positive whole number, then the quotient is divided by that number.	
	• If we multiply both the dividend and the divisor by the same positive whole number, the quotient does not change.	
	• If we divide both the dividend and the divisor by the same positive whole number, the quotient does not change.	
	36 min	

Bk5

Lesson Plan 128

Activity		*Notes*
5	***Book 5, page 128*** Q.3 Read: *Calculate 286 × 53.* *Show your working. You may get a mark.* Set a time limit of 2 minutes. Ps may use their *Ex. Bks.* if they need more space. Encourage Ps to estimate first and to check their result. Review with whole class. Ps could show result on scrap paper or slates on command. P anwering correctly explain at BB to Ps who were wrong. Who agrees? Who did it a different way? Mistakes discussed and corrected. *Solution:* e.g. $286 \times 53 = 286 \times 50 + 286 \times 3$ $= 2860 \times 5 + 858$ $= 14\,300 + 858$ $= 15\,158$ or $\begin{array}{r} 2\,8\,6 \\ \times\,5\,3 \\ \hline 8\,5\,8 \\ 1\,4\,3\,0\,0 \\ \hline 1\,5\,1\,5\,8 \\ \hline \end{array}$ *40 min*	Individual work, monitored Discussion, reasoning, checking (Ps could use a calculator), agreement, self-correction and marking, praising Accept any valid method. Feedback for T or 286×53 $= 300 \times 53 - 14 \times 53$ $= 3 \times 5300 - (530 + 212)$ $= 15\,900 - 742$ $= 15\,158$
6	***Book 5, page 128, Q.4*** Read: *What is the greatest 3-digit natural number in which the product of its digits is 108?* Allow a minute for Ps to think about it and discuss with their neighbours. Who thinks they know what we should do? T asks several Ps for their ideas. If no P is on the right track, T gives a hint about factorising. Ps come to BB to draw a factor tree. Class agrees/disagrees. BB:  $\boxed{108} = 2 \times \underbrace{2 \times 3}_{6} \times \underbrace{3 \times 3}_{9}$ $\boxed{962}$ Elicit that the 3-digit number which fuflfils the condition has the digits 2, 6 and 9 and the greatest 3-digit natural number which is made up of these digits is 962. *45 min*	Whole class activity If T gives the hint to factorise, allow Ps to continue the solution without further intervention if they can. Class applauds any P who suggests factorising before T does. Discussion, reasoning, agreement, praising Feedback for T

Bk5	R: Calculations **C: Revision: Measurement. Units of measure** *E: Problems*	*Lesson Plan* *129*

Activity		*Notes*
1	**Numbers** a) Let's factorise 161 and then list all its positive factors. Ps come to BB to draw the factor tree. Class agrees/disagrees. BB: $\boxed{\mathbf{161}} = 7 \times 23$ (7) (23) Positive factors: 1, 7, 23, 161 b) Let's define 161 in different ways. Class checks that definitions are correct and are unique to 161 and that there are no repeats. (e.g. 700% of 23, 16T + 1U, 5000 – 4839, $10^2 + 8^2 - 3$, etc.) *8 min*	Whole class activity Reasoning, agreement, praising At speed round class Extra praise for clever definitions. Feedback for T
2	**Quantities** Let's exchange these quantities. For each part, elicit what kind of measures they are, what tools are used to measure them and the relationships between the different units. Ps come to BB to write missing values, or dictate what T should write, explaining reasoning. Class agrees/disagrees. BB: a) i) 143 m 45 cm = $\boxed{14\ 345}$ cm ii) 375 cm = $\boxed{3.75}$ m iii) 62 cm 4 mm = $\boxed{624}$ mm iv) 816 mm = $\boxed{81.6}$ cm = $\boxed{0.816}$ m v) 42 km 60 m = $\boxed{42060}$ m vi) 4950 m = $\boxed{4.95}$ km b) i) 4 litres 5 cl = $\boxed{405}$ cl ii) 1230 cl = $\boxed{12.3}$ ℓ iii) 3 cl 6 ml = $\boxed{36}$ ml iv) 720 ml = $\boxed{72}$ cl = $\boxed{0.72}$ litres c) i) 61 kg 80 g = $\boxed{61080}$ g ii) 5200 g = $\boxed{5.2}$ kg iii) 4 t 380 kg = $\boxed{4380}$ kg iv) 6025 kg = $\boxed{6.025}$ t *20 min*	Whole class activity Written on BB or use enlarged copy master or OHP At a good pace Reasoning, agreement, praising Feedback for T Elicit that: a) Units of length: 1 mm < 1 cm < 1 m < 1 km (× 10) (× 100) (× 1000) b) Units of capacity: 1 ml < 1 cl < 1 litre (× 10) (× 100) c) Units of mass (weight): 1 g < 1 kg < 1 tonne (× 1000) (× 1000)
3	**True or false?** I will read out a statement. When I say, clap your hands once if you think it is true and hold your ears if you think it is false. a) *11 weeks are 77 days.* (T) [as 1 week = 7 days, so 11 weeks = 11 × 7 days = 77 days] b) *The area of a square with sides of length 100 cm is 10 m².* (F) [Area = 100 cm × 100 cm = 1 m × 1 m = 1 m²] c) *100 mm³ = 1 cm³* (F) [1 cm³ = 1 cm × 1 cm × 1 cm = 10 mm × 10 mm × 10 mm = 1000 mm³] d) *2 hours 50 minutes = 2.50 hours* (F) [2.50 hours = 2 hours + $\frac{1}{2}$ an hour = 2 hours 30 min]	Whole class activity T could also have statements written on BB or SB or OHT. (or use any pre-agreed actions, or Ps write T or F on slates and show in unison) Ps with opposing responses explain reasoning and class decides who is correct. Discussion, reasoning, agreement, praising [or 2 h 50 min = $2\frac{5}{6}$ h ≈ 2.83 h]

Bk5

Lesson Plan 129

Activity

Notes

3

(Continued)

e) *7540 seconds = 2 hours 5 minutes 40 seconds* (T)

[2 h = 120 min = 7200 sec; 5 min = 300 sec
7200 sec + 300 sec + 40 sec = 7540 sec]

T repeats Ps' reasoning in a clearer way when necessary.

d) *The weight of 1 kg of apples is the same on the Earth as it is on the Moon.* (F)

[Weight is the force of gravity. 1 kg of apples would be about 1 sixth lighter on the Moon than on the Earth – but its mass would be the same so there would be the same amount to eat!]

Extra praise for Ps who explain this correctly.

30 min

4

Book 5, page 129

Q.1 Read: *These are the times when letters are collected from a post box.*

Read the question yourselves, write the answers in the boxes, then show them to me when I say.

Set a time limit of 2 minutes. Review with whole class. Ps show answers to each part on slates or scrap paper on command. P answering correctly explains at table on BB to Ps who were wrong. Mistakes discussed and corrected.

Solution:

*What is the **latest** time that letters are collected on **Wednesdays**?* (6.30 pm)

*Carla posts a letter at **10 a.m.** on **Monday**. How **long** will it be before it is collected?* [4 hours]

Next collection: 2 pm 10 am to 12 noon: 2 hours;
12 noon to 2 pm: 2 hours.

Time before collection: 2 + 2 = 4 (hours)

*Gareth posts a letter on **Saturday at 4 p.m.** When will it be collected from the post box?*

Next collection: Monday at 9 am

Individual work, monitored

Table drawn on BB or use enlarged copy master or OHP

BB:

Monday to Friday	Saturday	Sunday
9 am 2 pm 6.30 pm	11.30 am	No collection

[Although calculators were allowed in the KS2 test, they are not needed!]

Responses shown in unison.

Agreement, self-correction and marking, praising

(T points to a time in the table and Ps say it in other forms.
e.g. 6.30 pm:
18:30, or 1830 hours, or half past 6 in the evening, etc.)

33 min

5

Book 5, page 129

Q.2 Read: *This diagram shows the distances of different towns from Birmingham.*

Who has been to one of these towns? When? Why? How?

Read the questions yourselves, write the answers in your *Pbs*, then show me them when I say.

Set a time limit of 2 minutes. Review with whole class. Ps show answers to each part on slates or scrap paper on command. P answering correctly explains at diagram on BB to Ps who were wrong. Mistakes discussed and corrected.

Solution:

*Write the name of a town which is **between 30 and 50 miles** from Birmingham.* (Derby or Stoke)

*Use the diagram to estimate the distance in **miles** from **Birmingham** to **Mansfield.*** (e.g. 62 miles)

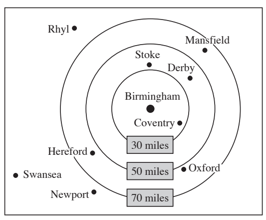
Accept 60 to 65 miles, as dot is slightly more than half-way between 50 miles and 70 miles.

Individual work, monitored

Ps tell what they know about some of the towns.

Diagram drawn on BB or use enlarged copy master or OHP

BB:



Responses shown in unison.

Agreement, self-correction and marking, praising

(Ps estimate distances of other towns from Birmingham.)

36 min

Bk5

Lesson Plan 129

Activity		*Notes*

6

Book 5, page 129

Q.3 Read the questions yourselves, write the answer to the first part in your *Pbs* and wrtite a sentence for the 2nd part in your *Ex. Bks*. Show me the answer to the first part when I say.

Set a time limit of 3 minutes. Review with whole class. Ps show answer to 1st part on slates or scrap paper on command. P answering correctly explains at table on BB to Ps who were wrong. Mistakes discussed and corrected.

T asks several Ps to read their sentence about the 2nd part. Who wrote much the same? Who wrote something different? Deal with all cases. Class decides who is correct and who is not.

Solution:

Emma parks her car at ***9.30 am****. She collects the car at* ***1.20 pm****. How much does she pay?* (£1.70)

9.30 am to 1.30 pm: 4 hours, 9.30 am to 1.20 pm: 3 h 50 min

(or 9.30 to 12 noon: 2 h 30 min; 12 noon to 1.20 pm: 1 h 20 min
Time parked: 2 h 30 min + 1 h 20 min = 3 h 50 min)

So charge is for '3 to 4 hours', i.e. £1 70.

Dan and Mark both use the car park.

Dan says. 'I paid exactly twice as much as Mark but I only stayed 10 minutes longer.' In your exercise book, explain how Dan could be correct.

e.g. 'Mark could have parked for 1 hour 54 minutes and paid 50 p, and Dan could have parked for 2 hours 4 minutes and paid £1.00.'

Notes:

Individual work, monitored

Table drawn on BB or use enlarged copy master or OHP

BB:

Car Park Charges	
Time	Charge
Up to 1 hour	20 p
1 to 2 hours	50 p
2 to 3 hours	£1.00
3 to 4 hours	£1.70
Over 4 hours	£5.00

Reasoning, agreement, self-correction nd marking, praising

Accept any valid explanation for 2nd part.

Praising only

40 min

7

Book 5, page 129

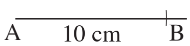
Q.4 Read: *Here is a sketch of a triangle. It is not drawn to scale.*
Draw the full size triangle ***accurately.***
*Use an angle measurer (****protractor****) and a ruler.*

Set a time limit. of 3 minutes. Review with whole class.

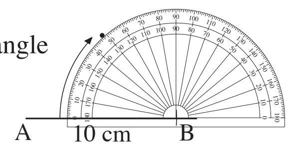
Ps come to BB to demonstrate and explain what they did, using BB ruler, (compasses) and protractor. Who did the same? Who drew it another way? Agree on the correct order of construction and that labelling the vertices makes the construction easier to describe.

Steps:

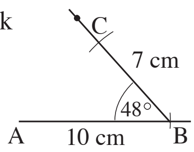
1) Draw a horizontal line 10 cm long. BB:
Label it AB.



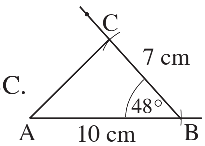
2) Using the protractor, measure an angle of 48° at B and mark with a dot.
(T demonstrates if necessary.)



3) Draw a line from B through the 48° mark and mark a point 7 cm from B.
Label it C.



4) Join up up A and C to form triangle ABC.



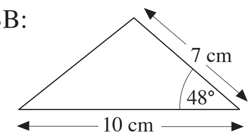
Notes:

Ps have protractors, rulers (and compasses) on desks.

Individual trial in *Ex. Bks,* monitored

Diagram drawn on BB or use enlarged copy master or OHP

BB:



Measuring the lengths of the sides can be done with a ruler or with a ruler and compasses.

Discussion, demonstration, agreement, self-correction, praising/encouragement only

Extension

What can you tell me about the shape you have drawn?

(e.g. plane shape, convex, 2-dimensional, acute-angled triangle, angles sum to 180°, unequal sides, etc.)

45 min

Bk5

R: Parallel and perpendicular lines

C: Revision: shapes, polygons, solids

E: Problems

Lesson Plan
130

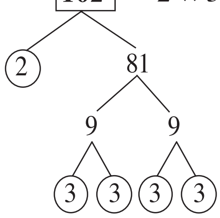
Activity | *Notes*

1 **Numbers**

a) Let's factorise 162 and then list all its positive factors.

Ps come to BB to draw the factor tree. Class agrees/disagrees.

BB: $\boxed{162} = 2 \times 3 \times 3 \times 3 \times 3$



Positive factors: 1, 2, 3, 6, 9, 18, 27, 54, 81, 162

b) Let's define 162 in different ways. Class checks that definitions are correct and are unique to 162 and that there are no repeats.

(e.g.1 tenth of 1620, 1h + 62U, 165 − 3, 1.62 × 100, 18 × 9, etc.)

6 min

Notes:

Whole class activity

Reasoning, agreement, praising

At speed. T chooses Ps at random.

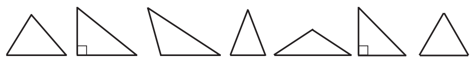
Extra praise for clever definitions.

Feedback for T

2 **Plane shapes**

T says the name of a shape and Ps draw as many different types as they can in their *Ex. Bks*. Allow 1 minute.

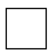
Review with whole class. Ps identify the different types from those already prepared by T (drawn or stuck on BB). Ps say what they know about each type. T prompts if any types are missed.

a) Triangle e.g. BB: 

e.g. acute (all angles < 90°), right (one angle 90°) or obtuse (one angle > 90°) -angled triangles; equilateral, (equal sides), isosceles (at least 2 adjacent sides equal), scalene (3 different sides)

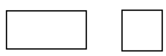
Elicit /point out that:

- All regular triangles are similar to each other.
- All right-angled isosceles triangles are similar to each other.

b) Square BB:  (only 1 type: 4 right angles, 4 equal sides)

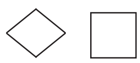
Elicit /point out that:

- All squares are similar to each other.
- A square is a quadrilateral with equal angles and sides.
- A square is a regular rectangle. (equal sides)

c) Rectangle BB: 

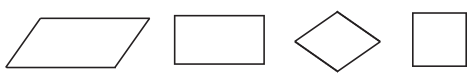
Elicit that:

- A rectangle is a quadraliteral which has 4 right angles (so opposite sides are equal).
- A regular rectangle is a square.

d) Rhombus BB: 

Elicit that:

- A rhombus is a quadraliteral which has 4 equal sides.
- A regular rhombus is a square. (equal angles)

e) Parallelogram BB: 

Elicit that:

- A parallelogram is a quadrilateral with 2 pairs of parallel sides.

Notes:

Individual work, monitored, helped in drawing shapes

Shapes drawn (or cut out and stuck) on BB or use enlarged copy master or OHP

Whole class discussion of types, definitions and properties

Involve all Ps.

Also elicit that:

A plane shape is an enclosed part of a plane and is 2-dimensional.

A polygon is a plane shape with many straight sides, and with 2 adjacent sides meeting at every vertex.

A triangle is a 3-sided polygon

A quadrilateral is a 4-sided polygon.

A pentagon is a 5-sided polygon

Elicit the names of other polygons too:

6-sides: hexagon
7-sides: heptagon
8-sides: octagon
9-sides: nonagon
10-sides: decagon

Rectangles, rhombi and squares are also parallelograms.

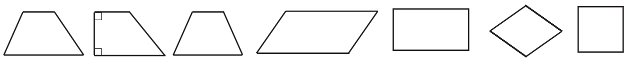
Bk5		*Lesson Plan 130*

Activity | ***Notes***

2

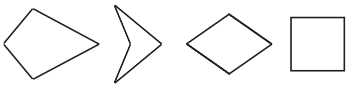
(Continued)

f) Trapezium

BB: e.g. 

Elicit /point out that:

- A trapezium is a quadrilateral with at least 2 parallel sides.
- Parallelograms, rectangles, rhombi and squares are also trapeziums.

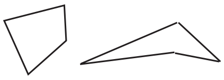
g) Deltoid BB: e.g. 

Elicit that:

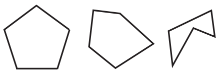
- A deltoid is a quadraliteral which has 2 pairs of equal adjacent sides.
- Rhombi and squares are also deltoids.

Notes: Ps point out the concave deltoid.

h) Quadrilateral which has no special property (4-sided polygon)

BB: e.g. 

Notes: Again, Ps point out the concave shapes.

i) Pentagon BB: e.g. 

Elicit that:

- A pentagon is a 5-sided polygon.
- All regular pentagons are similar to each other.

j) Circle BB: 

Elicit that:

- All circles are similar to each other.

Notes: Elicit that the circle is the only shape dealt with in the activity which is not a polygon, as it is bounded by a curved line.

20 min

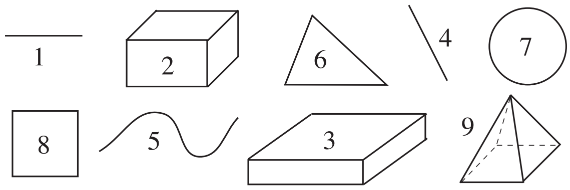
3

Shapes

Study these shapes. How could we put them into 3 groups?

Ps suggest the headings, then dictate the shapes which belong in each group and why. Class agrees/disagrees.

BB:



Lines	Plane shapes	Solids
1, 4, 5	6, 7, 8	2, 3, 9
straight (open), curved	triangle, circle, square	cuboid, pyramid
	polygon	polyhedron

Ps say what they know about each shape.

Discuss the difference between open and closed lines. e.g. 1, 4 and 5 are open lines; the circumference line of a circle is a closed line, while the whole circle (i.e. the circumference and the part of the plane it encloses is a plane shape.

Notes: Whole class activity

Drawn on BB or use enlarged copy master or OHP

(If possible, T also has models of the solids.)

Discussion, reasoning, agreement, praising

Ps could draw or describe other shapes for each group.

Feedback for T

25 min

Bk5

Lesson Plan 130

Activity		*Notes*
4	***Book 5, page 130***	

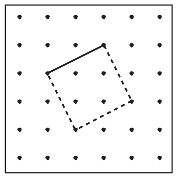
Q.1 Read: *The line on the grid is one side of a square.*
On the grid, draw the other three sides of the square.
Use a ruler.

Set a time limit of 1 minute. Review with whole class.
P comes to BB to draw solution on grid, explaining how he or she decided where the other 2 vertices should be. Class agrees/disagrees. Mistakes discussed and corrected.

If we started at this vertex (T points to, e.g. LH given vertex), how would you describe to somebody else where to draw the other vertices on the grid?

(e.g. from 1st to 2nd vertex: 2 Right, 1 Up
2nd to 3rd vertex: 1 Right, 2 Down
3rd to 4th vertex: 1 Down, 2 Left)

Notes:
Individual work, monitored
Drawn on BB or use enlarged copy master or OHP
Discussion, reasoning, agreement, self-correction and marking, praising
Feedback for T
Solution:



28 min

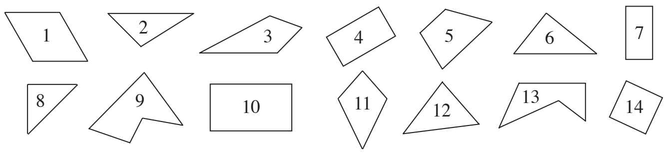
5 ***Book 5, page 130***

Q.2 Read: *Group these plane shapes by listing their numbers.*

What other name could we give to all these shapes? (polygons)

Set a time limit of 3 minutes. Review with whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes discussed and corrected

Solution:



2, 6, 8, 12	1, 3, 4, 5, 7, 10, 11, 14	4, 6, 7, 8, 10, 13, 14
Triangles	Quadrilaterals	Has at least 1 right angle

T points to each polygon in turn and Ps say what they know about it. (e.g. name, convex or concave, parallel, perpendicular or equal sides, types of angles, regular, symmetrical, etc.)

Notes:
Individual work, monitored
Drawn on BB or use enlarged copy master or OHP
Discussion, reasoning, agreement, self-correction and marking, praising

Whole class activity
At a good pace
Praising, encouraging only

34 min

Bk5

Lesson Plan 130

Activity | **Notes**

6

Book 5, page 130, Q.3

Read: *Decide whether the statments are true or false, then list their letters below.*

Deal with one statement at a time. T chooses a P to read the statement and class shows T or F on slates or scrap paper on command. Ps with different responses explain reasoning with examples or counter examples. Class decides who is correct. T writes its letter in the appropriate place on BB, while Ps do the same in *Pbs*.

Solution:

a) All rectangles are quadrilaterals. $\boxed{\text{T}}$

b) All quadrilaterals are rectangles. $\boxed{\text{F}}$

c) Every quadrilateral is a rectangle but not every rectangle is a quadrilateral. $\boxed{\text{F}}$

d) The diagonals of a rectangle are equal in length. $\boxed{\text{T}}$

e) The adjacent sides of any rectangle are equal to each other. $\boxed{\text{F}}$

f) The opposite sides of any rectangle are equal and parallel to each other. $\boxed{\text{T}}$

g) Every trapezium has only 1 pair of parallel sides. $\boxed{\text{F}}$

h) Every quadrilateral which has parallel sides is a trapezium. $\boxed{\text{T}}$

i) All quadrilaterals with equal angles are rectangles. $\boxed{\text{T}}$

j) There is a trapezium with equal sides which is not a rhombus. $\boxed{\text{F}}$

True: a, d, f, h, i   *False*: b, c, e, g, j

Notes:

Whole class activity

(or individual work, monitored, reviewed with whole class)

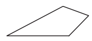
Written on BB or use enlarged copy master or OHP

Responses shown in unison.

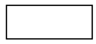
Discussion, reasoning:

e.g.

b) and c) counter example:



is not a rectangle

e) counter example: 

adjacent sides not equal

etc.

Agreement, (self-correction), praising

Feedback for T

41 min

7

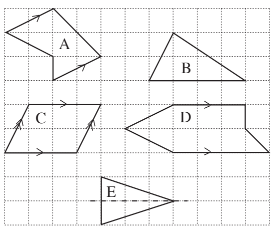
Book 5, page 130

Q.4 Read: *Here are five shapes on a square grid. Write in the* ***missing*** *letters.*

Set a time limit of 2 minutes. Review with whole class.

Ps come to BB to write letters, explaining reasoning and referring to diagram. Ps mark parallel lines on A, C and D and draw the *mirror line* (line of symmetry) in E. Class agrees/ disagrees. Mistakes discussed and corrected.

Solution:



Shape $\boxed{\text{C}}$ has 2 pairs of parallel sides.

Shape $\boxed{\text{A}}$ is a pentagon.

Shape $\boxed{\text{E}}$ has reflective symmetry.

Extension

Ps think of questions to ask about the shapes. e.g.

Individual shapes: What is its name? What type of angles does it have? What length is its perimeter? What is its area?

All the shapes: What name describes them all? How could they be grouped? etc.

Notes:

Individual work, monitored,

Darawn on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, self-correction and marking, praising

If necessary, revise notation for marking pairs of parallel lines. (1 arrow on 1st pair, 2 arrows on 2nd pair, etc.)

Point out that reflective symmetry is the same as line symmetry. i.e. if a mirror was held along the line of symmetry, one half of the shape would be the mirror image or reflection of the other half (or if the shape was folded along the line of symmetry, the edges would meet exactly).

Praising, encouragement only

Extra praise for clever questions.

45 min

Bk5

R: Coordinates

C: Revision: Reflection, translation, rotation

E: Problems

Lesson Plan 131

Activity		*Notes*

1

Numbers

a) Let's factorise 163 and then list all its positive factors.

Ps dictate to T or come to BB to try each of the prime numbers, 2, 3, 5, 7 and 11 as divisors, using 'quick' methods where possible.

Should we try dividing by 13? (No, as $13 \times 13 = 169 > 163$)

Elicit that 163 is a prime number and its factors are 1 and 163.

b) Let's define 163 in different ways. Class checks that definitions are correct, are unique to 163 and there are no repeats.

(100th of 16 300, $10^2 + 8^2 - 1^2$, 0.163×1000, 1H + 6T + 3U, etc.)

8 min

Notes: Whole class activity

Reasoning, agreement, praising

At speed in order round class

Extra praise for clever definitions.

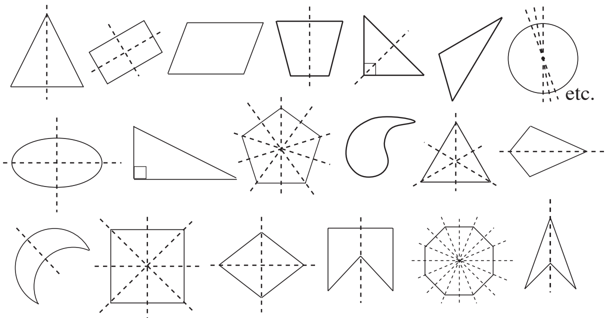
Feedback for T

2

Symmetry

Which of these shapes have reflective or line symmetry? Ps come to BB to point out the shapes, name them if they can and draw all their lines of symmetry. Class agrees/disagrees or points out any missed.

BB:



How could we put the shapes into two groups? (e.g. polygon/not a polygon, convex/concave, regular/irregular, right angle/no right angle, etc.)

14 min

Notes: Whole class acitivty

Drawn or stuck on BB or use enlarged copy master or OHP

At a good pace

Agreement, praising

What name can we give to all the shapes? (plane shapes)

Feedback for T

Praising, encouragement only

3

Transformations

T has grid on BB and Ps have grids on desks (or work in squared *Ex. Bks*).

T works on BB and Ps follow T's instructions on grid sheet or in *Ex. Bks*.

a) 1. Start at a point where the grid lines meet (near the bottom and to the left of the grid). Move 3 units up, then 1 unit diagonally up to the right, then 4 units down, then 1 unit to the right, then 1 unit diagonally down to the left, then 1 unit diagonally up to the left to join the starting point. Label the shape 1.

2. Draw a vertical axis on the grid line 1 unit to the right of *Shape 1*. Label the axis A.

3. Reflect *Shape 1* in the A axis. Label the image 2.

4. Draw a 2nd vertical axis on the grid line 1 unit to the right of *Shape 2*. Label the axis B.

3. Reflect *Shape 2* in the B axis. Label the image 3.

How could we get from *Shape 1* to *Shape 3* in one movement? (By moving 8 units horizontally to the right.)

What is this kind of movement in a plane called? (a translation)
T shows it by drawing an arrow at right angles to the two vertical axes (as shown). Agree that each point on *Shape 3* is 8 units to the right along the same grid line from the corresponding point on *Shape 1*.

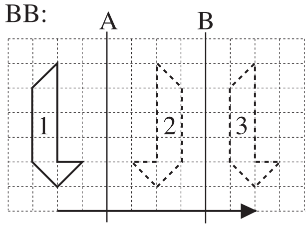
Notes: Whole class acitivity but individual drawing, monitored

T and Ps can use grids on copy master.

T should also have a cut out version of the shape to show the actual movements.

Demonstrate with the model that each reflection can also be thought of as a rotation of 180° out of the plane around axis A and then around axis B.

BB:



Translation

Discussion, agreement

Bk5

Lesson Plan 131

Activity		*Notes*

3

(Continued)

b) T and Ps use a new grid sheet (or a new page in *Ex. Bks.*)

We have reflected a shape in two axes which were parallel to each other. Now lets reflect a shape in two axes which are perpendicular to each another.

Again T works on BB or OHT and gives instructions to Ps who work on grid sheets or in *Ex. Bks.*

1. Start at a point where the grid lines meet (a little less than halfway down and to the left of the grid). Move 5 units up, then 1 unit diagonally down to the right, then 3 units down, then 1 unit to the right, then 1 unit diagonally down to the right, then 3 units to the left to join the starting point.
   Label the shape ①.
2. Draw a vertical axis on the grid line 2 units to the right of *Shape 1*. Label the axis *y*.
3. Reflect *Shape 1* in the *y* axis. Label the image ②.
4. Draw a horizontal axis along the grid line 2 units below *Shapes 1* and *2*. Label the axis *x*.
3. Reflect *Shape 2* in the *x* axis. Label the image ③.

How could we get from *Shape 1* to *Shape 3* in one movement?
(By rotating Shape 1 by $180°$ in the plane around the point where the *x* and *y* axes meet.) Elicit/tell that this point is called the origin.

Who can think of another way to to get from *Shape 1* to *Shape 2*, then from *Shape 2* to S*hape 3*? (Rotation by $180°$ out of the plane around the *y*-axis, then by $180°$ out of the plane around the *x* axis.)

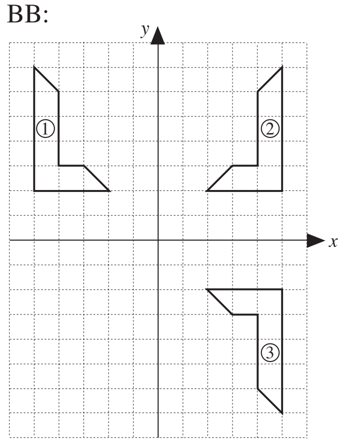
Notes:

Or use grid on copy master

BB: parallel ||

perpendicular

BB:



Elicit that in a reflection the corresponding points on the original shape and its image are an equal distance from the *mirror line*.

T demonstrates both rotations (within the plane and outside the plane) with a cut-out shape.

22 min

4

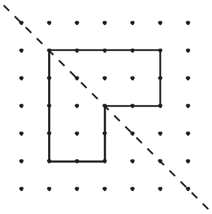
Book 5, page 131

Q.1 Read: *Use a ruler to draw the* ***reflection*** *of this shape in the mirror line. You may use a mirror or tracing paper.*

Set a time limit of 2 minutes. Encourage Ps to try it without the help of a mirror or tracing paper if they can.

Review with the whole class. P comes to BB to draw the image, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:



What can you tell me about the whole shape?
(e.g. hexagon, 5 right angles + 1 reflex angle, concave, etc.)

Notes:

Individual work, monitored

Mirrors and tracing paper should be available for less able Ps.

Drawn on BB or use enlarged copy master or OHP

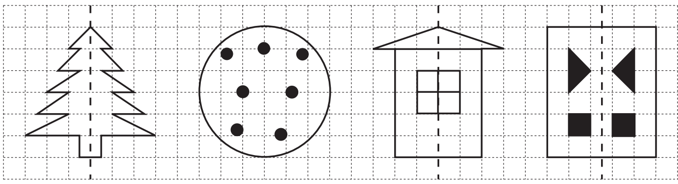
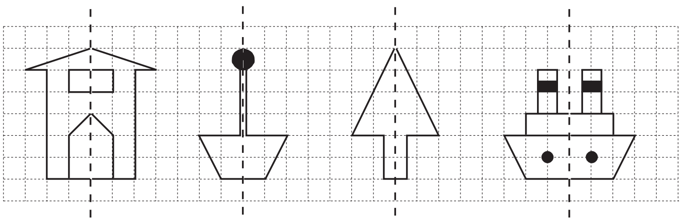
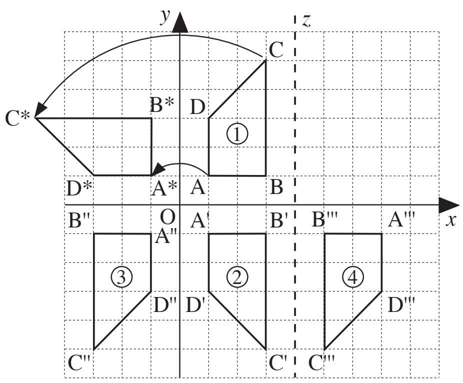
Discussion, agreement, self-correction and marking, praising

Feedback for T

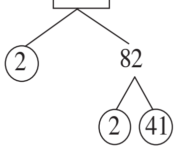
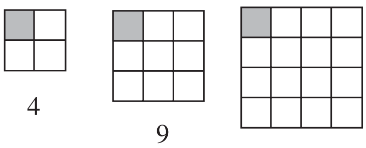
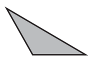
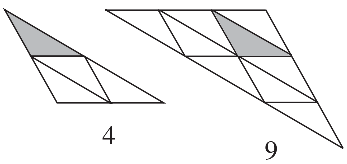
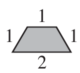
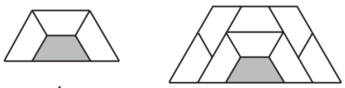
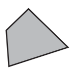
26 min

Bk5

Lesson Plan 131

Activity		*Notes*
5	***Book 5, page 131*** Q.2 Read: *Draw mirror lines on the diagrams which have reflective symmetry.* Set a time limit of 2 minutes. Review with whole class. Ps come to BB to draw mirror lines, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected. *Solution:*  *31 min*	Individual work, monitored (helped) Drawn on BB or use enlarged copy master or OHP Reasoning, agreement, self-correction, praising What is the least number of dots we need to move to make the circular diagram symmetrical? (2)
6	***Book 5, page 131*** Q.3 Read: *Draw the reflection of each shape in its mirror line.* Set a time limit. Ps finished first could come to BB to draw the reflections, keeping them hidden until needed. Review with whole class. Ps compare their shapes with those on BB. Ps agree with them or point out any errors. Mistakes discussed and corrected. *Solution:*  *37 min*	Individual work, monitored helped Drawn on BB or use enlarged copy master or OHP Discussion, agreement, self-correction, praising What geometric shapes can you see in the completed drawings? (circle, rectangle, trapezium, pentagon, heptagon)
7	***Book 5, page 131, Q.4*** Read: *Follow the instructions.* Deal with one part at a time. Ps read the instructions and other Ps come to BB to draw the shapes, label them and write the coordinates, explaining reasoning. Class points out errors. Rest of Ps draw shapes on grid in *Pbs* and write the coordinates in *Ex. Bks*. Remind Ps that rotation by: $+90°$ is anti-clockwise; $-\ 90°$ is clockwise. *Solution:*  A (1, 1); B (3, 1) C (3, 5); D (1, 3) a) A' (1, – 1); B' (3, – 1) C' (3, – 5); D' (1, −33) b) A'' (−1, −1]1); B'' (– 3, – 1 C'' (−3, −5]5); D −1, −3 –[c) A''' (7, −11); B''' (5, – 1) C''' (5, −55); D''' 7, −3]3) d) A* (−1, 11); B* −1, 3, 3) C* (−5, 33); D* −3, 1, 1) *45 min*	Whole class activity (or individual trial first if Ps wish and there is time) Drawn on BB or use enlarged copy master or OHP At a good pace Reasoning agreeement, praising T could have cut-out version of the shape for demonstration. Extra praise if Ps notice that an extra vertical grid line is necessary for *Shape 5*. Ps can measure where C* should be. Ask what other transformations Ps notice, e.g. S3 → S4 (translation – 8 units) S1 → S3 (rotation by 180° around 0, or reflection in O) etc.

Bk5	R: Calculations **C: Revision: Congruency, similarity. Perimeter, area** *E: Problems*	*Lesson Plan 132*

Activity		*Notes*
1	**Numbers** a) Let's factorise 162 and then list all its positive factors. Ps come to BB to draw the factor tree. Class agrees/disagrees. BB: $\boxed{\mathbf{164}} = 2 \times 2 \times 41$  Positive factors: 1, 2, 4, 41, 82, 164 b) Let's define 164 in different ways. Class checks that definitions are correct and are unique to 164 and that there are no repeats. (e.g. 400% of 41, 1 sixth of 984, 1000 – 836, $10^2 + 8^2$, etc.) *6 min*	Whole class activity Reasoning, agreement, praising At speed round class Extra praise for clever definitions. Feedback for T
2	**Congruent shapes 1** First elicit the meaning of congruent and similar shapes. (conguent: exactly the same size and shape; similar: the same shape but not necessarily the same size; all congruent shapes are also similar). Let's form a larger similar shape from congruent unit shapes. T has various unit shapes drawn on BB (or stuck on BB and congruent cut-out shapes in a boxes on desk). Allow Ps a minute to think about it and draw shapes in *Ex. Bks*. then Ps come to BB to draw (or stick more unit shapes on BB to form) larger similar shapes. Class checks that they are similar. Elicit that the number of unit shapes required are the square numbers.) BB: a) Unit shape:  (square)  4 9 16 25, 36, 49, . . . b) Unit shape:  (isosceles triangle)  4 9 16, 25, 36, 49, . . . c) Unit shape:  (trapezium)  4 9 16, 25, 36, 49, . . . d) Unit shape:  Impossible! *16 min*	Whole class activity Drawn on BB or use copy masters, enlarged on card and cut out. (If possible, Ps have shapes on desk too and work in pairs to form the similar shapes.) BB: congruent same size and shape similar same shape Discussion, reasoning, agreement, praising Ps say what they know about each shape (name, angles, sides, etc.) 2 adjacent sides equal 1 pair of parallel sides, 1 pair of equal sides (quadrilateral with no equal sides)

Bk5

Lesson Plan 132

Activity		*Notes*

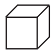
3

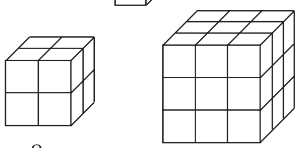
Congruent shapes 3

Let's make a larger similar shape from these congruent unit shapes. T has unit solids on desk and Ps come to front of class to make similar shapes. Class checks that they are correct.

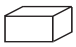
Elicit that the number of unit shapes required are the cubed numbers.

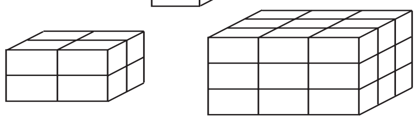
BB:

a) Unit shape:  (cube)

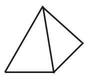


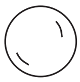
8   27   64, 125, . . .

b) Unit shape:  (cuboid)



8   27   64, 125, . . .

c) Unit shape:  (pyramid) Impossible!

d) Unit shape:  (sphere) Impossible!

Notes:

Whole class activity

If T has no real models, draw diagrams on BB or SB or OHT

(If possible, Ps have solids on desk too and work in pairs to form the similar shapes.)

Discussion, reasoning, demonstration, agreement, praising

Ps say what they know about each shape.

24 min

4

Problems

Listen to the problem and note the data in your *Ex. Bks*. Write a plan, do the calculation and show me the result when I say.

Ps with correct responses explain solution at BB to Ps who were wrong. Who agrees? Who did it another way? Mistakes discussed and corrected.

a) *One side of a square is 2 m 18 cm long. What is the length of its perimeter in cm?*

BB: P = 218 cm × 4 = 872 cm (= 8 m 72 cm = 8.72 m)

b) *The perimeter of a square is 4.72 m What is the length of a side?*

BB: P = 4.72 m = 472 cm

L = 472 cm ÷ 4 = 118 cm = 1m 18 cm = 1.18m

c) *What is the perimeter and area of a rectangle which measures 1 m 40 cm by 65 cm?*

BB: P = 2 × (140 cm + 65 cm) = 2 × 205 cm = 410 cm

A = 140 cm × 65 cm = 9100 cm^2

Elicit that 1 m^2 = 100 cm × 100 cm = 10 000 cm^2

So 9100 cm^2 = 0.91 m^2

Notes:

Individual work, monitored, helped

T could have questions written on BB or SB or OHT

Responses shown in unison.

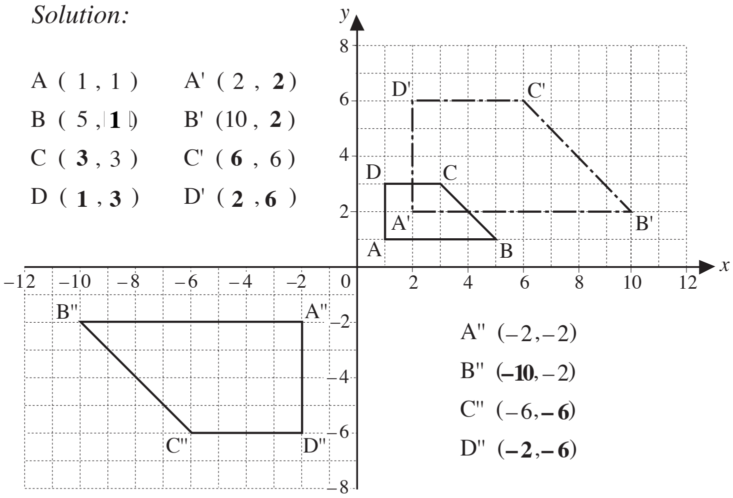
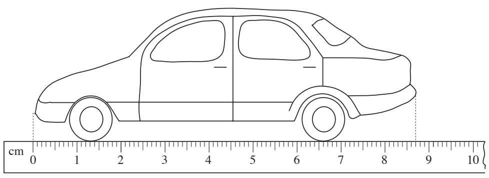
Reasoning, agreement, self-correction, praising

Accept any valid method.

Feedback for T

$$\begin{array}{r} 140 \\ \times\ 65 \\ \hline 700 \\ 8400 \\ \hline 9100 \\ \hline {}_{1}\ \ \ \ \ \ \end{array}$$

30 min

Bk5		*Lesson Plan 132*
Activity		***Notes***
5	***Book 5, page 132*** Q.1 Read: *Fill in the missing coordinates.* What is the name of each shape? (trapezium) Elicit that the first number is the x-coordinate (horizontal axis) and the 2nd number is the y-coordinate (vertical axis). Deal with one shape at a time or set a time limit. Review with whole class. Ps come to BB to point to revelant vertex and say and write the coordinates. Class agrees/disagrees. Mistakes discussed and corrected. *Solution:* A (1 , 1) A' (2 , **2**) B (5 , **1**) B' (10 , **2**) C (**3** , 3) C' (**6** , 6) D (**1** , **3**) D' (**2** , **6**)  A" (−2, −2) B" (**−10**, −2) C" (−6, **−6**) D" (**−2**, **−6**) What do you notice about the shapes? e.g. • A'B'C'D' ≅ A"B"C"D", ABCD ~ A'B'C'D' ~ A"B"C"D" •. ABCD has been enlarged by 2 times and then translated by 1 unit to the right and 1 unit up to form A'B'C'D'. • A'B'C'D' has been rotated by 180° to form A"B"C"D" or A'B'C'D' has been reflected in the origin to form A"B"C"D" *36 min*	Individual work, monitored, helped Drawn on BB or use enlarged copy master or OHP Differentiation by time limit Reasoning, agreement, self-correction, praising Feedback for T Elicit, or remind Ps about, the notation for 'congruent to' and 'similar to' Elicit that the origin is the point where the x and y axes meet (where $x = 0$ and $y = 0$).
6	***Book 5, page 132*** Q.2 Read: *Here is a drawing of a model car.* BB:  Set a time limit of 3 minutes. Ps read rest of question them selves, write an operation, do the calculation and write the answers in the boxes. Ps may use *Ex. Bks.* if necessary. Review with whole class. Ps could show answers on scrap paper or slates on command. Ps responding correctly explain at BB to Ps who were wrong. Class agrees/disagrees. Mistakes discussed and corrected.	Individual work, monitored, helped Drawn on BB or use enlarged copy master or oHP Responses shown in unison. Discussion, reasoning, agreement, self-correction and marking, praising

Bk5		*Lesson Plan 132*
Activity		***Notes***
6	(Continued) *Solution:* *What is the **length** of the model? Give your answer in **centimetres**, correct to one decimal place.* Length of model: 8.7 cm *The height of the model is **2.9 centimetres**. The height of the real car is **50 times** the height of the model. What is the **height** of the **real** car? Give your answer in **metres**.* *Show your **method**. You may get a mark.* Height of real car 2.9 cm × 50 = 29 cm × 5 = 145 cm = 1.45 m	Elicit that 'correct to 1 decimal place' means 'to the nearest tenth of a cm'.
Extension	What is the length of the real car? Length of real car: 8.7 cm × 50 = 87 cm × 5 = 435 cm = 4.35 m *40 min*	Whole class activity or extra work for quick Ps
7	***Book 5, page 132, Q.3*** Read: *Solve the problem in your exercise book.* *The lengths of the sides of a rectangle are whole centimetres. The perimeter of the rectangle is 20 cm.* *a) How many different such rectangles are possible? Give the length of their sides.* *b) Which of them has the smallest and greatest areas and what are these areas?*	Whole class activity (or individual or paired trial first if Ps wish, or leave open and Ps finish at home)
	Allow Ps a minute to think about it and try it in *Ex. Bks*. Who thinks that they know what to do Who agrees? Who thinks something else? Ps suggest what to do and how to continue. T gives hints only if necessary. (If time is short, once Ps have agreed on answer to part a), part b) could be set as homework.)	(If several Ps have an answer, ask them to show it on slates or scrap paper in unison.) Discussion, reasoning, agreement, praising Feedback for T
	Solution: a) $P = 2 \times (a + b) = 20$ cm, so $a + b = 20$ cm $\div 2 = 10$ cm a: 1, 2, 3, 4, 5 b: 9, 8, 7, 6, 5 There are 5 possible rectangles. (Assuming that we do not mind the order of a and b.).	
	b) i) Smallest possible area: $a = 1$ cm, $b = 9$ cm $A = 1 \text{ cm} \times 9 \text{ cm} = 9 \text{ cm}^2$ ii) Greatest possible area: $a = 5$ cm, $b = 5$ cm $A = 5 \text{ cm} \times 5 \text{ cm} = 25 \text{ cm}^2$ *45 min*	Agree that: • the most irregular rectangle has the smallest area, • the most regular rectangle (a square) has greatest area.

Bk5

R: Calculations
C: Revision : Perimeter and area
E: Problems

Lesson Plan 133

Activity

Notes

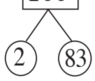
1

Numbers

a) Let's factorise 166 and then list all its positive factors.

Ps come to BB to draw the factor tree. Class agrees/disagrees.

BB: $\boxed{166} = 2 \times 83$ (and 83 is not divisible by 2, 3, 5 or 7)



Positive factors: 1, 2, 83, 166

b) Let's define 166 in different ways. Class checks that definitions are correct and are unique to 166 and that there are no repeats.

(e.g. 200% of 83, 1 third of 498, 16T + 6U, 1.66×100, etc.

6 min

Whole class activity

Reasoning, agreement, praising

At speed. T chooses Ps at random.

Extra praise for clever definitions

Feedback for T

2

Properties

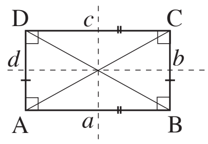
What are some properties of these polygons? T says the name of the polygon and shows diagram on BB, labelling the vertices and sides.

(If possible, Ps have sheets of paper to make the shape by folding or cutting, following T's demonstration.)

Ps say what they know about it and T writes in a mathematical way on BB. T prompts if any are missed. Ps mark certain properties on the diagrams on BB (e.g. equal angles, equal sides, right angles, parallel lines). Elicit the general formula for calculating area and perimeter.

BB:

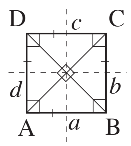
a) Rectangle: *(quadrilateral with equal angles)*



e.g. It has at least 2 lines of symmetry.
$a = c$ and $b = d$
It has 2 equal diagonals. (AC = BD)
$\angle A = \angle B = \angle C = \angle D = 90°$

$P = 2 \times (a + b)$, $A = a \times b$

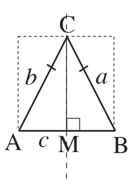
b) Square: *(regular quadrilateral)*



e.g. It has 4 lines of symmetry.
$a = b = c = d$
It has 2 equal, perpendicular diagonals.
$\angle A = \angle B = \angle C = \angle D = 90°$

$P = 4 \times a$, $A = a \times a$ $(= a^2)$

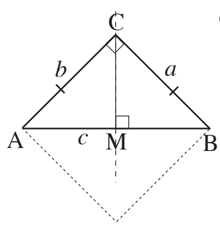
c) Isosceles triangle: *(triangle with at least 2 equal sides)*



e.g. It has at least one line of symmetry (CM)
$a = b$
$\angle A = \angle B$
CM $\perp$ AB (perpendicular to)
AM = MB (M is middle point of AB)

$P = 2 \times a + c$, $A =$ (Length of AB $\times$ length of CM) $\div$ 2

d) Right-angled isosceles triangle:



e.g. It has one line of symmetry (CM)
$a = b$
$\angle A = \angle B = 45°$, $\angle C = 90°$
CA $\perp$ CB and CM $\perp$ AB
AM = MB
$P = 2 \times a + c$, $A = (a \times a) \div 2$

Whole class activity

Outline diagrams already prepared on BB or SB or OHT, then appropriate labels and symbols added during the discussions.

Involve all Ps.

Discussion, reasoning, agreement, praising

T reminds Ps about notation where necessary.

Point out that:

- vertices are usually labelled with capital letters;
- labelling usually starts at bottom LH vertex and goes anti-clockwise;
- sides are labelled with the start and end points (e.g. AB) or with lower case letters, e.g *a;*
- in rectangles and squares, side *a* is usually AB, i.e. adjacent to angle A ($\angle$ A)
- in triangles, side *a* is usually opposite angle A

Reasoning for area of triangles:

c) Area of dotted rectangle:

width $\times$ height = AB $\times$ CM

Area of triangle ABC is half of the area of the rectangle, i.e. (AB $\times$ CM) $\div$ 2

d) Triangle ABC is half of the square with side *a*.

Area of square: $a \times a$

Area of triangle: $(a \times a) \div 2$

Bk5

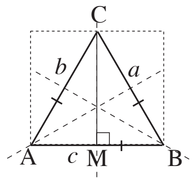
Lesson Plan 133

Activity		*Notes*

2

(Continued)

e) Equilateral triangle: *(regular triangle)*



e.g. It has 3 lines of symmetry

$a = b = c$

$\angle A = \angle B = \angle C = 60°$

CM $\perp$ AB

AM = MB (M is middle point of AB)

$P = 3 \times a$, $A =$ (Length of AB $\times$ length of CM) $\div$ 2

Notes: Reasoning for the area is the same as c)

N.B. The dotted rectangles also show how paper can be folded and/or cut to form the different types of triangle.

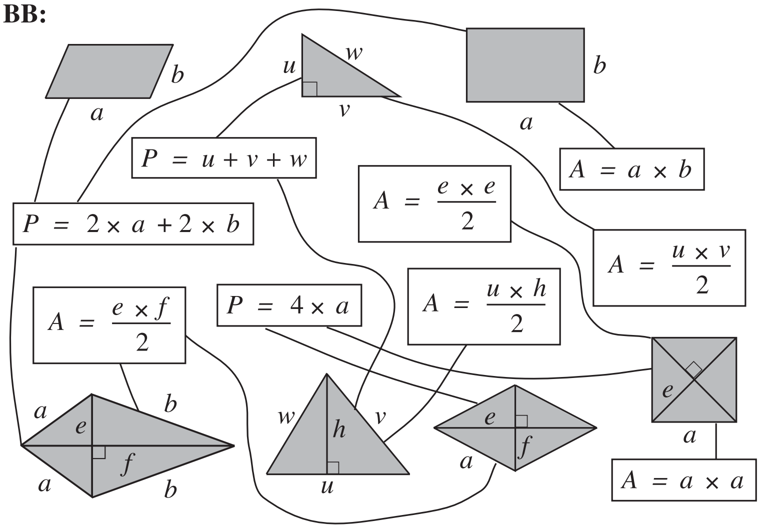
16 min

3

Area and perimeter

Let's join up each formula to the matching shapes. Ps come to BB to choose a formula, read it aloud, say whether it is a perimeter or an area and join it to the matching shape or shapes, explaining reasoning. Class agrees/disagrees or points out missed joinings.

BB:



Ask Ps to explain the formulae in words too. e.g. $A = \dfrac{e \times e}{2}$:

'The area of a square is equal to half of the product of its diagonals.'

Notes: Whole class activity

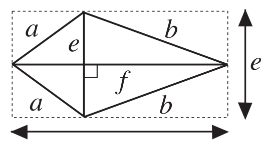
Drawn (stuck) on BB or use enlarged copy master or OHP

At a good pace

T helps where necessary.

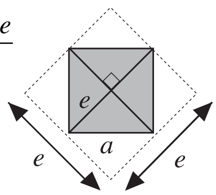
Reasoning: e.g.

$A = \dfrac{e \times f}{2}$



Point out congruent triangles.

$A = \dfrac{e \times e}{2}$



Point out congruent triangles.

Agreement, praising only

26 min

4

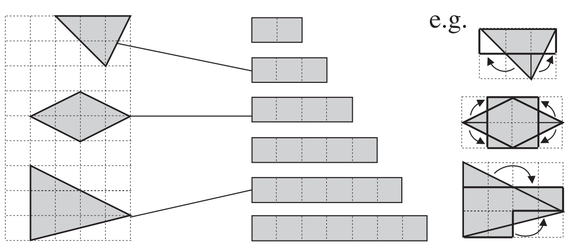
Book 5, page 133

Q.1 Read: *Draw **one line** from each shape to the rectangle which has the **same area**.*

Set a time limit of 2 minutes. Review with whole class. Ps come to BB to draw joining lines and explain reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

(T could have the shapes already cut into pieces so that Ps can manipulate them to make the rectangles.)

Solution:



Notes: Individual work, monitored

Drawn on BB or use enlarged copy master or OHP

Discussion, reasoning, demonstration, agreement, self-correction and marking, praising

Elicit the name of the shapes. (2 scalene triangles, 1 rhombus)

31 min

Bk5		*Lesson Plan 133*

Activity		***Notes***

5

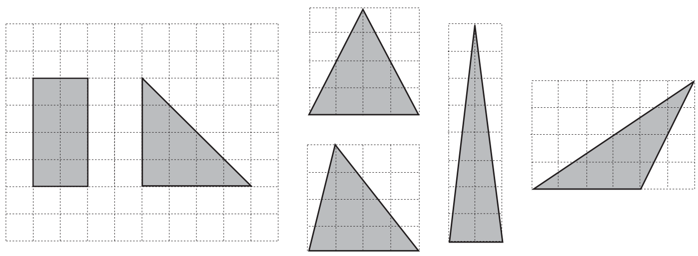
Book 5, page 133

Q.2 Read: *On the grid, draw a* ***triangle*** *which has the* ***same area*** *as the shaded rectangle.*

Set a time limit of 2 minutes. Review with whole class. Ps come to BB to draw their triangles. Who agrees? Who drew a different one? Agree that there are many different solutions.

(If all Ps drew the same triangle, T asks for other solutions or shows some and asks Ps if they are correct.)

Solution: **e.g.** **or**



Notes:

Individual work, monitored

Drawn on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, self-correction and marking, praising

Deal with all cases.

Ps name the different triangles (right-angled, scalene, isosceles, obtuse-angled)

Feedback for T

36 min

6

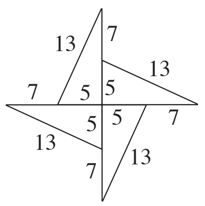
Book 5, page 133

Q.3 Read: *Lindy has 4 triangles, all the same size. She uses them to make a star. Calculate the* ***perimeter*** *of the star.*

Show your ***method****. You may get a mark.*

Set a time limit of 2 minutes. Review with whole class.
Ps show solution on slates or scrap paper on command.
P answering correctly explains at BB to Ps who were wrong.
Class agrees/disagrees. Mistakes discussed and corrected.

Solution:



$$P = 7 + 13 + 7 + 13 + 7 + 13 + 7 + 13$$
$$= 4 \times (7 + 13) = 4 \times 20 = 80 \text{ (cm)}$$

Notes:

Individual work, monitored

Drawn (stuck) on BB or use enlarged copy master or OHP

Responses shown in unison.

Reasoning, agreement, self-correction and marking, praising

Agree that as the diagram is *not to scale* you cannot measure the perimeter.

Extension

What is the area of the star? Ps come to BB or dictate what T should write. Class agrees/disagrees.

BB: $A = 4 \times \dfrac{5 \times 12}{2} = 2 \times 5 \times 12 = 10 \times 12 = 120 \text{ (cm}^2\text{)}$

Notes:

Whole class activity

Agreement, praising

41 min

Bk5		*Lesson Plan 133*
Activity		***Notes***
7	***Book 5, page 133, Q.4*** Read: *The numbers represented by the square must be even and greater than 6. List all the numbers which make the inequality true.* Allow a minute for Ps to think about it and discuss with their neighbours if they wish. Ps suggest what to do first and how to continue, coiming to BB or dictating what T should write. Who agrees? Who thinks we should do something else? etc. If Ps have no ideas, T gives hint of using reverse operations and prompts where necessary. Encourage the use of mathematical reasoning rather than trial and error. *Solution:* BB: $24 < (\blacksquare \div 2 - 3) \times 2 < 50$ Divide by 2: $12 < \blacksquare \div 2 - 3) < 25$ Add 3: $15 < \blacksquare \div 2 < 28$ Multiply by 2: $30 < \blacksquare < 56$ $\blacksquare$: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54	Whole class activity (or individual trial if Ps wish, completed at home if necessary and reviewed before the start of *Lesson 134*) Written on BB orsB or OHT Discussion, reasoning, checking, agreement, praising Involve several Ps. Extra praise for Ps who think of using reverse operations without hint from T.
Extension	Why must the numbers be greater than 6? (If the square was: • equal to 6, the inequality would be $24 < 0 < 50$, which is impossible; • less than 6, the centre part of the inequality would be a negative number, which again is impossible!) *45 min*	Whole class discussion T repeats Ps explanations in a clearer way if necessary. Praising, encouragement only

Bk5	R: Calculations C: **Revision: Area, surface area, volume** *E: Problems*	*Lesson Plan* *134*

Activity		*Notes*
1	**Numbers** a) Let's factorise 167 and then list all its positive factors. Ps dictate to T or come to BB to try each of the prime numbers 2, 3, 5, 7 and 11 as divisors, using 'quick' methods where possible. Should we try dividing by 13? (No, as $13 \times 13 = 169 > 163$) Elicit that 167 is a prime number and its factors are 1 and 167. b) Let's define 167 in different ways. Class checks that definitions are correct and are unique to 167 and that there are no repeats. (e.g. 1H + 6T + 7U, 1.67×100, half of 334, 2000 – 1833, etc.	Whole class activity Reasoning, agreement, praising At speed round class Praising, encouragement only

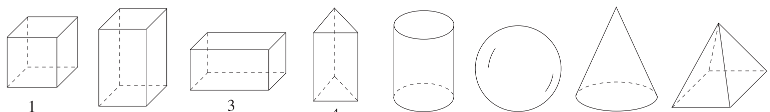
8 min

2 Solids

T has various solids on desk (and if possible, Ps have some too). What name can we give to all these shapes? (Solids) How could we put them into 2 groups? (e.g. all plane faces and at least one curved face) Elicit/remind Ps that a solid which has only plane faces is called a polyhedron. (BB)

T holds up one solid at a time and Ps say what they know about it . (e.g. name, number and types of faces, number of edges and vertices; equal, parallel, perpendicular faces and edges; etc.) T prompts if necessary. Elicit the general formula for calculating the surface area and volume of solids 1) to 3). e.g.

BB: Solids Polyhedron: 1, 2, 3, 4, 8



1) Cube e.g.

It has 6 congruent square faces, 12 equal edges and 8 vertices. Any 2 adjacent faces are perpendicular to one another. Any 2 opposite faces are parallel to one another.

If the length of each of its edges is a, then

Surface Area = $6 \times (a \times a)$ [= $6a^2$]

Volume = $a \times a \times a$ [= a^3]

2) Square-based prism e.g.

It has 2 congruent square faces and 4 congruent rectangular faces.

It has 12 edges (8 of one length, 4 of another length) and 8 vertices.

Any 2 adjacent faces are perpendicular to one another. Any 2 opposite faces are parallel to one another.

If the length of its short edge is a, and its long edge is b, then

Surface Area = $2 \times (a \times a) + 4 \times (a \times b)$ [= $2a^2 + 4ab$]

Volume = $a \times a \times b$ [= a^2b]

3) Cuboid e.g.

It has 6 faces, 12 edges and 8 vertices. Any 2 adjacent faces are perpendicular. Any 2 opposite faces are parallel and congruent.

If the length of its edges are a, b and c, then

Surface Area = $2 \times (a \times b) + 2 \times (b \times c) + 2 \times (c \times a)$

Volume = $a \times b \times c$ [= abc]

Notes:

Whole class activity

T has models to show and also axiomatic diagrams drawn on BB (or use enlarged copy master or OHP)

Involve all Ps. T helps with the correct wording.

Agreement, praising

Point out/elicit that:

- a prism is a polyhedron which has at least one pair of opposite, parallel, congruent faces;
- every cube is a special square-based prism and is also a cuboid;
- every square-based prism is a special cuboid.

T might also give specific lengths of edges and ask Ps to calculate the surface area and volume.

e.g. Cube of side 3 cm:

$A = 6 \times 3 \times 3 = 54$ (cm^2)

$V = 3 \times 3 \times 3 = 27$ (cm^3)

[T could show the short forms of the formulae.]

[= $2ab + 2bc + 2ca$]

Bk5

Lesson Plan 134

Activity		*Notes*
2	(Continued) 4) Regular rectangle-based prism e.g. It has 5 faces; 2 faces are congruent triangles and 3 faces are congruent rectangles. The rectangular faces are perpendicular to the triangular faces. The 2 triangular faces are parallel to each other. It has 9 edges, 6 of them of one length and 3 of them of another length. 5) Cylinder e.g. It has 2 congruent circular faces (base and top) and one curved surface which is perpendicular to the base. It has 2 circular edges and no vertices. 6) Sphere e.g. It has 1 curved surface, no edges and no vertices. Each point on it surface is an equal distance from its centre point. 7) Cone e.g. It has 1 circular face and one curved surface. It has 1 circular edge and one vertex. 8) Regular square-based pyramid e.g It has 5 faces, 1 square face and 4 congruent triangular faces. It has 8 edges (4 of one length and 4 of another length) and 5 vertices. *20 min*	(Other solids can be substituted for some of those shown.) Point out that a pyramid is not a prism as it has no parallel faces. Feedback for T
3	**Polyhedra table** Let's fill in the table for the polyhedra (plural of polyhedron) we have just been talking about. Ps come to BB or dictate what T should write. Class agrees/disagrees. BB: (table below) What do you notice? (e.g. Number of edges + 2 = number of faces + number of vertices) Who could write it mathematically? Who could write it another way? Ps check each form with values from table. *24 min*	Whole class activity Drawn on BB or use enlarged copy master or OHP At a good pace Agreement, praising Discussion on the rule Checking, agreement, praising [Euler's polyhedra theorem]

Polyhedra

	1	2	3	4	8
Faces	6	6	6	5	5
Vertices	8	8	8	6	5
Edges	12	12	12	9	8

$e + 2 = f + v$

$e - f - v = 2$

$e = f + v - 2$, etc.

Bk5

Lesson Plan 134

Activity		*Notes*

4

Book 5, page 134

Q.1 Set a time limit of 3 minutes. Ps read question themselves, calculate mentally or in *Ex. Bks*. and write results in relevant boxes in *Pbs*.

Review with whole class. Ps could show each result on scrap paper or slates on command. Ps answering correctly explain reasoning to Ps who were wrong, Mistakes discussed/corrected.

Solution:

*This cuboid is made from centimetre cubes. It is 4 cm by 3 cm by 2 centimetres. What is the **volume** of the cuboid?*

$V = 4\text{ cm} \times 3\text{ cm} \times 2\text{ cm} = 24\text{ cm}^3$

*Another cuboid is made from centimetre cubes. It has a volume of **30 cubic centimetres**. What could the **length**, **height** and **width** be?*

e.g. $V = 30\text{ cm}^3 = 2\text{ cm} \times 5\text{ cm} \times 3\text{ cm}$

Let's show all the possibilities in a table. Ps come to BB or dictate what T should write. Class checks that the product is 30.

BB:

Length	30	15	10	6	5
Height	1	2	3	5	3
Width	1	1	1	1	2

(in cm)

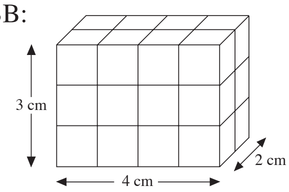
(if length $\geq$ height $\geq$ width)

Notes:

Individual work, monitored

Drawn on BB or use enlarged copy master or OHP or show a real model

BB:



Responses shown in unison.

Reasoning, agreement, self-correction and marking, praising

Deal with all cases used by Ps and elicit any that Ps did not think of.

Extra praise if Ps notice that all the values are factors of 30: 1, 2, 3, 5, 6, 10, 15, 30

30 min

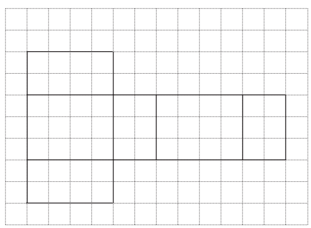
5

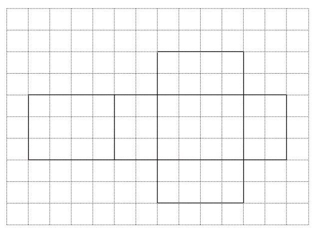
Book 5, page 134

Q.2 a) Read: *Draw the net of a cuboid with sides 4 cm, 3 cm and 2 cm.*

Set a time limit. Review with whole class. T chooses Ps with different correct nets to show them on BB, or T has some already prepared Mistakes discussed and corrected. (If disagreement, cut out the net and fold it as a check.)

Solution: e.g. or





etc.

b) Read: *Calculate its surface area.*

Ps write a plan, calculate the result in *Ex. Bks*. then show answer on slates or scrap paper on command. P responding correctly explains at BB to Ps who were wrong. Who agrees? Who did it a different way? (e.g. counting the grid squares) Mistakes discussed and corrected. Check by counting the grid squares.

Solution:

$A = 2 \times (4 \times 3 + 2 \times 3 + 4 \times 2) = 2 \times (12 + 6 + 8)$

$= 2 \times 26 = 52\ (\text{cm}^2)$

Notes:

Individual work, monitored closely, helped, corrected

Grid drawn on BB or use enlarged copy master or OHP

Ps finished early could be asked to draw different nets on separate grid sheets provided by T.

Discussion, reasoning, agreement, self-correction, praising

Extra praise if Ps notice that the net they have drawn forms the cube in the diagram in Q.1, so its volume is 24 cm^2.

Feedback for T

38 min

Bk5		*Lesson Plan 134*
Activity		***Notes***
6	***Book 5, page 134*** Q.3 Read: *Use each of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9* ***only once*** *to make* ***five*** *whole numbers, so that one number is twice, another number is three times, another number is four times and the last number is five times the smallest number.* Set a time limit. Ps work in *Pbs* or *Ex. Bks* and discuss with their neighbours if they wish. Review whole class. Ps who have an answer could show their smallest number on slates or scrap paper on command. P answering correctly explains reasoning at BB. Who agrees? Who did it another way? etc. Expect Ps to use trial and error but extra praise for good reasoning. (e.g. last number is 5 times the first number so must have units digit 0 or 5, 2nd number must be even, 3rd number must have digits which sum to a multiple of 3, etc.) If no P could solve it, T helps class to solve it together. *Solution:* 18, 36, 54, 72, 90 *Check:* $18 \times 2 = 36$ $18 \times 3 = 54$ $18 \times 4 = 72$ $18 \times 5 = 90$ ✓	Individual trial first, monitored (or whole class activity if time is short or Ps are not very able) Responses shown in unison. Discussion, reasoning, agreement, checking, (self-correction), praising (or leave the question open for Ps to do at home and review before start of *Lesson 168*) Note that the solution 09, 18, 27, 36, 45 is not valid, as 09 is really 9!

45 min

Bk5	R: Calculations **C: Revision and practice** *E: Problems*	*Lesson Plan 135*

Activity		***Notes***
1	**Factorising** a) Let's factorise 168 and list all its positive factors. Ps come to BB to draw tree diagram, show the number as the product of its prime factors and list all its positive factors. Class agrees/ disagrees. BB: $\boxed{\mathbf{168}} = 2 \times 2 \times 2 \times 3 \times 7$ 168 → 2, 84; 84 → 4, 21; 4 → 2, 2; 21 → 3, 7 Positive factors: 1, 2, 3, 4, 6, 7, 8, 12, 14, 21, 24, 28, 42, 56, 84, 168 b) Let's define 168 in different ways. Ps dictate to T. Class checks that the definition is valid, is unique to 168 and is not a repeat.. e.g. 16T + 8U, 5000 − 4832, 0.168 × 1000, $10^2 + 8^2 + 2^2$, etc. *8 min*	Whole class activity Reasoning, agreement, praising Involve as many Ps as possible. Ps can join up the factor pairs. T chooses Ps at random Extra praise for clever definitions
2	**Find a rule** Let's find a rule and complete the table. Ps suggest a rule in words using the completed columns. Ps come to BB to choose a column and write missing number, explaining reasoning. Class points out errors. Who can write the rule in a mathematical way? Who agrees? Who can think of another way to write it? Class checks that they are correct using values from table. BB:	Whole class activity Drawn on BB or use enlarged copy master or OHP At a good pace **Bold** numbers were missing. Reasoning, checking, agreement, praising Feedback for T **Extension** Ps suggests values for extra columns in each table.

a)

e	7	−2.8	$\frac{3}{4}$	0.81	**− 3163**	$-100\frac{1}{10}$	$\mathbf{\frac{5}{14}}$
f	−14	5.6	$-\frac{3}{2}$	**− 1.62**	6326	$\mathbf{20\frac{2}{10}}$	$-\frac{5}{7}$

Rule: $f = -(2 \times e)$, $e = -(f \div 2)$

[i.e. f is the opposite of 2 times e, or e is the opposite of half of f]

b)

u	1	10	6	100	2	**3**	−2	**15**	3.3	0
v	2	29	17	299	**5**	8	**−7**	44	**8.9**	**−1**

Rule: $v = 3 \times u - 1$, $u = (v + 1) \div 3$, $[(v + 1) \div u = 3]$

c)

x	0	1	2	3	8	4	5	**6**	7	**9**	**10**	11
y	1	2	5	10	**65**	**17**	**26**	36	**50**	82	101	**122**

Rule: $y = x \times x + 1$, $x \times x = y - 1$

19 min

Bk5

Lesson Plan 135

Activity		*Notes*

3

Book 5, page 135

Q.1 Read: *This table shows the cost of sending a letter.*

Set a time limit of 2 minutes. Ps read question themselves and write results in relevant boxes in *Pbs*.

Review with whole class. T chooses a P to read each part of the question and Ps could show answer on scrap paper or slates on command. Ps answering correctly show solution on table on BB. Mistakes corrected. T chooses a P to say the answer in a sentence.

Solution:

*Paul is sending a letter. It costs **£1.99 second class**. How much would it cost him to send it **first class**?*

Answer: It would cost Paul £2.39 to send the letter first class.

Jenny has a letter with a mass of 550 g. What does it cost to send it first class?

Answer: It costs £3.30 to send Jenny's letter first class.

Extension

Ps think of other questions to ask about the table. (e.g. If I paid exactly £3.06 to post some letters, how many letters could I have posted?)

Individual work, monitored

Table drawn on BB or use enlarged copy master or BB:

Mass	Cost First class	Cost Second class
Letter Up to 100 g	85p	66p
Large Letter Up to 100 g	£1.29	£0.96
" 250 g	£1.83	£1.53
" 500 g	£2.39	£1.99
" 750 g	£3.30	£2.70

Responses shown in unison.

Agreement, self-correction and marking, praising

Extra praise for clever questions

23 min

4

Book 5, page 135

Q.2 Set a time limit of 2 minutes. Ps read question themselves, do calculation in *Ex. Bks.* and write result in box in *Pbs.*

Review with whole class. T chooses a P to read the question and Ps show answer on scrap paper or slates on command. P answering correctly explains at BB to Ps who were wrong. Mistakes discussed and corrected. T chooses a P to say the answer in a sentence

Solution:

Five children collect money to plant trees. Here is a bar chart of the amounts they have raised so far.

Their target is £40 altogether. How much more money do they need to reach the target?

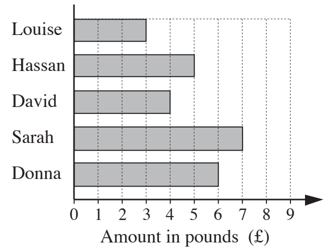
*Show your **working** in your exercise book.*

BB: $40 - (3 + 5 + 4 + 7 + 6) = 40 - 25 = 15$ (£)

Answer: They need £15 more to reach the target.

Individual work, monitored

Bar chart drawn on BB or use enlarged copy master or OHP BB:



Responses shown in unison.

Reasoning, agreement, self-correction and marking, praising

28 min

Bk5

Lesson Plan 135

Activity		Notes

5

Book 5, page 135

Q.3 Read: *Tom, Amy and Helen want to go on a boat trip. There are three boats.*

Set a time limit of 3 minutes. Ps read question themselves, do calculation in *Ex. Bks*. and write results in relevant boxes in *Pbs*.

Review with whole class. T chooses a P to read each part of the question and Ps show answer on scrap paper or slates on command. P answering correctly explains at BB to Ps who were wrong. Who agrees? Who did it another way? etc. Mistakes discussed and corrected. T chooses a P to say the answer in a sentence.

Solution:

How much does it cost altogether for ***three*** *people to go on the* ***Lark****?*

BB: £2.75 × 3 = £8.25

Answer: It costs £8.25 for 3 people to go on the Lark.

Tom and Amy go on the ***Heron****. They leave at* ***2.15 pm****.*
At what ***time*** *do they return?*

BB: e.g. 2.15 pm + 70 min = 2.15 pm + 1 h 10 min = 3. 25 pm

Answer: Tom and Amy return at 3.25 pm.

Helen goes on the ***Kestrel*** *and gets back at* ***4.15 pm.***
At what ***time*** *did the boat leave?*

BB: e.g. 90 min = 1 h 30 min

4.15 pm – 1 h 30 min = 3.15 pm – 30 min = 2.45 pm

Answer: The boat left at 2.45 pm.

Notes:

Individual work, monitored

Written on BB or use enlarged copy master or OHP

BB:

Lark	***Heron***	***Kestrel***
50 minute trip	70 minute trip	90 minute trip
Tickets	**Tickets**	**Tickets**
£2.75 each	£3.50 each	£4.20 each

Responses shown in unison.

Reasoning, agreement, self-correction and marking, praising

Extension (or optional h/work)

Which boat trip is the best value for money? e.g.

Lark: 50 min → £2.75
10 min → £2.75 ÷ 5
= £0.55 = 55 p

Heron: 70 min → £3.50
10 min → £3.50 ÷ 7
= £0.50 = 50 p

Kestrel: 90 min → £4.20
10 min → £4.20 ÷ 9
= $£0.4\dot{6}$ ≈ 47 p

The *Kestrel* is the best value.

33 min

6

Book 5, page 135

Q.4 Set a time limit of 2 minutes. Ps read question themselves, write answers in boxes in *Pbs* and write explanation for a) in *Ex. Bks*.

Review with whole class. T chooses a P to read each part of the question and Ps show answer on scrap paper or slates on command. In a), T chooses Ps answering correctly to read their explanations. Class decides which is best. Mistakes discussed and corrected.

Solution:

The inner ring on this spinner is divided into 12 equal sections.

a) *On which number is the pointer most likely to stop? Explain your answer in your exercise book.* (3)

BB: Number 1: $\frac{3}{12}$; Numbers 2, 4: $\frac{1}{12} + \frac{1}{12} = \frac{2}{12}$

Number 3: $\frac{2}{12} + \frac{2}{12} = \frac{4}{12}$; Number 5: $\frac{1}{12}$

The pointer is most likely to stop on the number 3, as it takes up more of the circle than the other numbers.

b) *What is the probability of getting an even number?*

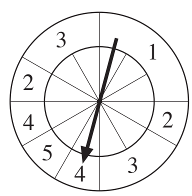
p (even number) = p (2) + p (4) = $\frac{2}{12} + \frac{2}{12} = \frac{4}{12} = \boxed{\frac{1}{3}}$

Notes:

Individual work, monitored

Diagram drawn (stuck) on BB or use enlarged copy master or OHP

BB:



Responses shown in unison.

Reasoning, agreement, self-correction, praising

Feedback for T

Extension

What is the probability of getting an odd number?

p (odd) = $1 - \frac{1}{3} = \boxed{\frac{2}{3}}$

38 min

Bk5		*Lesson Plan 135*

Activity		***Notes***
7	**Problem** Listen carefully, note the important data and think about how you would solve the problem *We have 36 squares with side length 1 cm.* a) *How many different rectangles can we make if we use all the squares for each rectangle?* Allow Ps a minute to think about it and discuss with their neighbours. What should we do first? (Make a table showing possible the possible lengths of the two sides.) T suggests it if no P thinks of it. Ps come to BB or dictate what T should write. Class agrees/disagrees. BB: (table below) *Answer:* We can make 5 different rectangles.	Whole class activity (or individual trial first in *Ex.Bks*. if Ps wish) Discussion, reasoning, agreement, (self-correction), praising At a good pace Involve several Ps.
	b) *Which of the rectangles has the shortest perimeter and what is its perimeter?* Ps come to BB to point to relevant column in table and calculate its perimeter. Who agrees? Who thinks it should be another column? Elicit that the rectangle with the shortest perimeter is the most regular, i.e. the square (RH column). $P = 4 \times 6\text{ cm} = 24\text{ cm}$	(or Ps could show dimensions on slates on scrap paper in unison on command) Agreement, praising
	c) *Which of the rectangles has the longest perimeter and what is its perimeter?* Ps come to BB to point to relevant column in table and calculate its perimeter. Who agrees? Who thinks it should be another column? Elicit that the rectangle with the longest perimeter is the least regular, (or most irregular), i.e. the LH column. $P = 2 \times (1\text{ cm} + 36\text{ cm}) = 2 \times 37\text{ cm} = 74\text{ cm}$	Revise previously learned facts: For a given area, the rectangle with the greatest perimeter is the least regular. For a given perimeter, the rectangle with the greatest area is the most regular.

BB table (in cm):

a	1	2	3	4	6
b	36	18	12	9	6

45 min

Bk5	R: Calculations C: **Revision and practice** E: *Problems*	*Lesson Plan 136*
Activity		***Notes***
1	**Numbers** a) Let's factorise 169 and then list all its positive factors. Ps try the prime numbers 2, 3, 5, 7 and 11 in turn, using quick methods where they can. Should we try 13? (Yes) BB: $13 \times 13 = 130 + 39 = 169$ So $169 = 13 \times 13$ and its positive factors are 1, 13, 169. What is special about it? (It is a square number.) BB: $\begin{array}{cc} & 13 \\ 13 & \boxed{\mathbf{169}} \end{array}$ b) Let's define 169 in different ways. (e.g. 13^2, $170 - 1$, 100th of 16 900, 0.169×1000, etc.) *6 min*	Whole class activity Extra praise if Ps remember $169 = 13 \times 13$ from the trials of previous numbers. Reasoning, agreement, praising At speed round class Extra praise for unexpected definitions
2	**Sequences** Let's think of different rules for continuing these sequences. T writes first 3 terms on BB and a P suggests a rule. The next Ps dictate the following terms until T decides when to stop. Class points out any errors. Who can think of another rule? Ps continue the sequence in other ways where possible. BB: a) 1.1, 2.2, 4.4, (e.g. 8.8, 17.6, 35.2, 70.4, 140.8, . . . [$\times 2$] (or 1.1, 2.2, 4.4, 1.1, 2.2, . . . [Cycle repeating] (or 7.7, 12.1, 17.6, 24.2, . . .) [Difference increasing by 1.1] (or 5.5, 7.7, 8.8, 11.0, 12.1, . . .) [+ 1.1, + 2.2] b) 84, 28, $9\frac{1}{3}$, ($3\frac{1}{9}$, $1\frac{1}{27}$, $\frac{28}{81}$, $\frac{28}{243}$, . . .) [$\div$ 3] or $\frac{28}{3}$, ($\frac{28}{9}$, $\frac{28}{27}$, $\frac{28}{81}$, . . .) c) 1, 3, 7, (e.g. 13, 21, 31, 43, 57, 73, 91, 101, . . .) [Difference increasing by 2] (or 15, 31, 63, 127, 255, 511, 1023, . . .) [Difference is increasing by 2 times; or each term is twice the previous term + 1] *16 min*	Whole class activity Discussion on possible rules At a good pace In good humour! Agreement, (correcting) praising Accept any valid rule if reasoned correctly. Extra praise for unexpected rules
3	***Book 5, page 136*** Q.1 Allow 2 minutes. Ps read the questions themselves and write the relevant numbers in the boxes. Review with whole class. A P reads each part of question, then Ps show numbers on scrap paper or slates on command. Ps answering correctly explain to Ps who were wrong. Mistakes discussed and corrected. *Solution:* *Rob has some number cards.. He holds up a card. He says, 'If I multiply the number on this card by 5, the answer is 35.' What is the number on the card?* (7) BB: $35 \div 5 = 7$ or $\square \times 5 = 35$, $\square = 7$	Individual work, monitored Encourage Ps to read questions carefully and to check their answers. Responses shown in unison. Reasoning, agreement, self-correction and marking, praising N.B. Although these are simple inverse operations on the multiplication table, some Ps might have difficulty in understanding the long text.

Bk5

Lesson Plan 136

Activity		*Notes*
3	(Continued) *He holds up a different card. He says,* *'If I divide the number on this card by 6, the answer is 4.'* *What is the number on the card?* (24) BB: $4 \times 6 = 24$ or $\square \div 6 = 4$, $\square = 24$ *20 min*	If Ps found these questions too easy, ask them to make up their own similar problems to ask the class. Feedback for T
4	***Book 5, page 136*** Q.2 Read: *Here is the calendar for August 2020.* Set a time limit of 2 minutes. Ps read the questions and write the answers in the boxes in *Pbs*. Review with whole class. For each part, T chooses a P to read the question and Ps show answers on slates or scrap paper on command. Ps correctly explain on calendar on BB to Ps who were wrong. Mistakes corrected. *Solution:* *Simon's birthday is on* ***August 20th****. In 2020 he had a party on the* ***Sunday after*** *his birthday. What was the* ***date*** *of his party?* (August 23rd) *Tina's birthday is on* ***September 9th****. On what* ***day of the week*** *was her birthday in 2020?* (Wednesday) 1st of September is a Tuesday so 8th September is also a Tuesday, therefore 9th September is a Wednesday. *25 min*	Individual work, monitored Drawn on BB or use enlarged copy master or OHP BB: Responses shown in unison. Reasoning, agreement, self-correction and marking, praising [Ps think of own problems to ask about the calendar.]
5	***Book 5, page 136*** Q.3 Read: *The same number is missing from each box. Write the missing numbers in the boxes.* Set a time limit of 2 minutes. Encourage Ps to think logically. Ps can work in *Ex. Bks* or use a calculator if they wish. Review with whole class. Ps could show the number on slates or scrap paper on command. **A**, tell us how you worked it out. Who did the same? Who did it another way? Mistakes discussed and corrected. *Solution:* e.g. $1331 \approx 1000$; $10 \times 10 \times 10 = 1000 < 1331$ As 1331 is odd, try the next greater odd number: $11 \times 11 \times 11 = 121 \times 11 = 1331$ ✓ *30 min*	Individual work, monitored Written on BB or SB or OHT Responses shown in unison. Discussion, reasoning, self-correction and marking, praising or by factorising: not divisible by 2, 3, 5 or 7 but divisible by 11. $1331 \div 11 = 121$ $121 \div 11 = 11$ So $1331 = 11 \times 11 \times 11$

August 2020

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	(1)				

(8) (9)

Bk5		*Lesson Plan 136*
Activity		***Notes***
6	***Book 5, page 136*** Q.4 Allow 2 minutes. Ps read question themselves, write operation and do calculation in *Ex. Bks*. then write result in *Pbs*. Review with whole class. T chooses a P to read out the question, then Ps show result on scrap paper or slates on command. P answering correctly explains at BB to Ps who were wrong. Who did the same? Who did it another way? etc. Mistakes discussed and corrected. T asks a P to say the answer in a sentence. *Solution:* *Parveen buys **3 small bags of peanuts**. She gives the shopkeeper **£2** and gets **80 p change.** What is the cost in **pence** of **one** bag of peanuts? Show your **working** in your exercise book.* (40 p) BB: e.g. Let the cost of one bag be x. *Plan:* $x = (200\text{ p} - 80\text{ p}) \div 3 = 120\text{ p} \div 3 = 40\text{ p}$ *Answer:* The cost of one bag of peanuts is 40 p. *35 min*	Individual work, monitored Responses shown inunison. Discussion, reasoning, agreement, self-correction and marking, praising Feedback for T or $3 \times \boxed{} = 200 - 80$ $3 \times \boxed{} = 120$ $\boxed{} = 120 \div 3 = 40$ (p)
7	***Book 5, page 136*** Q.5 Allow 2 minutes. Ps read question themselves, work out the answer in *Ex. Bks*. then write numbers in *Pbs*. Review with whole class. P comes to BB to write sequence and explain how he or she worked it out. Who agrees? Who thought in a different way? Mistakes discussed and corrected. *Solution:* *Kalid makes a sequence of numbers. The first number is 2. The last number is 18. His rule is to add the **same amount** each time. Write in the **missing** numbers.* BB: e.g. Each difference: $(18 - 2) \div 4 = 16 \div 4 = 4$ Sequence: $\boxed{2} \xrightarrow{+4} \boxed{6} \xrightarrow{+4} \boxed{10} \xrightarrow{+4} \boxed{14} \xrightarrow{+4} \boxed{18}$ *40 min*	Individual work, monitored [Although calculators were allowed in the KS2 test, they are not needed.] Discussion, reasoning, agreement, self-correction and marking, praising Ps who could not solve the problem, write correct calculation in *Pbs*.
8	***Book 5, page 136, Q.6*** Read: *In the year 2002, a man's age in years was equal to the sum of the digits of the year in which he was born. How old was he in 2002?* T gives Ps a couple of minutes to think about it and discuss with their neighbours if they wish. Who has an idea what to do? Who agrees? Who would do it another way? etc. Expect Ps to suggest trial and error, as using algebra is rather difficult at this stage. If no P has an idea, T starts and Ps continue the trials. *Solution:* e.g. Try 50 years: birth year: 2002 – 50 = 1952. Sum of digits = 17 ✗ Try 25 years: birth year: 2002 – 25 = 1977. Sum of digits = 24 ✗ Try 22 years: birth year: 2002 – 22 = 1980 Sum of digits = 18 ✗ Try 21 years: birth year: 2002 – 21 = 1981 Sum of digits = 19 ✗ Try 20 years: birth year: 2002 – 20 = 1982. Sum of digits = 20 ✓ *Answer:* The man was 20 years old in 2002.	Whole class activity (or individual or paired trial first if Ps wish) Discussion involving several Ps. Reasoning, agreement, (self-correction), praising In this problem, trial and error is actually easier than using algebra! An algebraic solution is given below for Ts in case a bright P suggests it.

Bk5		*Lesson Plan 136*
Activity		***Notes***
8	(Continued) **For Ts only**: Solution using algebra e.g. The man must have been born in the 1900s. Let tens digit be a and units digit be b Then birth year is: $19ab \rightarrow 1900 + 10a + b$ and age is: $2002 - (1900 + 10a + b) = 102 - 10a - b$ But age also equals the sum of the digits in the birth year, so. $102 - 10a - b = 1 + 9 + a + b = 10 + a + b$ $92 = 11a + 2b$ As $0 \leq a \leq 9$ and $0 \leq b \leq 9$, and a and b are integers, $92 \leq 11a + 18$ (as 9 is the greatest possible value for b) $74 \leq 11a$ $a \geq 74 \div 11 = 6\frac{6}{11}$ But a must be an even number less than 9, so $a = 8$ Therefore $2b = 92 - 11 \times 8 = 92 - 88 = 4$ $b = 2$ So the man was born in 1982 and was 20 years old in 2002.	Other methods of solution using algebra are also possible. (e.g. birth year + age = 2002) Some very bright Ps might be able to follow the reasoning if explained slowly and clearly.

45 min

Bk5	R: Calculations **C: Puzzles and challenges** *E: Problems*	*Lesson Plan* *137*

Activity

Notes

1 **Numbers**

Whole class activity

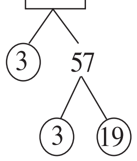
a) Let's factorise 171 and then list all its positive factors.

P comes to BB to draw a tree diagram, explaining reasoning. Class points out errors.

At a good pace

Reasoning, agreement, praising

BB: $\boxed{\mathbf{171}} = 3 \times 3 \times 19$



Positive factors: 171: 1, 3, 9, 19, 57, 171

b) Let's define 171 in different ways.

(e.g. $13^2 + 2$, $1000 - 829$, 1.71×100, 1H + 7T + 1U, etc.)

T chooses Ps at random.

Extra praise for unexpected definitions

6 min

2 **Find a rule**

Let's find a rule and complete the table. Ps suggest a rule in words using the completed columns. Ps come to BB to choose a column and write missing number, explaining reasoning. Class points out errors.

Who can write the rule in a mathematical way? Who agrees? Who can think of another way to write it? Class checks that they are correct using values from table.

Whole class activity

Drawn on BB or use enlarged copy master or OHP

At a good pace

***Bold** numbers were missing.*

Reasoning, checking, agreement, praising

BB:

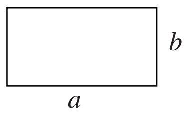
a)

a	5	1.3	103	40	6	**1**	$\mathbf{\frac{2}{10}}$
b	2	2.4	76	25	**3**	$2\frac{1}{5}$	$\frac{1}{10}$
P	14	7.4	358	**130**	18	$6\frac{2}{5}$	$\frac{3}{5}$

Rule: $P = 2 \times (a + b)$ $[= 2 \times a + 2 \times b]$

$b = P \div 2 - a$, $a = P \div 2 - b$

BB:



What could the table be about? (If a and b are positive numbers, we can think of the table being about the perimeter of a rectangle, where a and b are different sides and P is the perimeter.)

What other quadrilaterals could it also refer to? (parallelograms and deltoids)

Discussion, agreement, praising

If no P has an idea, T makes suggestions and asks Ps what they think about it.

b)

e	3	5.8	10	30	9	**2**	1.4
f	4	2	200	60	**10**	$4\frac{3}{4}$	5
A	6	5.8	1000	**900**	45	$4\frac{3}{4}$	**3.5**

Rule: $A = \dfrac{e \times f}{2}$, $[f = 2 \times A \div e,\ e = 2 \times A \div f]$

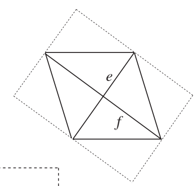
What could the table be about? (If e and f are positive numbers, we can think of the table being about the area of a deltoid or rhombus, where e and f are the diagonals; or

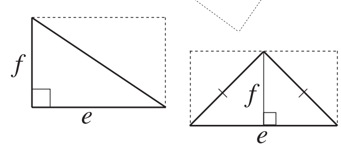
if we think of e and f as being the perpendicular sides of a right-angled triangle, then A would be its area; or

if we think of e as the base of an isosceles triangle and f as its height, then A would be its area.)

T draws diagrams on BB to help Ps understand the formula.

BB:





Bk5

Lesson Plan 137

Activity		Notes

2

(Continued)

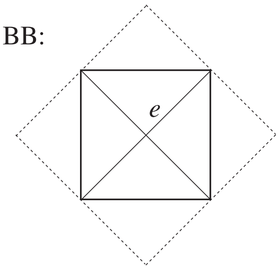
c)

e	1	2	3	10	4	**5**	6	**7**	8	9	11
A	$\frac{1}{2}$	2	4.5	50	**8**	$12\frac{1}{2}$	**18**	24.5	**32**	$40\boldsymbol{\frac{1}{2}}$	**60.5**

Rule: $A = \dfrac{e \times e}{2}$, $[e \times e = A \times 2]$

What could the table be about? (If e is positive, we can think of it as being the diagonal of a square and A is its area.) T shows it on BB.

BB:



16 min

3

Book 5, page 137

Q.1 Allow 2 minutes. Ps read question themselves and write numbers in boxes in *Pbs*.

Review with whole class. Ps could show number for each part on scrap paper or slates on command. T asks Ps with wrong numbers why their answers are wrong. Mistakes corrected. (If a P has a valid unexpected answer, ask rest of class whether it is correct.)

Solution:

Milly and Ryan play a number game: What's my number?

Milly:	***Ryan:***	
Is it under 20?	*Yes*	
Is it a multiple of 3?	*Yes*	
Is it a multiple of 5?	*Yes*	*What is the number?* (15)

Milly and Ryan play the game again.

Ryan:	***Milly:***	
Is it under 20?	*No*	
Is it under 25?	*Yes*	
Is it odd?	*Yes*	
Is it a prime number?	*Yes*	*What is the number?* (23)

Notes:

Individual work, monitored

Although calculators were allowed in the KS2 test, they are not necessary!

Responses shown in unison.

Reasoning, agreement, self-correction and marking, praising

[Also accept 0, – 15, – 30, – 45, . . . or elicit them!]

(as 21 is not a prime number)

21 min

4

Book 5, page 137

Q.2 Allow 2 minutes. Ps read question themselves and answer in *Pbs*.

Review with whole class. For each part, a P reads the question, then Ps show the fraction on scrap paper or slates on command. Ps answering correctly explain reasoning to Ps who were wrong. P comes to BB to mark the fraction on the number line. Mistakes discussed and corrected.

Solution:

Here are two bags. Each bag has ***3 white balls*** *and* ***one black ball*** *in it. A ball is taken from* ***one of the bags*** *without looking.*

What is the probability that it is a ***black ball****? Give your answer as a fraction.*

In each bag, the black ball is 1 out of 4, so p (black) $= \boxed{\frac{1}{4}}$

All the balls from both bags are now mixed together in a new bag. Put a ***cross*** *on this line to show the probability of taking a* ***black ball*** *from the new bag*

The black balls are 2 out of 8, so p (black) $= \frac{2}{8} = \boxed{\frac{1}{4}}$

Notes:

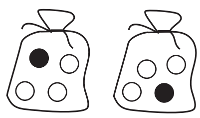
Individual work,monitored

Diagrams drawn on BB or use enlarged copy master or OHP (or real bags of marbles)

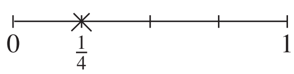
Responses shown in unison.

Reasoning, agreement, self-correction and marking, praising

BB:



BB:



26 min

Bk5

Lesson Plan 137

Activity		*Notes*

5

Book 5, page 137

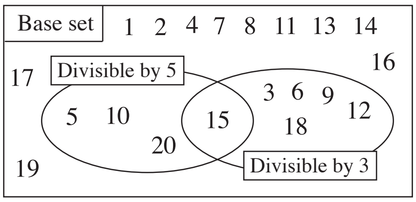
Q.3 Read: *Write the positive whole numbers which are not greater than 20 in the Venn diagram.*

What special name do we give to positive whole numbers? (natural numbers) Set a time limit.

Review with whole class. Ps come to BB to write the numbers in the correct set, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected. Elicit that zero is neither positive nor negative, so cannot be included.

What is the rule for the intersection of the 2 sets? (Divisible by 5 and by 3, or divisible by 15)

Solution:



Notes:

Individual work, monitored, (helped)

Drawn on BB or use enlarged copy master or OHP

Differentiation by time limit.

Reasoning, agreement, self-correction, praising

Feedback for T

Extension

T points to each part of the diagram and Ps describe the numbers which belong there.

P describes a set of numbers and another P shows where they are on the diagram.

31 min

6

Book 5, page 137

Q.4 Read: *List the whole numbers greater than 500 and less than 900 in which the digits are* ***increasing****. Try it out in your exercise book first.*

Set a time limit. Encourage a logical listing.

Review with whole class. Ps come to BB or dictate numbers to T. Class agrees/disagrees or points out missed numbers. Mistakes and omissions corrected.

Solution:

567, 568, 569, 578, 579, 589; 678, 679, 689; 789 (10)

Notes:

Individual work, monitored

(or whole class activity if time is short – Ps come to BB or dictate to T)

Agreement, self-correction, praising

Extension

Ps think of questions to ask about the numbers.
(e.g. What is the difference between the greatest and smallest numbers? What is the sum of the even numbers? Which of the numbers are divisible by 3? How could they be grouped? etc.)

Notes:

Whole class activity

Extra praise for clever questions

36 min

7

Book 5, page 137

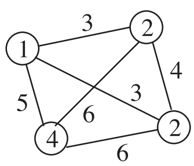
Q.5 Read: *When we add two numbers from four natural numbers, the sums are: 3, 3, 4, 5, 6 and 6. What are the four numbers?*

Ps try it out in *Ex. Bks* first and discuss with their neighbours.

Review with whole class. Ps who have an answer, or think that they know what to do, come to BB to explain. Who agrees? Who thought of a different way to do it? etc.

If no P has an idea, or to check a solution given by Ps, T suggests drawing a digram as below. Ps come to BB to write the sums beside the joining lines and to fill in the numbers in the circles. Ps draw diagram in *Ex. Bks* and write the 4 numbers in *Pbs*.

Solution:
$3 = 2 + 1$ (twice)
$4 = 3 + 1$ or $2 + 2$
$5 = 4 + 1$ or $3 + 2$
$6 = 5 + 1$ or $4 + 2$ or $3 + 3$



Notes:

Individual trial first, monitored

(or whole class activity if time is short)

Discussion, reasoning, agreement, checking, (self-correction), praising

Extra praise for Ps who solved it without help from T.

Accept trial and error but also show the method opposite.

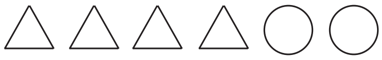
Answer:

The four numbers are 1, 2, 2 and 4.

41 min

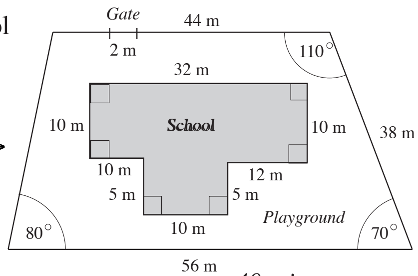
Bk5

Lesson Plan 137

Activity		***Notes***
8	**Combinatorics** In how many different ways can we order these shapes? BB:  Ps come to BB to redraw the shapes or to rearrange them after recording the order with letters, or Ps dictate what T shold write. T encourages a logical listing. e.g. BB: t t t t c c t c t t t c c t t t t c t t t c t c t c t t c t c t t t c t (15 different t t t c c t t c t c t t c t t c t t orders) t t c t t c t c c t t t c t c t t t t t c t c t c c t t t t t t c c t t Elicit that the order of the 4 triangles and the order of the 2 circles does not matter	Whole class activity Drawn (stuck) on BB or use enlarged copy master or OHP Discussion on how to list logically, e.g. as shown: • 4 triangles at start • 3 triangles at start • 2 triangles at start • 1 triangle at start • 0 triangles at start Agreement, praising Ps list the different ways in *Ex. Bks*.

45 min

Bk5	R: Calculations **C: Measurement outside (or inside) the dlassroom** *E: Challenges*	*Lesson Plan* *138*

Activity		*Notes*
1	**Measurement: Introduction** T divides the class into groups of about 4 Ps. Each group is given a measuring tape, protractor and/or compass. T quickly revises how to use the measuring tools, with Ps coming to front of class to demonstrate and explain. Revise the units of measure too. Ps make notes on their notepads if needed. T sets a task for each group. e.g. making a plan of the school buildings (playing fields, classroom, library, dining hall, etc.) Discuss how the task should be done and what measurements will be needed. (Make a rough sketch first and write the actual measurements on it – lengths of walls, width of spaces, angles of corners, etc.) Ps ask questions if they are unsure about anything. *10 min*	Whole class activity Ps have measuring tools, notepads or clipboards, pencils etc. for making sketches and notes. T arranges the tasks so that the groups do not get in each other's way (e.g. they could all have the same task but start measuring at different places, or each group could have a different task).
2	**Estimation** Before we start, let's practise estimating. e.g. How long do you think the front wall of the school is? Show me a 10 m by 10 m square on the classroom floor. What angle do you think is between this wall and that one? etc. T asks several Ps what they think and class decides which are possible and which are not. (T teases in a lighthearted way Ps who make outlandish estimates or who use inappropriate units.) Ps can also suggest things which relate to their given task for the class to estimate. *14 min*	Whole class activity This estimation practice is to help Ps to realise when a measurement is obviously wrong and should be done again and to get them used to using appropriate units of measure. Praising, encouragement only
3	**Group measurement** Set a time limit of 20 minutes. Ps decide what should be measured and who will measure what. All information is shared among the group and all Ps in the group make a rough sketch and note the collected information. Ps should note on their sketch any lengths they could not measure, or make estimates (e.g. no. of paces or footsteps). e.g. Sketch of School We could not measure this side. →  *40 min*	Group work T continuously goes from group to group, helping, making suggestions, pointing out missed measurements or any which should be checked, and monitoring what Ps have written and drawn. In good humour! T keeps each group aware of how much time is left. Praising, encouragement only
4	**Back in the classroom** a) The groups report on their data and draw a rough sketch on the BB. Rest of Ps point out any missed measurements or unlikely values. b) Ps decide on a suitable scale and draw an accurate plan of their sketch in *Ex. Bks*. c) Ps calculate areas and perimeters from their plans in *Ex. Bks*. *45 min*	Quick whole class review, then individual (or paired) work in drawing a plan and calculating, monitored closely, helped Ps could finish the tasks for homework.
Extra questions	The extra questions on page 138 of the *Pb* are mainly challenges and can be used as voluntary homework, or as a competition, or for Ps to do when they have finished other tasks early, or in case the weather prevents Ps from measuring outside. *Solutions are on the following page.*	If used as a lesson, individual trial first, then whole class review as usual.

Bk5

Lesson Plan 138

Activity

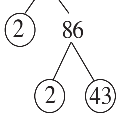
Notes

Extra questions

Book 5, page 138
Solutions:

Q.1 *Factorise 172 and list its positive factors.*

$\boxed{172} = 2 \times 2 \times 43$



Positive factors: 1, 2, 4, 43, 86, 172

Q.2 *The digits of a 4-digit number greater than 5000 follow each other in increasing order.*
Another 4-digit number has those digits too, but in decreasing order. A third 4-digit number has those digits too.
What are the three numbers if we know that their sum is 26352?

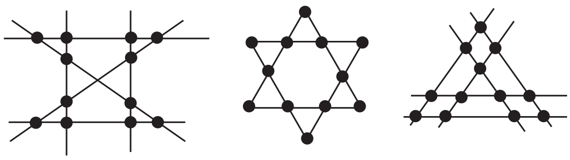
e.g.

5 6 7 8	5 6 7 9	5 6 8 9	5 7 8 9	6 7 8 9
8 7 6 5	9 7 6 5	9 8 6 5	9 8 7 5	9 8 7 6
+ 9	+ 8	+ 7 9 8	+ 8 8	+ 9 6 8 7
2 6 3 5 2	2 6 3 5 2	2 6 3 5 2	2 6 3 5 2	2 6 3 5 2 ✓

Expect Ps to use trial and error but in a logical way, as shown.

Q.3 *We want to place 12 spotlights in the ceiling so that they are in 6 straight lines and there are 4 spotlights in each line.*
Draw different arrangements.

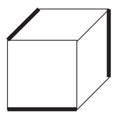
e.g.



Other arrangements are possible.

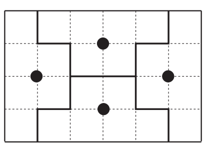
Q.4 *The edges of a cube are to be coloured either red or blue so that each face has at least one red edge. What is the least number of edges which should be coloured red?*
Draw a diagram to show your answer.

3 edges coloured *red* are enough. e.g.

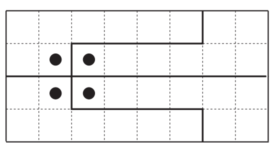


Q.5 *Each diagram is the map of a field in which there are 4 wells. Show how the field could be divided into 4* ***congruent*** *parts so that each part has exactly one well.*

a)



b)



Elicit that each shape is a hexagon

Bk5	R: Calculations **C: Puzzles** *E: Challenges*	*Lesson Plan* *139*
Activity		***Notes***
1	**Numbers** a) Let's factorise 173 and then list all its positive factors. Ps dictate or come to BB to try each of the prime numbers, 2, 3, 5, 7, 11 and 13 as divisors, using 'quick' methods where possible. Should we try dividing by the next prime number, 17? (No, as $17 \times 17 = 289 > 173$) Elicit that 173 is a prime number and its factors are 1 and 173. b) Let's define 173 in different ways. Ps make suggestions and class checks that they are correct, not duplicates and unique to 173. (e.g. $13^2 + 2^2$, 2000 –□1800 – 27, $6\times 25 + 23$, 100th of 17 300, etc. *8 min*	Whole class activity At a good pace Ps explain reasoning or do divisions at side of BB or use a calculator. Class agrees/disagrees Praising At speed round class Extra praise for clever definitions
2	**Problem** Listen carefully, note the data and try to solve the problem You can discuss it with your neighbour if you wish. *The day before yesterday, Suzanne was 10 years old and next year she will be 13 years old. What is the date of Suzanne's birthday?* After about 4 minutes, Ps who have an answer show it on slates or scrap paper on command. Ps with correct answer explain reasoning to class with the aid of a calendar. If no P has an answer, either leave the question open for Ps to solve at solve at home if they wish, or T helps class to solve it together. *Reasoning:* If today is the 1st of January, the day before yesterday was the 30th December last year when Suzanne was 10 years old. Yesterday (31st of December last year) was Suzanne's birthday and she was 11 years old. This year she will be 12 years old on 31 December, and next year she will be 13 years old on 31st December. *16 min*	Individual or paired trial first, monitored T repeats slowly to give Ps time to think and discuss. Responses shown in unison. Discussion, reasoning, agreeement, praising Class applauds any Ps who deduced the correct answer without help. BB: Today: e.g. 1 Jan 2003 30 Dec 2002: 10yrs 31 Dec 2002: 11 yrs 31 Dec 2003: 12 yrs 31 Dec 2004: 13 yrs

Bk5

Lesson Plan 139

Activity | *Notes*

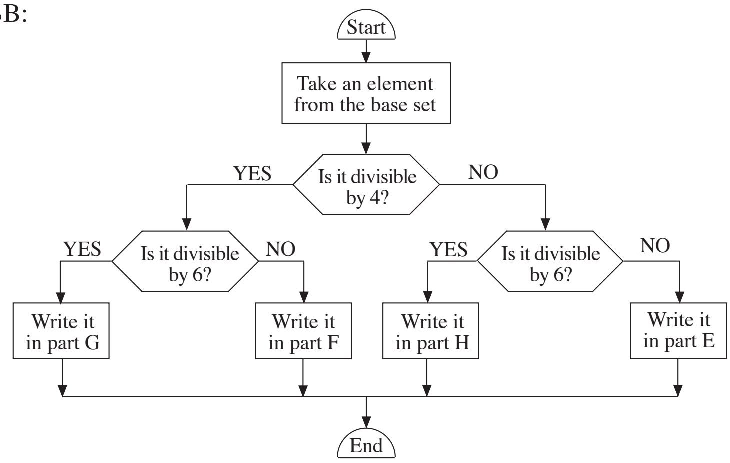
3

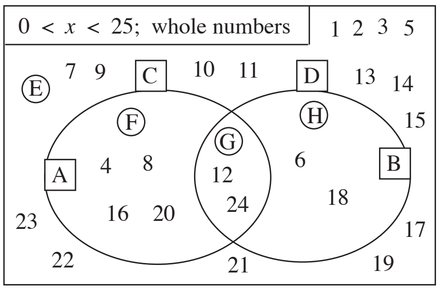
Number sets

Let's write the whole numbers between 0 and 25 in the Venn diagram using the flow chart to help us.

Ps deal with the numbers in increasing order, coming to BB to show the route through the flow chart and then to write the number in the correct place in the Venn diagram. Class agrees/disagrees.

BB:





Elicit what each part of the Venn diagram means.

A: Divisible by 4 B: Divisible by 6

C: Not divisible by 4 D: Not divisible by 6

E: Divisible by neither 4 nor 6.

F: Divisible by 4 but not by 6.

G: Divisible by both 4 and 6. (i.e. divisible by 12)

H: Divisible by 6 but not by 4.

Notes:

Whole class activity

Drawn on BB or use enlarged copy master or OHP

At a good pace

(Eventually Ps will be able to say where a number should go without using the flow chart.)

Agreement, praising

Discussion, reasoning, agreement, praising

T might show set notation: e.g.

$A \cup B$ (read as 'A union B', means all the numbers which are in either set A or set B)

$A \cap B$ (read as 'A intersection B', and means all the numbers which are in set A and in set B)

25 min

4

Book 5, page 139

Q.1 Read: *Fill in the missing numbers so that the product of any two **adjacent** numbers is the number directly above them.*

Set a time limit. Ps do necessary calculations in *Pbs* or *Ex Bks*.

Review with whole class. Ps come to BB to fill in the missing numbers, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

9000

60 150

6 **10** 15

3 **2** 5 **3**

Notes:

Individual work, monitored, (helped)

Drawn on BB or use enlarged copy master or OHP

Bold numbers are given.

Reasoning, agreement, self-correction, praising

Feedback for T

30 min

Bk5

Lesson Plan 139

Activity		*Notes*

5

Book 5, page 139

Q.2 Set a time limit of 2 minutes. Ps read the question themselves, circle the appropriate response in *Pbs* and write a sentence of explanation for their choice.

Individual work, monitored

Review with whole class. T chooses a P to read out the question and Ps show 'Yes' or 'No' on slates or scrap paper or with pre-agreed actions. T chooses several Ps with different (or the same) responses to read their explanations to class. Class decides who is correct and which explanation is best. Mistakes corrected. Demonstrate with a real coin if necessary.

Responses shown in unison.

Reasoning, agreement, self-correction and marking, praising

Feedback for T

Solution:

Sannir spins a ***fair*** *coin and records the results. In the first four spins,* ***heads*** *comes up each time. Sannir, says, 'A* ***head*** *is more likely than a tail.' Is he* ***correct****? Circle Yes or No. Give a reason for your answer.* (No)

Reason: e.g.

He is not correct because there are 2 possible outcomes, a head or a tail, and as the coin is fair, each outcome is equally likely.

Elicit that:

$p\,(\mathrm{H}) = p\,(\mathrm{T}) = \frac{1}{2}$

35 min

6

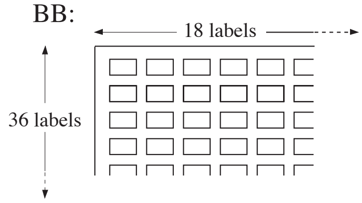
Book 5, page 139

Q.3 Set a time limit of 3 minutes. Ps read the question themselves, write a plan, do the calculation (with or without a calculator) and write the result in the box in *Pbs*.

Individual work, monitored

Drawn on BB or use enlarged copy master or OHP

BB:



Review with whole class. T chooses a P to read out the question and Ps show results on slates or scrap paper on command. P answering correctly explains at BB to Ps who were wrong. Show the written calculations too. Mistakes discussed and corrected. T chooses a P to say the answer in a sentence.

Responses shown in unison.

Reasoning, agreement, self-correction and marking, praising

Solution:

A shop sells sheets of sticky labels. On each sheet there are ***36 rows*** *and* ***18 columns*** *of labels. How many lables are there altogether in* ***45 sheets?*** *Show your* ***method****. You may get a mark.* (29 160)

BB: e.g.

Plan: $\underbrace{36 \times 18}_{\text{on each sheet}} \times 45 = 29\,160$

C:

$$\begin{array}{r} 3\,6 \\ \times\ 1\,8 \\ \hline 2\,8\,8 \\ +\ 3\,6\,0 \\ \hline 6\,4\,8 \\ \hline \end{array} \qquad \begin{array}{r} 6\,4\,8 \\ \times\ 4\,5 \\ \hline 3\,2\,4\,0 \\ +\ 2\,5\,9\,2\,0 \\ \hline 2\,9\,1\,6\,0 \\ \hline \end{array}$$

Answer: There are 29 160 labels on 45 sheets.

Extension

If we need 1300 labels, how many sheets do we need to buy? (3, as 648 + 648 = 1296, so we need 1 more sheet)

40 min

Bk5		*Lesson Plan 139*

Activity		*Notes*

7

Book 5, page 139

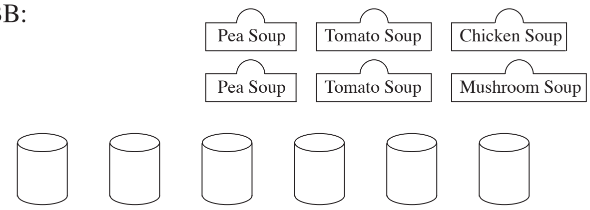
Q.4 Set a time limit of 2 minutes. Ps read the question themselves and write fractions in the boxes in *Pbs*.

Review with whole class. For each part, T chooses a P to read out the question and Ps show answers on slates on command.
P answering correctly explains at BB to Ps who were wrong.
Mistakes discussed and corrected

Solution:

Harry has six tins of soup. The labels have fallen off. Here are the labels and tins. Harry chooses a tin.

BB:



*What is the **probability** that it is a tin of **Pea Soup**? Give your answer as a fraction.* $\left[\dfrac{2}{6} = \dfrac{1}{3}\right]$

(6 possible outcomes, each equally likely and two of them are Pea Soup.)

*What is the probability that the tin he chooses is **not** a tin of of **Tomato Soup**? Give your answer as a fraction.* $\left[\dfrac{4}{6} = \dfrac{2}{3}\right]$

(Two of the 6 possible outcomes are Tomato Soup, so 4 outcomes are not Tomato Soup.)

Extensions

- What are the probabilities as decimals? ($\dfrac{1}{3} = 0.\dot{3}$; $\dfrac{2}{3} = 0.\dot{6}$)
- Ps think of other questions to ask. e.g.

  What is the probability of the tin containing a type of vegetable soup? (5 sixths)

  If the probability of Harry choosing his favourite soup is 1 sixth, what could his favourite soup be? (chicken or mushroom)

45 min

Notes:

Individual work, monitored

(or whole class activity if time is short)

Drawn on BB or use enlarged copy master or OHP

Responses shown unison.

Reasoning, agreeement, self-correction and marking, praising

Feedback for T

Whole class activity

Elicit other recurring decimals too:

$\dfrac{1}{6} = 0.1\dot{6}$, $\dfrac{1}{7} = \dot{1}4285\dot{7}$

$\dfrac{1}{9} = 0.\dot{1}$

Extra praise for clever questions.

Bk5	R: Calculations **C: Visiting the market** (supermarket, post office, station, etc.) *E: Challenges*	*Lesson Plan 140*
Activity		***Notes***
1	**Visiting the market: Before setting off** T divides the class into groups of about 4 Ps. Talk about where the class is going and elicit Ps' own experiences of the place. Elicit the kind of jobs done there and the types of products sold. Discuss the units of measure which might be used there. (e.g. £s, pence; kg, g; litres, cl, pints; etc.) T sets a task for each group. (e.g. *Group A* will find out and note down the prices of different vegetables at different stalls. *Group B* will do the same for different types of fruit. *Group C* will find out the prices of different types of cheeses and milk. *Group D*: meat. *Group E*: flowers, etc.) Stress that not only is the item and price to be noted down but also what amount you can get for that price. Look out for special offers too! Ps ask questions if they are unsure about anything. *6 min*	Whole class activity Ideally the destination should be within close walking distance of the school and arranged in advance. Ps have notepads or clip-boards, pencils, etc. Each group could choose the items they would like to find out about – but they should be decided on before Ps set off. e.g. Vegetables: potatoes, tomatoes, onions, carrots, cabbage, celery, mushrooms, cauliflower, green beans.
2	**On arrival** T tells Ps how much time they have and where and when they should all meet up. The groups go their different ways and Ps decide the best way to collect and note down the information. T continuously goes from group to group, helping, making suggestions about additional information, pointing out missed prices or any which should be checked, and monitoring what Ps have written and drawn. T also keeps each group aware of how much time is left. Ps meet up again and walk back to school. *35 min*	Group work (It would be helpful if other adults were attached to the groups – classroom assistants or clerical staff or parents might volunteer!) All done in good humour! Praising, encouragement only
3	**Back in the classroom** Ps from each group give a brief summary of what they found out and the kinds of differences they noticed among similar items. (e.g. apples grown locally might be cheaper than imported apples; 2 litres of milk might be cheap today because its sell-by date is tomorrow; washed potatoes are more expensive than unwashed ones; etc.) T sets the homework task: e.g. Each P in a group writes in detail about one or two items, e.g. giving the cheapest, most expensive and average prices and what they consider to be the best buy that day and why. *45 min*	Quick whole class review, then discussion on the task set and how the data collected could be presented (table, bar chart, pictogram, etc.) If time, Ps start their task in the classroom and finish it at home
Extra questions	The extra questions on page 140 of the *Pb* are mainly challenges and can be used as voluntary homework, or as a final competition, or in case the weather prevents Ps from venturing outside. *Solutions are on the following page.*	If used as a lesson, individual trial first then whole class review, as usual.

Bk5

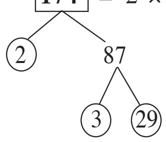
Lesson Plan 140

Activity		*Notes*

Book 5, page 140
Solutions:

Q.1 *Factorise 174 and list its positive factors.*

$\boxed{\mathbf{174}} = 2 \times 3 \times 29$



Positive factors:
1, 2, 3, 6, 29, 58, 87, 174

Q.2 *Freddy Fox decided that from that day forward he would always tell the truth on Mondays, Wednesdays and Fridays but he would always tell lies on the other days of the week.*

One day he said, 'Tomorrow I will tell the truth.'

On which day of the week do you think he said this?

Reasoning: e.g.

He could not have said it on a Sunday, Tuesday or Thursday because these are the days he told lies.

He could not have said it on a day before he told a lie, i.e. on a Monday, Wednesday or Sunday, as he told the truth on these days and he would have said, 'Tomorrow I will tell a lie.'

He must have said it on a Saturday, because he told lies on that day and would also have told a lie the next day, Sunday.

Q.3 *Two barrels of equal size contain oil. One of the barrels is full and the other is half full. Their masses are 86 kg and 53 kg. What is the mass of an empty barrel?*

e.g. By reasoning:

Difference between the two barrels: 86 kg − 53 kg = 33 kg

So the mass of half the liquid a barrel holds is 33 kg. →

Notes: As 86 kg and 53 kg are made up of the mass of an empty barrel + the liquid it contains.

Mass of all the liquid a barrel holds: 33 kg × 2 = 66 kg

Mass of an empty barrel: 86 kg – 66 kg = 20 kg

Using algebra: e.g.

Let b be the mass of an empty barrel and m be the mass of the liquid in a full barrel.

$$b + m = 86 \text{ kg}$$

$$b + \frac{m}{2} = 53 \text{ kg}$$

Subtracting: $\frac{m}{2} = 33$ kg, so $m = 66$ kg

$$b = 86 \text{ kg} - 66 \text{ kg} = 20 \text{ kg}$$

Bk5		*Lesson Plan 140*
Activity		***Notes***
Extra questions	(Continued) Q.4 *Andy, Betty, Cindy and Danny are walking down a mountain and need to go through a narrow, dark tunnel but have to overcome these difficulties.* • *They have a torch which has only 12 minutes of power left.* • *Andy is able to walk through the tunnel in 1 minute, Betty in 2 minutes, Cindy in 4 minutes and Doris in 5 minutes.* • *They are all scared of the dark so each of them will need the torch.* • *The tunnel is so narrow that only 2 of them can walk through it at the same time.* *Is it possible for them all to get through the tunnel? If so, how could they do it? If not, why not?* Yes, they could all get through the tunnel. A + B go through at the same time (2 minutes) A returns with the torch. (1 minute) C + D go though at the same time. (5 minutes) B returns with the torch. (2 minutes) A and B go through together. (2 minutes) Total time: 12 minutes	
	Q.5 *Write the natural numbers from 1 to 9 into a 3 by 3 grid so that:* • *the sum of the 3-digit numbers formed in the top and middle rows is equal to the 3-digit number in the bottom row;* • *the sum of the 3-digit numbers formed in the left and middle columns is equal to the 3-digit number formed in the right column.* e.g. 1 5 7 / 4 8 2 / 6 3 9 or 7 1 8 / 2 3 6 / 9 5 4 *Check:* 157 + 482 = 639 718 + 236 = 954 146 + 583 = 729 729 + 135 = 864	Vertical numbers are read downwards.