Y5

R: Fractions. Mental calculation

C: Time: 24 hour clock; a.m., p.m.

E: Problems. Average duration of months, sevenths as decimals

Lesson Plan
31

Activity

1

Time 1

What can you tell me about how we measure time? Ps might mention:

- tools to measure time: clocks (analogue, digital, 24-hour clock, stop-watches, alarm clocks), calendars
- units of time: seconds, minutes, hours, days, weeks, months, years, (decades, centuries, millennia)

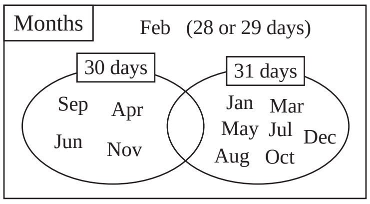
Let's write the units of time which are exact in increasing order and write the relationship between each pair. Ps dictate what T should write and class copies in *Ex. Bks*.

BB:

$$1 \text{ second} \xrightarrow{\times 60} 1 \text{ minute} \xrightarrow{\times 60} 1 \text{ hour} \xrightarrow{\times 24} 1 \text{ day} \xrightarrow{\times 7} 1 \text{ week}$$

Agree that the duration of months varies. Let's show the different months in a Venn diagram. Ps come to BB or dictate to T.

BB:



Elicit that February normally has 28 days but 29 days in a leap year. Tell/elicit that leap years are multiples of 4, apart from the case of centuries, which are leap years if they are multiples of 400. (e.g. 1996 and 2000 were leap years, but 2100, 2200, 2300 will not be.) What will the next leap year be? (2004)

a) *How many weeks are in each month?* Elicit:

February: $28 \text{ days} = 4 \text{ wks}$; leap year: $29 \div 7 = \dfrac{29}{7} = 4\dfrac{1}{7}$ (wks)

30 day months: $30 \div 7 = \dfrac{30}{7} = 4\dfrac{2}{7}$ (weeks) = 4 wks 2 days

31 day months: $31 \div 7 = \dfrac{31}{7} = 4\dfrac{3}{7}$ (weeks) = 4 wks 3 days

b) *How many days are in a year?* (365 days, but 366 in a leap year)

Let's check it. T starts and Ps continue by dictating to T.

BB: $1 \text{ year} = (31 \times 7 + 30 \times 4 + 28 = 217 + 120 + 28 = \underline{365})$ days

c) *How many weeks are in a year?* (52) Let's check it! Ps dictate to T.

BB: $365 \div 7 = (350 + 15) \div 7 = 50 + 2 + \dfrac{1}{7} = 52\dfrac{1}{7}$

or $366 \div 7 = (350 + 16) \div 7 = 50 + 2 + \dfrac{2}{7} = 52\dfrac{2}{7}$

Agree that 52 is a rounded number, i.e. it is approximate, not exact.

d) *What is the average number of days in a month?* T helps Ps.

BB: $365 \div 12 = 30\dfrac{5}{12} \approx 30$ (days) [$= 30.41666\ldots$ or $30.41\dot{6}$]

In practice, to make calculations easier, we use these relationships:

BB: 1 month ≈ 4 weeks or 30 days

1 year = 12 months ≈ 52 weeks = 365 days (366 in a leap year)

Notes

Whole class activity

(If possible, Ps have calculators.)

Involve several Ps.

Praise all positive contributions.

BB: decade: 10 years
century: 100 years
millennium: 1000 years

Agreement, praising

Drawn on BB or SB or OHT

At a good pace

Agreement, praising

BB: Leap year
February: 29 days

Ps say what they know and T explains what they don't.

Praising, encouragement only

[**Extensions**

T shows the fractions as decimals using a calculator:

BB: $4\dfrac{1}{7} = 4.\overline{142857} \approx \underline{4.14}$

(rounded to 2 decimal places)

The horizontal line above the decimal digits means that they forma cycle and the cycle keeps repeating itself endlessly to infinity)

Ps use calculators to work out:

$4\dfrac{2}{7} = 4.\overline{285714} \approx 4.29$

$4\dfrac{3}{7} = 4.\overline{428571} \approx 4.43$

$52\dfrac{1}{7} = 52.\overline{142857} \approx 52.14$

$52\dfrac{2}{7} = 52.\overline{285714} \approx 52.29$

What do you notice? (Same cycle of digits in each decimal)]

[A raised dot next to a decimal digit means that the digit is repeated to infinity. We say the decimal digit is recurring.]

10 min

Y5		*Lesson Plan 31*
Activity		***Notes***
2	**Time 2**	Whole class activities and individual exercises
	a) *In how many months in a year are there 30 days?* Show me . . . now! (Majority will probably have written 4 months, but some might have written 11 months.) Who is correct? After discussion, agree that there are 30 days in 11 of the months as 'there are' in this case means 'there are at least'.	Responses shown on scrap paper or slates in unison (or T asks 1 or 2 Ps what they think) Discussion, agreement
	b) *How many months are 30 days long?* (4) (In this case 4 is correct.)	Ps name the 4 months.
	c) Close your eyes, count from 1 to 20 in your head when I say, and stand up as soon as you have finished. Start counting . . . now! T keeps a note of the seconds taken by 1st and last P to stand up. (e.g. 15 to 20 seconds)	Why are the counting times different? Ps suggest reasons.
	d) Let's see how long you take to do this calculation. Watch the second hand on the clock and we will start when it gets to 12. Start . . now! (T uncovers calculation.) BB: 1828 – (123 + 942 + 516) = (1828 – 1581 = 247) Ps stand up when they have finished and note how many seconds they took. Ask several Ps for their times, then review answers and methods used. (Mental calculation will probably be quickest.)	Written on BB or SB or OHT Ps may use own watches if they have second hands. Ps calculate mentally or on slates/scrap paper or in *Ex. Bks.* Discussion, self-correction, agreement, praising
	e) Let's see if you can be quicker this time! Write the next 10 terms in this sequence in your *Ex. Bks*. Start . . . now! (T uncovers terms.) BB: 56, 51, 46, 41, (36, 31, 26, 21, 16, 11, 6, 1, – 4, – 9) [*Rule*: – 5] Ps stand up when finished and note their times. T chooses Ps to dictate the terms and give the rule. Class agrees/ disagrees. Mistakes corrected. Class applauds quickest, correct Ps.	First 4 terms written on BB but covered up. Ps use class clock or own watches to time themselves. Reasoning, agreement, self-correction, praising
	f) Let's knock on our desks for 1 minute, keeping time with the seconds ticking on the clock. Listen . . . start! T starts clock.	In unison. Use clock with loud tick or a metronome.
	g) Close your eyes. Estimate 1 minute of time passing from when I clap my hands, then stand up. . . . T claps! T asks most accurate Ps how they did it. (e.g. counting mentally from 1 to 60 in a steady beat)	Make sure that there is no clock ticking this time! [T tells Ps with poor estimation that saying 'elephant' between each number helps.]
	h) i) *How many years old are you?* (e.g. 9 to 10) ii) *How many months old are you?* (e.g. 108 to 120)	Shown on slates or scrap paper in unison on command.
	iii) *How many days old are you?* T chooses own or a P's birth date as an example. e.g. P born on 3 March 1993 and today is 18 November 2002: BB: 3 March 1993 to 3 March 2002: 9×365 days = 3285 days 3 March 2002 to 18 November 2002: Mar Apr May Jun Jul Aug Sep Oct Nov 28 + 30 + 31 + 30 + 31 + 31 + 30 + 31 + 18 = 260 (days) But 1996 and 2000 were leap years, so 2 extra days are needed. BB: Total age: 3285 + 260 + 2 = <u>3547</u> (days) T asks Ps who have finished their calculations to tell class their results. T (class) teases Ps with obviously unrealistic ages. Ps not finished can complete calculations at home if they wish.	Whole class discussion on how to work out the answer. Allow Ps to suggest what to do, otherwiseT directs Ps' thinking. T (P) works at BB while rest of Ps calculate own ages using same method in *Ex. Bks*. Allow the use of calculators to speed up calculations. Extra praise if Ps think of leap years without prompting. In good humour! Praising, encouragement only

20 min

Y5

Lesson Plan 31

Activity ***Notes***

3

Time 3

T has large model clock for demonstration and Ps have model clocks on desks if possible (or draw clocks and arms on slates or scrap paper).

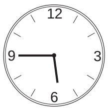
a) T says a time. Ps draw or set their clocks and show T on command. P with correct response explains to those who were wrong.

e.g. 2 o'clock, half past 3, 5 hours 45 minutes, 10 minutes to 8, twenty past 1, seven twenty-one am, 2.58 am, 1300 hours, etc.

Ps can say times too but encourage the use of different forms.

b) T sets a time on large clock, saying whether it is morning or night. Ps write time in *Ex. Bks*. in as many different ways as they can.

e.g.



a quarter to 6, 5:45, 1745 hours, 5 hr 45 min, 5 and 3 quarter hours, 15 minutes to 6, 5.45 am (pm)

Review with whole class. Deal with all cases. Class points out incorrect times. Ps can set some times too.

Whole class activity (but if possible, individual work in drawing/setting times)

Discussion, agreement, (self-correction) , praising

Agree that the time could be a.m. or p.m. if part of day is not specified.

Individual work, monitored

Set short time limits, and encourage quick writing, so that several times can be dealt with.

Discussion, agreement, self-correction, praising

25 min

4

PbY5a, page 31

Q.1 Read: *Fill in the missing numbers and signs.*

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

Allow Ps to check approximations with calculators <u>after</u> the review and discuss cyclic/recurring digits and rounding.

Solution:

a) $1 \text{ second} \underset{\times 60}{<} 1 \text{ minute} \underset{\times 60}{\boxed{<}} 1 \text{ hour} \underset{\times \boxed{24}}{\boxed{<}} 1 \text{ day} \underset{\times \boxed{7}}{\boxed{<}} 1 \text{ week}$

b) 1 hour = $\boxed{3600}$ seconds, 1 month ≈ $\boxed{30}$ days, 1 year ≈ $\boxed{52}$ weeks

1 year = $\boxed{365}$ days, 1 year = $\boxed{12}$ months, 1 day = $\boxed{24}$ hours

c) 85 minutes $\boxed{=}$ 1 hour 25 minutes, 1 week = $\boxed{168}$ hours

Individual work, monitored, (helped)

Written on BB or use enlarged copy master or OHP

Differention by time limit

Reasoning, agreement, self-correction, praising

Show details on BB if problems.

e.g.

$60 \times 60 = 600 \times 6 = \underline{3600}$

$24 \times 7 = 140 + 28 = \underline{168}$

$365 \div 7 = (350 + 15) \div 7$

$= 52, \text{ r } 1 \approx \underline{52}$

30 min

5

PbY5a, page 31

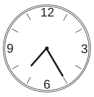
Q.2 Read: *Draw the hours and minute hands on the clocks.*
Write each time in another way.

Set a time limit. Ps finished early could write additional forms in *Ex. Bks*.

Review with whole class. Ps come to BB to complete clocks and write and say times. Class points out errors. Mistakes corrected. Deal with all forms written by Ps and elicit any not given.

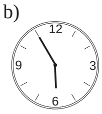
Solution:

a)



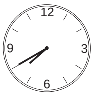
7 hrs 25 min

b)



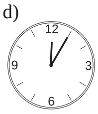
05:55

c)



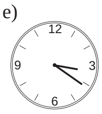
20 min to 8

d)



0 hrs 5 min

e)



15 h 20 min 45 sec

Individual work, monitored, (helped)

Drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

Other forms, e.g.

a) 07:25, 19:25, 7.25 am, 7.25 pm, twenty-five past 7

b) 5 to 6, 5.55 am, 0555 hrs,

c) 07.40, 19:40, 7.40 am (pm) 7 hr 40 min

d) 00:05, 12.05 pm, five past midnight, etc

35 min

Y5

Lesson Plan 31

Activity

Notes

6

PbY5a, page 31

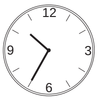
Q.3 Read: *Write these times using the 24 hour clock.*

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

T points to each clock in turn and chooses Ps to express the time in other ways. Class points out errors.

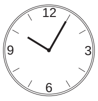
Solution:

a) morning



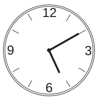
10:35

b) evening



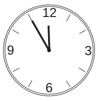
10:05

c) afternoon



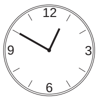
17:10

d) night



23:55

e) night



00:50

39 min

Individual work, monitored, (helped)

Drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

At speed. Praising

Feedback for T

7

PbY5a, page 31

Q.4 a) Read: *How many days are in the first 5 months of a leap year?*

Set a time limit. Ps write plan in *Pbs*, do calculation in *Ex. Bks* if necessary, then write answer as a sentence in *Pbs*.

Review with whole class. Ps could show results on scrap paper or slates in unison on command. Ps responding correctly explain at BB to Ps who were wrong. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

Plan: $31 + 29 + 31 + 30 + 31 = 3 \times 31 + 29 + 30$

$= 93 + 59 = \underline{152}$ (days)

or $= 5 \times 30 + 3 - 1 = 150 + 2 = \underline{152}$ (days)

Answer: There are 152 days in the first 5 months of a leap year.

b) Read: *A train travelled 127 km in the first hour and a half of a journey, then it stopped for 12 minutes. It took 65 minutes to cover the remaining 102 km.*

How much time did the train take to do the whole journey?

Set a time limit. Ps write plan and answer in *Pbs*, but calculations can be done in *Ex. Bks* if necessary.

Review with whole class. Ps could show results on scrap paper or slates in unison on command. Ps responding correctly explain at BB to Ps who were wrong. Who agrees? Who solved it another way? etc. Mistakes discussed and corrected. Agree that the distances are not needed for solution.

Solution:

Plan: $1\frac{1}{2}$ hours + 12 min + 65 min = (90 + 12 + 65) min

= 167 min = $\underline{\text{2 hr 47 min}}$

Answer: The whole journey took 2 hours 47 minutes..

45 min

Individual work, monitored, (helped)

Reasoning, agreement, self-correction, praising

Inividual work, monitored, helped
(or whole class activity if time is short)

T might warn Ps about superfluous data.

Discussion, reasoning, agreement, self-correction, praising

or $1\frac{30}{60} + \frac{12}{60} + 1\frac{5}{60}$ (hrs)

$= 2 + \frac{30 + 12 + 5}{60}$ (hrs)

$= 2\frac{47}{60}$ hrs $= \underline{\text{2 h 47 min}}$

Y5

R: Mental calculation

C: Time: word problems

E: Timetables. Calendars

Lesson Plan *32*

Activity		*Notes*

1

Problem 1

Johnny wants to invite his friends to his birthday party on the 6th of December at 2 o'clock in the afternoon. How could he write the date and time on the invitation cards?

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

BB: 6th December 2002 at 1400 hours
6 December 2002 at 2.00 pm
16.12.02 at 14.00, etc.

4 min

Whole class activity

At a good pace

Agreement, praising

Feedback for T

2

Problem 2

Listen carefully, note the data, and show me the answer when I say.

Four boys took part in a race. Adam's time was 5 and a half minutes, Brian's time was 5 minutes 25 seconds, Callum's time was 330 seconds and David's time was 5 and a third minutes. Who won the race?

Show me . . . now! (David) (as he had the shortest time)

Let's list their times in increasing order. Ps dictate to T.

BB: D B A C
5 min 20 sec < 5 min 25 sec < 5 min 30 sec = 5 min 30 sec
or 320 sec < 325 sec < 330 sec = 330 sec

8 min

Whole class activity

T repeats slowly to give Ps time to note the data and convert the units.

In unison (on scrap paper or slates)

Discussion, reasoning, agreement, praising

Feedback for T

3

Addition of units of time

I want to add up these time periods using vertical addition. Who can help me to do it? Ps suggest ideas and come to BB to explain reasoning in detail. Class points out errors or helps if Ps are stuck.

BB: a)
4 hours 32 min
\+ 3 hours 49 min
7 hours 81 min
8 hours 21 min

b)
3 hours 25 min 30 sec
\+ 11 hours 41 min 45 sec
14 hours 66 min 75 sec
14 hours 67 min 15 sec
15 hours 7 min 15 sec

T might show the short form of notation for hours, minutes, seconds.

BB: e.g. 3h 25' 30", 15 h 7' 15"

13 min

Whole class activity

Written on BB or SB or OHT

BB: 1 hour = 60 min
1 min = 60 sec

Discussion, reasoning, agreement, praising

Ps write calculations in *Ex. Bks.* at same time.

Ps can use this notation in future to save time if they wish.

4

Timetables

T has enlarged pages from real local bus (train, plane, boat) timetables for demonstration and Ps have copies on desks too.

Discuss meaning of abbreviations and symbols and relate to Ps' own experiences where possible. (e.g. the different classes of seats, whether food and drink is available; D: departure time, A: arrival time; whether bicycles can be taken, where passengers have to change trains, which days the service operates, downward facing arrows show continuous journeys without stops, etc.)

Whole class activity

Involve as many Ps as possible in the discussion.

Ps might also mention reserving seats, special cheap prices and travel times, etc.

Y5

Lesson Plan 32

Activity

Notes

4

(Continued)

Here is a fictional (made-up) timetable. What does it tell you? (Train leaves London at 10:20 and gets to York at 16:21, stopping at Sheffield and Doncaster on the way.)

Let's work out how long the journeys are between the stations.

How can we do it? Ps come to BB to do calculations, with T's help. Class agrees/disagrees. Rest of Ps write calculations in *Ex. Bks* too.

BB: e.g.

London	D	10:20
Sheffield	A	13:12
	D	13:15
Doncaster	A	14:53
	D	15:00
York	A	16:21

London to Sheffield:

$$\begin{array}{r} 12\text{ h } 72\text{ min} \\ \cancel{13\text{ h } 12\text{ min}} \\ -\ 10\text{ h } 20\text{ min} \\ \hline 2\text{ h } 52\text{ min} \\ \hline \end{array}$$

Sheffield to Doncaster:

$$\begin{array}{r} 14\text{ h } 53\text{ min} \\ -\ 13\text{ h } 15\text{ min} \\ \hline 1\text{ h } 38\text{ min} \\ \hline \end{array}$$

Doncaster to York: 1 h 21 min

Or use a real timetable if it is simple enough

Written on BB or SB or OHT

Allow Ps to suggest ideas.
T intervenes or gives hints only if Ps are stuck and other Ps cannot help.

Reasoning, agreement, praising

T might show other forms of writing times of arrival and departure, e.g.

$10^{\underline{20}}$, $14^{\underline{53}}$, etc.

20 min

5

Yearly calendar

T has large class calendar and Ps have small calendars on desks (for current year if possible).

T asks questions and Ps use their calendar to find the answer. e.g.

- Number of Sundays in certain months
- Which days can be counted 4 (5) times in certain months?
- Number of days between two given dates. (e.g. Ps' birthdays)
- Length of Easter (summer, Christmas, mid-term) holidays in weeks and days.
- Length of school term (year) in weeks (months). etc.

Ps can think of questions to ask too.

Whole class activity

Use own calendars or download calendars for any year from:

http://www.ex.ac.uk/cimt/res2/trolqc

Agreement, praising

Extra praise for creative questions from Ps.

25 min

6

Sequences

T dictates first few terms of a sequence. Ps write in *Ex. Bks*, then continue the sequence for 5 more terms.

Set a time limit. Review with whole class. Ps come to BB or dictate terms to T, saying the rule that they used. Who agrees? Who used a different rule? Mistakes discussed and corrected.

BB:

a) 14 h 20 min, 14 h 40 min, 15 h, (15 h 20 min, 15 h 40 min, 16 h, 16 h 20 min, 16 h 40 min) [*Rule*: + 20 min]

b) 3.50 pm, 3.10 pm, 2.30 pm, 1.50 pm, (1.10 pm, 12.30 pm, 11:50 am, 11:10 am, 10:30 am) [*Rule*: – 40 min]

c) 3.50 am, 3.10 am, 2.30 am, 1.50 am, (1.10 am, 0.30 am, 11.50 pm, 11.10 pm, 10.30 pm) [Rule: – 40 min]

Individual work, monitored (b) and c) helped)

T writes given terms on BB.

Discussion, agreement, self-correction, praising

Feedback for T

Extension

Ps say the terms in b) and c) using the 24 hour clock.

b) 15:50, 15:10, 14:30, 13:50, 13:10, 12.30, etc.

c) 03:50, 03:10, 02:30, 01:50, 01:10, 00:30, 23:50, etc.

Whole class activity

Ps dictate terms to T. Class points out errors.

30 min

Y5 *Lesson Plan 32*

Activity ***Notes***

7

PbY5a, page 32

Q.2 Read: *A ship sailed from A to B in 1 hour 47 minutes, then from B to C in 2 hours 35 minutes*

a) How much time did it take to sail from A to C?

b) How much more time did it take to sail from B to C than from A to B?

Deal with one part at a time if class is not very able, otherwise set time limit. Ps calculate in *Ex. Bks*, them write answer as a sentence in *Pbs*.

Review at BB with whole class. Ps come to BB to write calculations and explain reasoning. Who agrees? Who did it a different way? etc. Mistakes discussed and corrected.

Solution: e.g.

a) *Plan:* 1 h 47 min + 2 h 35 min
= 3 h + 82 min
= 3 h + 1 h 22 min
= <u>4 h 22 min</u>

or *C:*
1 h 47 min
\+ 2 h 35 min
~~3 h 82 min~~
→ 4 h 22 min

Answer: It took 4 hours 22 minutes to sail from A to C.

b) *Plan:* 2 h 35 min – 1 h 47 min
= 1 h 35 min – 47 min
= 95 min – 47 min
= <u>48 min</u>

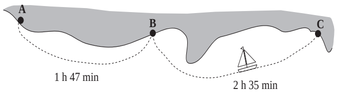
or *C:*
2 h 35 min → 1 h 95 min
– 1 h 47 min   – 1 h 47 min
0 h 48 min ← 0 h 48 min

Answer: It took 48 minutes more to sail from B to C than A to B.

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

BB:



Discussion, reasoning, agreement, self-correction, praising

Accept any correct form of calculation but T shows column form if Ps have not used it.

[Another method of subtraction is shown in *Activity* 8.]

35 min

8

PbY5a, page 32

Q.3 Read: *Write a plan, do the calculation and check your result in the context of the question. Write the answer in a sentence.*

Deal with one part at a time. Set a time limit. Ps read questions themselves and solve in *Ex. Bks* if they need more space.

Review with whole class. Ps could show results on scrap paper or slates in unison on command. Ps answering correctly explain solution at BB. Who agrees? Who did it a different way? etc. Mistakes discussed and corrected.

Solution:

a) *How many minutes are there between half past ten in the morning and a quarter past one in the afternoon of the same day?*

Plan: 13 h 15 min – 10 h 30 min
= 3 h 15 min – 30 min
= 2 h 75 min – 30 min
= 2 h 45 min
= 120 min + 45 min
= <u>165 min</u>

or
→ 12 h 75 min
~~13 h 15 min~~
– 10 h 30 min
2 h 45 min
(= 165 min)

Answer: There are 165 minutes between 10.30 am and 1.15 pm on the same day.

Individual work, monitored, helped

(or whole class activity if time is short)

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

Accept any valid method of solution.

or.

10.30 am to 12 noon: 90 min

12 noon to 1.15 pm: 75 min

Total time:
(90 + 75 = <u>165</u>) min

Check:
10 h 30 min = 630 min
630 min + 165 min = 795 min
= 13 h 15 min ✔

Activity ***Notes***

8

(Continued)

b) Lenny spent 6 and a half hours on maths last week.

He had 5 maths lessons of 45 minutes each and spent 90 minutes at the school's maths club. The rest of the time was spent on his maths homework.

How long did it take Lenny to do his maths homework last week?

Plan: 6 h 30 min – (5 × 45 min + 90 min)

= 390 min – (225 min + 90 min)

= 390 min – 315 min

= 75 min

= <u>1 h 15 min</u>

(or Ps might use decimals or fractions of an hour)

Answer: Lenny took 1 hour 15 minutes to do his homework last week.

or

$5 \times 45 + 9 + \square = 390$ (min)

$225 + 90 + \square = 390$ (min)

$\square = 390 - 315$ (min)

= 75 min = <u>1 h 15 in</u>

Check: e.g.

5 × 45 min = 225 min

= 3 h 45 min

90 min = 1 h 30 min

3 h 45 min + 1 h 30 min + 1 h 15 min

= 5 h 90 min = 6 h 30 min ✔

41 min

9

PbY5a, page 32, Q.4

Read: *Draw two straight lines to divide this clock face into three parts so that the sum of the numbers in each part is the same.*

Who has an idea on how to solve this problem? Ps suggest strategies. Accept any valid method, including trial and error.

If no P has thought of method below, T gives hints and directs Ps' thinking Then Ps suggest where the 2 lines should be drawn. Class checks that they are correct.

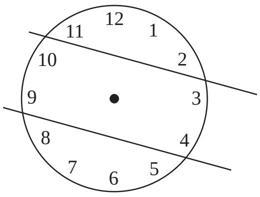
Solution:

Total sum of numbers. on the clock:

1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 = 6 × 13 = 78

Total of each part should be 1 third of 78: 78 ÷ 3 = <u>26</u>

BB:



Check: 12 + 11 + 2 + 1 = 26 ✔

10 + 9 + 4 + 3 = 26 ✔

8 + 7 + 6 + 5 = 26 ✔

Whole class activity

(or individual trial first if Ps wish, monitored)

Drawn on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, checking, praising

Extra praise for clever strategies and for Ps who find the positions of the 2 lines.

45 min

Y5

R: Mental calculation

C: Simple problems with ratio and proportion

E: Fractions and decimals in problems

Lesson Plan
33

Activity

Notes

1

Missing items

Let's fill in the missing numbers and units. Ps come to BB or dictate to T, explaining reasoning. Class points out errors.

BB:

a) $\frac{1}{4}$ hour = $\boxed{15}$ min. = $\boxed{900}$ sec.
b) $\frac{3}{4}$ hour = $\boxed{45}$ min. = $\boxed{2700}$ sec.
c) $\frac{1}{2}$ hour = $\boxed{30}$ min. = $\boxed{1800}$ sec.
d) $\frac{3}{2}$ hour = $\boxed{90}$ min. = $\boxed{5400}$ sec.
e) $\frac{1}{3}$ hour = $\boxed{20}$ min. = $\boxed{1200}$ sec.
f) $\frac{2}{3}$ hour = $\boxed{40}$ min. = $\boxed{2400}$ sec.
g) $\frac{1}{5}$ hour = $\boxed{12}$ min. = $\boxed{720}$ sec.
h) $\frac{3}{5}$ hour = $\boxed{36}$ min. = $\boxed{2160}$ sec.
i) $\frac{1}{6}$ hour = $\boxed{10}$ min. = $\boxed{600}$ sec.
j) $\frac{5}{6}$ hour = $\boxed{50}$ min. = $\boxed{3000}$ sec.
k) $\frac{1}{8}$ hour = $\boxed{7.5}$ min. = $\boxed{450}$ sec.
l) $\frac{7}{8}$ hour = $\boxed{52.5}$ min. = $\boxed{3150}$ sec.
m) $\frac{1}{10}$ hour = $\boxed{6}$ min. = $\boxed{360}$ sec.
n) $\frac{3}{10}$ hour = $\boxed{18}$ min. = $\boxed{1080}$ sec.

What relationships do you notice among the statements?

T (or Ps if they can) explains about direct and inverse proportion.

BB: e.g.

$$\begin{tikzcd}
\frac{1}{4}\text{ hour} \arrow[r, bend left, "\times 60"] \arrow[r, bend right, "\div 60"'] \arrow[d, bend right, "\div 2"'] \arrow[r, phantom, "="] & 15\text{ min} \arrow[r, bend left, "\times 60"] \arrow[r, bend right, "\div 60"'] \arrow[r, phantom, "="] & 900\text{ sec} \arrow[d, bend left, "\div 2"] \\
\frac{1}{8}\text{ hour} \arrow[r, phantom, "="] & 7.5\text{ min.} \arrow[r, phantom, "="] & 450\text{ sec.}
\end{tikzcd}$$

5 min

Whole class activity

Written on BB or use enlarged copy master or OHP

At a good pace

Discuss

- direct proportion among the rows: as one amount increases (decreases), the other amount also increases (decreases) at the same rate;
- inverse proportion between the measuring numbers and the units: as one value increases, the other decreases at the same rate.

Praise all positive contributions to the discussion.

2

Problems 1

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

P answering correctly explains at BB to those who were wrong. Who agrees? Who did it another way? etc. Mistakes discussed and corrected.

a) *If Jenny spent on average 1 hour 40 minutes each evening reading her new book, and she finished it after 5 evenings, how long did it take her to read the book?*

Show me . . . now! (8 h 20 min)

BB: e.g. 1 evening $\rightarrow$ 1 h 40 min

$$5\text{ evenings} \rightarrow 5 \times 1\text{ h }40\text{ min} = 5 \times 1\text{h} + 5 \times 40\text{ min}$$
$$= 5\text{ h } 200\text{ min} = \underline{8\text{ h } 20\text{ min}}$$

$$\text{or } 5 \times 1\text{ h }40\text{ min} = 5 \times 100\text{ min.} = 500\text{ min} = \underline{8\text{ h }20\text{ min}}$$

Answer: Jenny took 8 h 20 min to read her book.

b) *If Benny exercises for 45 minutes 4 times a week, how many hours of exercises does he do in a year?*

Show me . . . now! (156 hours)

BB: e.g. 1 week $\rightarrow$ 4 × 45 min = 180 min = 3 hours

52 weeks $\rightarrow$ 3 h × 52 = 150 h + 6 h = $\underline{156\text{ h}}$

Answer: In 1 year, Benny exercises for 156 hours.

10 min

Individual work, monitored, (helped)

T repeats slowly to give Ps time to think and calculate.

Responses shown in unison, on scrap paper or slates

Reasoning, agreement, self-correction, praising

Accept any valid method but T also shows direct proportion if Ps have not used it.

Feedback for T

Extra praise if a P points out that the answer is unlikel to happen in real life. (e.g. Benny might be ill or be on holiday, or have visitors, or just be too busy – a year is a long time!)

Y5

Lesson Plan 33

Activity | *Notes*

3

Problems 2

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

Deal with one question at a time. T reads problem and asks a P to repeat it in own words. Set a time limit.

Review with whole class. Ps show results on scrap paper or slates on command. Ps answering correctly explain at BB to those 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.

a) *How much does 1 m of wire cost if 45 m of wire cost £93.15 ?*

BB: e.g. 45 m → £93.15

1 m → £93.15 ÷ 45 = 9315 p ÷ 45

= 1035 p ÷ 5 = 207 (p) = £2.07

Answer: 1 m of wire costs £2.07.

b) *How many lbs of apples can the leader of a group of 32 people on a day trip buy if he has £15 to spend and 1 lb of apples costs 68 p?*

BB: *Plan:* £15 ÷ 68 p = 1500 p ÷ 68 p

or 68 p → 1 lb

1500 p → 1500 p ÷ 68 p (times)

C:
e.g.

				2	2	r 4
6	8	1	5	0	0	
	–	1	3	6		
			1	4	0	
		–	1	3	6	
					④	

Answer: With £15 he can buy 22 lbs of apples and he will have 4 p left over.

Which data were not needed? (32 people, 1-day trip)

Individual work, monitored, (helped)

Encourage Ps to use direct proportion, but accept any valid method of calculation

Discussion, reasoning, agreement, self-correction, praising

or,
e.g.

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

or Ps might suggest:

$$1500 \div 68 = 22\frac{4}{68} = 22\frac{1}{17}$$

So $22\frac{1}{17}$ lb of apples could be bought with £15.

Agreement, praising

15 min

4

Problem 3

Listen carefully, note the data and think how to solve this problem.

124 000 litres of water flows steadily into a pool in 4 and a half hours. How much water flowed into the pool every minute?

T chooses Ps to come to BB to write a plan and do the calculation, with help of class where necessary. e.g. Using direct proportion:

BB: 4 h 30 min = 240 min + 30 min = 270 min

270 min → 124 000 litres

1 min → 124 000 litres ÷ 270 = 12 400 litres ÷ 27

Discuss what to do with the 7 remaining. Elicit that the amount remaining is really 70 litres, as 124 000 litres ÷ 270 = 27 litres, and 70 litres remain (i.e. the remainder 7 must be changed back to its original magnitude) Agree that the 70 litres cannot be left as a remainder, as it does not make sense in the context of the question.

What should we do? Elicit that the 70 litres should be divided into 270 equal parts. Ps dictate what T should write:

BB: $\frac{70}{270} = \frac{7}{27}$ (litre) 459 litres + $\frac{7}{27}$ litre = $459\frac{7}{27}$ litres

Answer: Every minute, $459\frac{7}{27}$ litres flow into the pool.

Whole class activity

T repeats slowly and a P repeats in own words to give Ps time to think and discuss.

Discussion, reasoning, agreement, praising

C:
e.g.

				4	5	9	r 7
2	7	1	2	4	0	0	
	–	1	0	8			
			1	6	0		
		–	1	3	5		
				2	5	0	
			–	2	4	3	
						⑦	

Allow Ps to explain if they can, otherwise T lshows it.

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

20 min

Y5

Lesson Plan 33

Activity ***Notes***

5

Problem 4

Listen carefully and think how you would solve this problem.

A bucket holds 15 litres of water and it takes 16 buckets of water to fill a tank. If we used an 8-litre jug instead of a bucket, how many jugfuls of water would we need to fill the same tank?

Let's estimate the answer first. How could we do it?

(e.g. The capacity of the bucket is nearly twice that of the jug, so the number of jugfuls needed is roughly twice the number of bucketfuls, i.e. approximately 32 jugfuls will be needed.)

How can we work it out exactly? Ps suggest plans and calculations. If Ps are stuck, T shows this method and Ps copy in *Ex. Bks.*

BB: 15 litre container → 16 (times)

1 litre container → 16 × 15 = 240 (times)

8 litre container → 240 ÷ 8 = <u>30</u> (times)

Who can write an operation in a shorter form on one line?

BB: *Plan*: 15 × 16 ÷ 8 = 15 × 2 = <u>30</u> (jugs)

Answer: We would need thirty 8-litre jugfuls of water to fill the tank.

Individual work, monitored, helped

Written on BB or SB or OHT

Discussion, reasoning, agreement, self-correction, praising

BB: e.g.

$$\begin{array}{rccc} & & 1 & 6 \\ & \times & 1 & 5 \\ \hline & & 8 & 0 \\ + & 1 & 6 & 0 \\ \hline & 2 & 4 & 0 \\ & {\scriptstyle 1} & & \end{array}$$

Elicit that the smaller the container, the more times it needs to be filled, and vice versa. i.e. the amounts are in <u>inverse proportion</u> to one another.

25 min

6

PbY5a, page 33

Q.1 Read: *If 1 lb of cherries costs 32 p, how much do 2 lb, 3 lb, 10 lb, 437 lb of cherries cost? Continue the table and complete the statement.*

Set a time limit. Ps follow the example and complete the table. Ps can use *Ex. Bks* for calculations if they need more room.

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

Solution:

1 lb → 32 p

2 lb → 2 × 32 p = 64 p

3 lb → 3 × 32 p = 96 p

10 lb → 10 × 32 p = 320p = £3.20

437 lb → 437 × 32 p = 13 984 p = £139.84

Elicit that the costs are in <u>direct</u> proportion to the amounts.

Individual work, monitored (helped on last row)

Written on BB or SB or OHT

Differentiation by time limit.

Discussion, reasoning, agreement, self-correction, praising

Final calculation shown in detail on BB:

e.g.

$$\begin{array}{rccccc} & & & 4 & 3 & 7 \\ & & & \times & 3 & 2 \\ \hline & & & 8 & 7 & 4 \\ + & 1 & 3 & 1 & 1 & 0 \\ \hline & 1 & 3 & 9 & 8 & 4 \end{array}$$

As the quantity increases, so does the price at the same rate.

30 min

7

PbY5a, page 33

Q.2 and Q.3 Read: *Solve this problem in your exercise book and write the answer here.*

Set a time limit. Ps read problems themselves and solve them.

Review with whole class. Ps could show results on scrap paper or slates on command. P answering correctly explains reasoning at BB. Who agrees? Who did it another way? Mistakes discussed and corrected. Elicit that within each question the amounts are in <u>direct</u> proportion to one another.

Individual work, monitored (helped)

Differentiation by time limit.

Or deal with one question at a time if Ps are still unsure about proportion.

Discussion, reasoning, agreement, self-correction, praising

Y5

Lesson Plan 33

Activity ***Notes***

Q.2 *If 4 rolls of material contain 256 m, what length of material would be in 150 such rolls?*

Solution: e.g.

4 rolls → 256 m

1 roll → 256 m ÷ 4 = 64 m

150 rolls → 150 × 64 m = $\underline{9600\text{ m}}$

C:

$$\begin{array}{rrrrr} & & 1 & 5 & 0 \\ & & \times & 6 & 4 \\ \hline & & 6 & 0 & 0 \\ + & 9 & 0 & 0 & 0 \\ \hline & 9 & 6 & 0 & 0 \\ \hline \end{array}$$

Answer: There would be 9600 m in 150 rolls of material.

Or 64 × 150 = 640 × 15
= 640 × 10 + 640 × 5
= 6400 + 3000 + 200
= $\underline{9600}$

Q.3 *If 6 pens cost 240 p, how many pens can we buy for 360 p?*

Solution: e.g.

6 pens → 240 p

1 pen → 240 p ÷ 6 = 40 p

360 p ÷ 40 p = $\underline{9}$ (times)

Answer: We can buy 9 pens for 360 p.

T might show other methods: e.g. using $\underline{\text{ratio}}$:

360 : 240 = 36 : 24 = 3 : 2

x : 6 = 3 : 2 = 9 : 6, so x = $\underline{9}$

or 360 p is 1 and a half times 240 p, so we can buy 1 and a half times 6 pens, i.e. $\underline{9}$ pens.

36 min

8

PbY5a, page 33

Q.4 Read: *If 1 kg of paint cost £9.45, how much do 1 kg, 2 kg, 5 kg, 11 kg, 20 kg, 27 kg, 30 kg, 150 kg of paint cost? Complete the table. Do the calculations in your exercise book.*

Set a time limit. Encourage Ps to look for relationships to make calculations easier.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Who agrees? Who did it a quicker way? etc. Mistakes discussed and corrected.

Solution:

Quantity	15 kg	1 kg	2 kg	5 kg	11 kg	20 kg	27 kg	30 kg	150 kg
Price	£9.45	**63** p	**£1.26**	**£3.15**	**£6.93**	**£12.60**	**£17.01**	**£18.90**	**£94.50**

Extension

What do you think is wrong with this question if you consider what happens in real life?

(Paint is usually sold by the litre, not by the kg. Price of paint is not usually in direct proportion to the amount – the larger the tin, the cheaper the paint is per litre to encourage customers to buy more.)

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, self-correction, praising

Extra praise if Ps suggest clever ways to calculate, e.g.

945 p ÷ 15 = 315 ÷ 5 = $\underline{63\text{ p}}$

5 kg → £9.45 ÷ 3 = $\underline{£3.15}$

11 kg → 630 p + 63 p
= 693 p = $\underline{£6.93}$

20 kg → £1.26 × 10
= $\underline{£12.60}$

27 kg → £12.60 + £3.15 + £1.26 = $\underline{£17.01}$

30 kg → £3.15 × 6 = $\underline{£18.90}$

150 kg → £9.45 × 10 = $\underline{£94.50}$

41 min

9

PbY5a, page 33, Q.5

Read: *A journey took 6 hours in a car travelling at an average speed of 50 km per hour. How much time would the journey have taken if the car had travelled at these average speeds?*

What does average speed mean? (As if the car had travelled at the same speed all the time, which is not likely in real life.)

Ps come to BB or dictate to T, using quick ways to calculate where possible. Class points out errrors or easier calculations.

What is the relationship between speed and time? Ask several Ps what they think. (Elicit that they are in $\underline{\text{inverse}}$ proportion to one another, i.e. as speed increases, time taken decreases, and as speed decreases, time taken increases.)

Whole class activity

Written on BB or SB or OHT

At a good pace

Reasoning, agreement, praising. Ps write in *Pbs* too.

Solution:

50 km/h → 6 h

25 km/h → 12 h (6 h × 2)

60 km/h → 5 h (6 h × 5 ÷ 6)

100 km/h → 3 h (6h ÷ 2)

40 km/h → 7.5 h (6 h × 5 ÷ 4)

45 min

Y5

R: Mental calculation
C: Real-life relationships. Graphs. Properties
E: Fractions and decimals in calculations

Lesson Plan
34

Activity ***Notes***

1

Presenting and reading discrete data

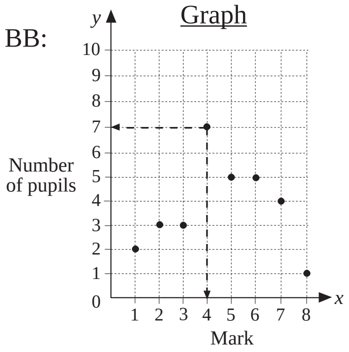
This table shows the results of a class test. Who can explain what it means? P comes to BB. Class agrees/disagrees. How many Ps did the test? (30) What do you think the test was out of? (8 marks)
(T points out that if the test was out of, e.g. 10 marks, there would be two more columns, with 9 and 10 in top row and zeros in bottom row.)

BB:

Mark	1	2	3	4	5	6	7	8
Number of pupils	2	3	3	7	5	5	4	1

In what other ways could the data have been shown? (e.g. simple list, graph, bar chart, pie chart, pictogram)

a) Let's show the data in a graph. BB:



T has axes already drawn on BB. Ps come to BB to draw a dot for each column in table, pointing to appropriate values on *x* and *y* axes and moving fingers along grid lines until they meet.

Class points out errors.

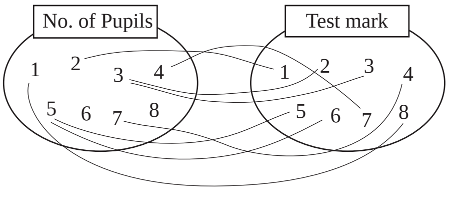
Is it correct to join up the dots?

(No, as it is not possible to have part of a person or part of a mark. They are separate points.) T: We call such data discrete data. (BB)

b) Let's show the data in a bar chart. Again, T has axes already drawn and Ps come to BB to draw appropriate 'bars' for each column in the table. Class points out errors.

c) We could also show the data in sets. How many should we draw? What should their labels be? Which numbers should we write in them? How could we show which number belongs with which? Ps dictate what T should draw/write then come to BB to draw joining lines. Class agrees/disagrees.

BB: Sets



T asks questions about the data. Class points out errors.

- How many Ps scored 1 mark (2, 3, 4, 5, 6, 7, 8 marks)?
- What mark was scored by 1 (2, 3, 4, 5, 6, 7) Ps?
- Which mark was the most (least) frequent? (4, 8)

Which diagram helped you most to answer the questions?

6 min

Whole class activity

Table and axes drawn on BB or use enlarged copy master or OHP

If possible, use real class data and amend the activities accordingly.

Praise all contributions.

Reasoning, agreement, praising

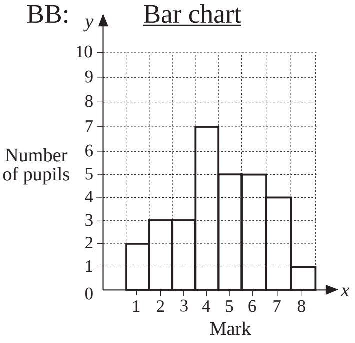
At a good pace

(If possible, Ps have copies of axes on desks too.)

Discussion, agreement, praising

BB: discrete data
separate data points

BB:



Agreement, praising

Ps chosen at random.

At speed

Agreement/correcting, praising

Ask several Ps what they think and why.

Y5

Lesson Plan 34

Activity

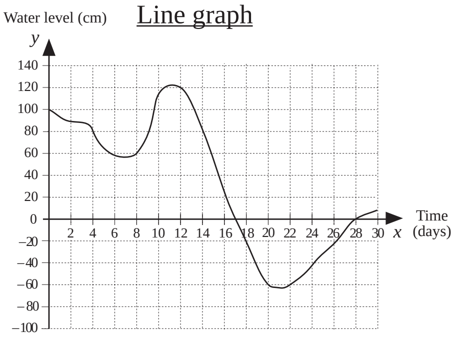
Notes

2

Continuous data

The Environment Agency has set up a piece of equipment which measures continuously the level of the water in a river. The normal level at 0 cm has been fixed after years of experience.

BB: Line graph



Who can explain the graph? (e.g. level above 0 is positive; level below zero is negative; data shown by a continuous line; if line is rising, water level is increasing; if line is falling, water level is decreasing, data collected over 30 days, or a month; etc.)

We say that such data are continuous data and are shown on a line graph.

Use the graph to help you answer these questions.

a) What height was the water level on these dates and was it raising or falling?

i) 10th (about 110 cm; rising) ii) 20th (about – 60 cm; falling)

iii) 22nd (about – 60 cm; rising) ii) 12th (about 120 cm; falling)

b) Did the water level rise or fall during the first 7 days? (fall)

c) When was the water level highest (lowest)? (11th, 21st) etc.

12 min

Whole class activity

Drawn on BB or use enlarged copy master or OHP

(If possible, Ps have copies on desks too.)

Praising, encouragement only

T gives hints if Ps miss something important.

BB: Continuous data

Ps come to BB to say and show answers on the graph.

Class agrees/disagrees.

Praising

Ps think of questions to ask too. Extra praise for clever questions.

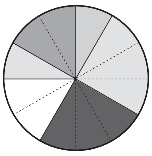
3

Pie chart

The pupils in a class were asked what was their favourite subject and the T showed the results like this. Who remembers the name for this method of showing data? (pie chart)

BB: Pie Chart

e.g.



▨ French $\left(\frac{1}{12}\right)$
▨ Mathematics $\left(\frac{3}{12} = \frac{1}{4}\right)$
■ English $\left(\frac{3}{12} = \frac{1}{4}\right)$
□ Science $\left(\frac{2}{12} = \frac{1}{6}\right)$
□ Music $\left(\frac{1}{12}\right)$
▨ P. E. $\left(\frac{2}{12} = \frac{1}{6}\right)$

Who can explain it? Ps come to BB to point and explain, with T's help.

Let's write the fraction of the class which preferred each subject. Ps come to BB to point to relevant section and write as a fraction. Class agrees/disagrees. T asks Ps questions about the diagram. e.g.

a) If there were 24 pupils in the class. How many Ps preferred each subject?

Ps come to BB or dictate to T, explaining reasoning.

b) What is the ratio of Ps choosing:

i) English to French? (6 to 2, or 3 to 1) BB: 6 : 2 = 3 : 1

ii) French to English? (2 to 6, or 1 to 3) BB: 2 : 6 = 1 : 3

iii) English to Science? (6 to 4, or 3 to 2) BB: 6 : 4 = 3 : 2

18 min

Individual work, monitored

Drawn on BB or use enlarged copy master or OHP, or use blank copy master, coloured appropriately

(If possible, Ps have copy of dagram on desks too.)

(circle divided into 12 equal parts, so each part represents 1 twelfth of the class; different shadings show how many twelfths of the class preferred each subject.)

BB:

F: $\frac{1}{12}$ of 24 = 24 ÷ 12 = 2

E/M: $\frac{1}{4}$ of 24 = 24 ÷ 4 = 6

S/P: $\frac{1}{6}$ of 24 = 24 ÷ 6 = 4

Ps can think of questions too!

Y5

Lesson Plan 34

Activity ***Notes***

4

Class Pie Chart

Let's make a pie chart about which subjects you prefer.

What should we do first? (Collect the data) Ps suggest (e.g. 4) subjects and T writes them on BB. T points to each subject in turn and Ps put up their hands if they prefer it. Check that the data match the number of Ps in the class. Now what should we do?

Ps work out the fractions for the various subjects, then suggest how to draw the pie-chart, with T's help where necessary.

T works on BB (using BB instruments if possible) and Ps work in *Ex. Bks*. (drawing around circular object or using compasses if they have them). Ps choose a colour for each subject, write a key or label diagram.

T (and Ps) ask questions about the data.

Whole class activity

(Or Ps choose another topic)

Discussion about strategy and in which order things should be done.

Fractions should be accurate but sections of circle need only be approximate.

Discussion, reasoning, agreement, praising

Ps could finish pie charts in *Lesson 35* if necessary.

24 min

5

PbY5a, page 34

Q.1 Read: *The graph shows the variation in temperature over one day.*

Discuss the graph and context first. (e.g. line graph; shows continuous data, so the temperature must have been monitored throughout the day; grid lines at every hour on *x*-axis and every °C on *y*-axis; as graph line rises, temperature is increasing, etc.)

Set a time limit. Ps read questions and find answers on graph.

Review with whole class. Ps could show answers on slates or scrap paper. Ps answering correctly come to BB to confirm on graph. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

a) *What temperature was it at 10.00 am?* (15 °C)

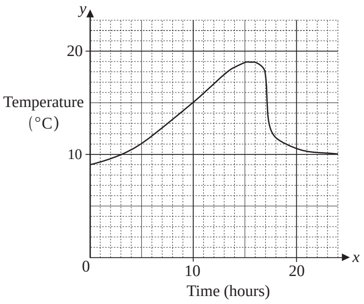
b) *At what time of day was it hottest?* (3.00 pm – 4.00 pm)

c) *During which times was the temperature rising?* (00:00 to 15:00)

d) *There was a downpour during the day. When do you think that it happened?* (4.00 pm to 6.00 pm) (as the temperature dropped sudenly)

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP:



Discussion, reasoning, agreement, self-correction, praising

Extension

Who can think of other questions to ask about the graph? (e.g. highest (lowest) temperature, probable time of year, at what time was it a certain temperature, what was the temperature at a certain time, etc.)

Whole class activity

Praise clever questions and good answers.

30 min

6

PbY5a, page 34

Q.2 Read: *One day we measured the temperature every hour from 6 o'clock in the morning to 3 o'clock in the afternoon. We noted the data as pairs of numbers.*

Discuss how the pairs of numbers relate to the graph and ask a P to demonstrate and explain by plotting (6, 2). Liken to a pair of coordinates, i.e. the *x* value is given first.

a) Read: *Show the data on a graph.*

Set a time limit. Review with whole class. Ps come to BB to draw dots, explaining what they are doing. Class agrees/ disagrees. Mistakes corrected before Ps read remaining questions themselves and answer them in *Pbs*.

Whole class discussion to start to clarify the relationship between the data and graph.

Coordinates written on BB. Graph drawn on BB or use enlarged copy master or OHP

Individual work, monitored, helped (or continue as whole class activity if Ps are still unsure)

Reasoning, agreement, self-correction, praising

Y5

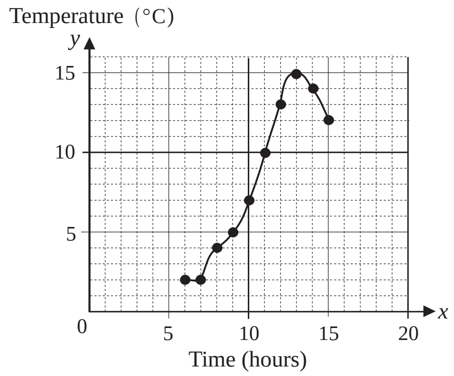
Lesson Plan 34

Activity ***Notes***

6 (Continued)

Solution:

(6, 2), (7, 2), (8, 4), (9, 5), (10, 7), (11, 10), (12, 13), (13, 15), (14, 14), (15, 12)



Check correct positions of points first, then after discussion (as below) and agreement, join points with a curved line.

b) *Is it correct to join the dots with a continuous curve? Why?*

(Accept Yes <u>and</u> No with correct reasoning, e.g.

No, as the data was collected hourly and we do not know what the exact temperature was between the hours, BUT

Yes, as temperature is continuous and a continuous curve would show the approximate temperatures between the hours.)

T joins up dots on BB and Ps join up dots in *Pbs*.

T repeats reasoning more clearly if necessary, but extra praise for Ps who think of these ideas.

Curve need only be rough, as long as it passes through the points.

c) *When was the temperature highest?* (At about 1300 h or 1.00 pm)

d) *Estimate the temperature at:*

6.30 am (≈ 2 °C); *9.15 am* (≈ 5.5 °C); *12.45 pm* (≈ 14.75 °C)

e) *Which season do you think it was?* (Accept autumn or spring)

[or c), d) and e) done as a whole class activity]

Extension When was the temperature rising (falling)? Ps come to graph to show the relevant sections of the curve and to say the approximate times.

Discussion, agreement, praising

38 min

7 ***PbY5a, page 34***

Q.3 Read: *Among 60 people at a conference, 10 are American, 20 are British, 5 are Chinese, 15 are Japanese and 10 are Hungarian.*

a) Show the data in a pie chart.

Into how many equal part should we divide the circle? T asks several Ps what they think. If nobody has an idea, T suggests:

BB: A: 60 ÷ 10 = <u>6</u> B: 60 ÷ 20 = <u>3</u>

C: 60 ÷ 5 = <u>12</u> J: 60 ÷ 15 = <u>4</u>

H: 60 ÷ 10 = <u>6</u>

What is the lowest number which is divisible by 3, 4, 6 and 12? (12) Let's divide the circle into 12 equal parts. How could we do it? (Divide circle into quarters first, then divide each quarter into 3 equal parts.) T works at BB and Ps work in *Pbs*.

Ps decide on a colour for each nationality, then work out how how many twelfths they should colour and label with the initial letter of the country.

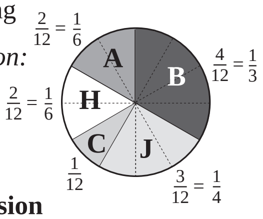
Review with whole class. Mistakes discussed and corrected.

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

(or continue as whole class activity if Ps are unsure or time is short)

Discussion, reasoning, agreement, self-correction, praising

Solution:



Extension

What is the <u>ratio</u> of, e.g.:

C to B (1 to 4 or 1 : 4)

B to C (4 to 1, or 4 : 1),

J to B? (3 to 4, or 3 : 4), etc.

45 min

Y5

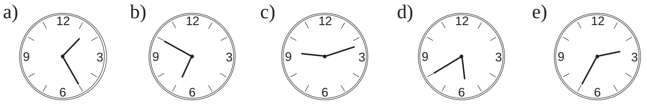
Lesson Plan 35

Activity | **Notes**

Tables and calculation practice, revision (completing pie charts)
PbY5a, page 35

Solutions:

Q.1



a) 13:25 b) ten to seven c) 9.12 am d) 5 h 40 min e) twenty-five to three

Q.2 a)

5 hours 24 min 36 sec
\+ 6 hours 55 min 41 sec
~~11 hours 79 min 77 sec~~
~~11 hours 80 min 17 sec~~
12 hours 20 min 17 sec

b)

21 hours 77 min 44 sec
~~22 hours 17 min 44 sec~~
– 11 hours 20 min 10 sec
10 hours 57 min 34 sec

Ps do calculations in *Ex. Bks.* first then write answer in *Pbs*.

Q.3 a) 3478 + 123 + 6032 = <u>9633</u>

b) 7359 + 22 + 450 + 13 687 = <u>21 518</u>

c) 14 722 – 1853 = <u>12 869</u>

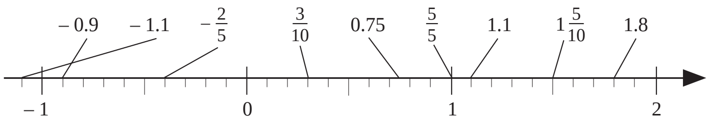
d) 5380 – 3953 = <u>1427</u>

e) $\frac{4}{5} + \frac{7}{10} - 1\frac{2}{10} = \frac{8}{10} + \frac{7}{10} - \frac{12}{10} = \frac{15-12}{10} = \underline{\frac{3}{10}}$

f) 12.35 + 37.9 – 0.98 = 50.25 – 0.98 = <u>49.27</u>

Ps do calculations a) to d) and f) in column form in *Ex. Bks*.

Q.4



Q.5 a) *Red*: $\frac{1}{9}$ of 27 = 27 ÷ 9 = <u>3</u> (pupils)

Blue: $\frac{4}{9}$ of 27 = 27 ÷ 9 × 4 = 3 × 4 = <u>12</u> (pupils)

Yellow: $\frac{1}{9}$ of 27 = 27 ÷ 9 = <u>3</u> (pupils)

Green: $\frac{2}{9}$ of 27 = 27 ÷ 9 ×2 = 3 × 2 = <u>6</u> (pupils)

b) The uncoloured part could represent absent pupils, or pupils who did not like any of the 4 colours.

Y5

R: Mental calculation. Fractions, decimals, negative numbers
C: Practice in order of operations
E: Problems

Lesson Plan 36

Activity ***Notes***

1

Order of operations 1

Let's do these calculations. For each calculation, T asks class what kind of operations are involved and in what order they should be done. Ps come to BB to work out answer using conventional order and explaining reasoning. Class agrees/disagrees.

Could we calculate the operations in a different order? Ps try other orders in *Ex. Bks*, then decide which are possible.

BB:

a) $\underbrace{\underbrace{150 - 45}_{105} - 5}_{100} + 50 = (150)$

Only addition and subtraction (or addition of positive and negative values), so we normally calculate from left to right.

Agree that it can be calculated in other orders too, but only as long as the same <u>signs</u> remain in front of the same numbers!

e.g. $-45 - 5 + 150 + 50 = -50 + 200 = 150$

or $150 + 50 - (45 + 5) = 200 - 50 = 150$, etc.

b) $\underbrace{\underbrace{24 \times 14}_{336} \div 12 \div 7}_{28} = (4)$

Only multiplication and division so we normally calculate from left to right.

Is there an easier way?

Agree that it can be calculated in other orders too.

e.g. $24 \div 12 \times 14 \div 7 = 2 \times 14 \div 7 = 28 \div 7 = \underline{4}$

or $24 \div 12 \times 14 \div 7 = (24 \div 12) \times (14 \div 7) = 2 \times 2 = \underline{4}$

c) What is different about this one? (All 4 operations are involved, so multiplication and division should be done first, from left to right.)

Order: ③ ① ④ ②

$110 + \underbrace{56 \times 2}_{112} - \underbrace{70 \div 10}_{7} = (222 - 7 = 215)$

Agree that in this case the order <u>cannot</u> be changed, as different orders will give different results.!

Whole class activity

Operations written on BB or SB or OHT

Individual trials in *Ex. Bks.*

Discussion, reasoning, agreement, praising

$$\begin{array}{rrrr} & & 2 & 4 \\ & \times & 1 & 4 \\ \hline & & 9 & 6 \\ + & 2 & 4 & 0 \\ \hline & 3 & 3 & 6 \\ \hline & 1 & & \end{array} \qquad \begin{array}{rr|rrr} & & & 2 & 8 \\ \cline{3-5} 1 & 2 & 3 & 3 & 6 \\ \hline & - & 2 & 4 & \\ \cline{3-4} & & & 9 & 6 \\ & & - & 9 & 6 \\ \cline{3-5} & & & & 0 \\ \cline{3-5} \end{array}$$

T might also show:

BB: $\dfrac{24 \times 14}{12 \times 7} = 2 \times 2 = 4$

and ask if it is correct.

Ps try different orders in *Ex. Bks* and tell their results. e.g.

$110 \div 10 + 56 - 70 \times 2$

$= 11 + 56 - 140$

$= 67 - 140 = -73 \neq 215$

Agreement, praising

8 min

2

Order of operations 2

Is there anything new in this calculation, compared with the previous ones? (This calculation has brackets.) How does this affect the order? (Operations in brackets should always be done first.)

Ps write calculation in *Ex. Bks* and work out the answer. **A**, come and show us how you did it. Who agrees? Who did it a different way? (If all Ps calculated in the same way, T asks whether it could be done a simpler way and shows it if Ps cannot think of it.)

BB: $44 + (128 - 28) \times 5 - 44 =$

$(44 + 100 \times 5 - 44 = 44 + 500 - 44 = 544 - 44 = \underline{500)}$

or $44 + (128 - 28) \times 5 - 44 = (128 - 28) \times 5 + 44 - 44$

$= 100 \times 5 + 0$

$= \underline{500}$

Agree that operations in brackets <u>must</u> be done first, then multiplication or division, then addition or subtraction, but within each type, look for the easiest order.

Whole class discussion fist then individual work, monitored

Written on BB or SB or OHT

Discussion, reasoning, agreement, self-correction, praising

Ask Ps which method they think is easiest.

12 min

Activity ***Notes***

3

Order of operations 3

Who can do this calculation? P comes to BB to mark the normal order of operations and work out the answer. Class agrees/disagrees.

Could we have used a different order and still get the right answer? Ps suggest other orders for the operations. Class calculates the operations mentally and decides whether the order is valid.

BB: e.g.

$$\overbrace{15\times 8}^{120} + \overbrace{(175-25)}^{150} \div 25 - \overbrace{140\div 10}^{14} = (120 + \overbrace{150\div 25}^{6} - 14 = 126 - 14 = \underline{112})$$

② ⑤ ① ④ ⑥ ③

or ① ⑥ ③ ④ ⑤ ②

or ⑤ ⑥ ① ② ④ ③

} (different orders of calculation)

16 min

Whole class activity

Written on BB or SB or OHT

Discussion, reasoning, agreement, praising

Feedback for T

Agree that multiplication and division can be done before brackets but only if they do not affect the operations on either side of the brackets !

4

Problem

Think of a word problem for this plan.

BB: (17.5 + 2.5) × 4 + 1.5 × 10 =

Allow Ps to discuss with their neighbours for a minute, then Ps tell their contexts to class. Class decides whether or not they match the plan. Class chooses one of the contexts and Ps come to BB to work out the calculation. Class agrees/disagrees. Could we have written another plan? Come and show it to us. Class decides whether that is valid too. e.g.

Mum and Dad bought each of their 4 children a Christmas present for £17.50 and a card for £2.50. Then they bought 10 sheets of wrapping paper at £1.50 per sheet. How much did they spend altogether?

Plan: (17.5 + 2.5) × 4 + 1.5 × 10 = 20 × 4 + 15 = 80 + 15 = $\underline{95}$ (£)

or 17.50 × 4 + 2.50 × 4 + 1.5 × 10 = 70 + 10 + 15 = $\underline{95}$ (£)

P whose context was used says the answer in a sentence. e.g

Answer: They spent £95 altogether.

20 min

Whole class activity

Written on BB or SB or OHT

Praise all suggestions but give extra praise for creative, correct contexts.

Discussion, reasoning, agreement, praising

In 2nd plan, T shows how to multiply a decimal.

BB: $\underline{17.50} \times 4$

$\underline{70.00}$

32

U × h → h

U × t → t

U × U → U

U × T → T

5

Find the mistakes!

Silly Sammy had to calculate the perimeter and area of these rectangles for homework, but he did it too quickly and made some mistakes.

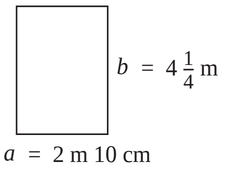
Can you find them? Ps come to BB to point to a mistake and say why it is wrong. Class grees/disagrees. Who can write the solution correctly?

Ps come to BB to write operations and do calculations, showing details at side of BB if necessary, and explaining reasoning in a loud voice. Class agrees/disagrees. Elicit that:

BB: 1 m^2 = 1 m × 1 m = 100 cm × 100 cm = $\underline{10\,000}$ cm^2

BB:

a)



a = 210 cm *Mistake!*

$b = 4\enclose{circle}{4}0$ cm $(4\frac{1}{4}$ m = 4.25 m = $4\underline{2}5$ cm)

$A = 2 \times (210 + 4\enclose{circle}{4}0)$ cm = 1300 cm ✗

P = 440 cm × 210 cm = $\underline{92400\ cm^2}$ ✗

Mistake! (Area and perimeter are the wrong way round.)

Whole class activity

Written on BB or use enlarged copy master or OHP

Ps check calculations in *Ex. Bks.*

Discussion, reasoning, agreement, praising

Correct solution: e.g.

A = 425 cm × 210 cm

= 4250 cm × 21 cm

= (85 000 + 4250) cm^2

= $\underline{89\,250\ cm^2}$ (= 8.925 m^2)

P = 2 × (210 + 425) cm

= 2 × 635 cm

= $\underline{1270\ cm}$ (= 12.7 m)

Y5

Lesson Plan 36

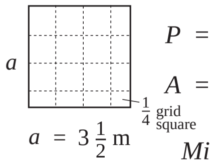
Activity

Notes

5

(Continued)

b)



$P = 2 \times (3\frac{1}{2} + 3\frac{1}{2})$ m $= 2 \times 7$ m $= 14$ m ✔

$A = 3\frac{1}{2}$ m $\times$ $3\frac{1}{2}$ m $= \bigcirc\!\!\!\!\!\!9\frac{1}{2}$ m^2 ✗

Mistake! We have not learned a fraction × a fraction but answer should be more than 9 and a half!

Correct solution:

$A = 3\frac{1}{2}$ m $\times$ $3\frac{1}{2}$ m $= (3 \times 3 + 6 \times \frac{1}{2} + \frac{1}{4})$ m^2 (by counting the grid squares)

$= (9 + 3 + \frac{1}{4})$ m^2 $= 12\frac{1}{4}$ m^2 (= $\underline{12.25 \text{ m}^2}$)

or $A = 350$ cm $\times$ 350 cm $= 3500$ cm $\times$ 35 cm $= 122\,500$ cm^2

(= $\underline{12.25 \text{ m}^2}$)

Agree that perimeter is o.k. but perimeter of a square would normally be written as:

$P = 4 \times 3\frac{1}{2} = 12 + 2 = \underline{14}$ (m)

T confirms area is incorrect by drawing lines on the square as shown.

[Preparation for multiplication of fractions and decimals]

BB:

			3	5	0	0
				×	3	5
		1	7	5	0	0
+	1	0	5	0	0	0
	1	2	2	5	0	0
		1				

25 min

6

PbY5a, page 36

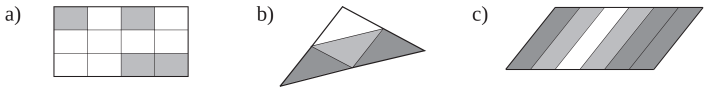
Q.1 Read: *Complete the diagrams so that the correct number of grid units are shaded to make the fraction correct.*

Write in the boxes the number of extra grid squares you had to shade.

Set a time limit. Review with whole class. Ps come to BB to shade and write numbers, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

What <u>part</u> of the shape did you have to shade?

Solution:



a) $\frac{1}{3}$ $\boxed{0}$ *No extra shading needed*

b) $\frac{3}{4}$ $\boxed{2}$ *Extra shading:* $\frac{2}{4} = \frac{1}{2}$

c) $\frac{5}{6}$ $\boxed{3}$ *Extra shading:* $\frac{3}{6} = \frac{1}{2}$

Individual work, monitored

Drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

Feedback for T

Extra shading shown darker than original.

28 min

7

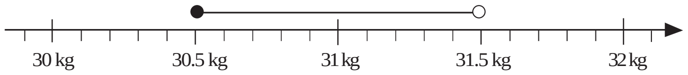
PbY5a, page 36

Q.2 Read: *Joe weighed himself and told his friend that he weighed 31 kg, to the nearest kg. How heavy could Joe be? Write an inequality and show it on the number line.*

Elicit that the number line has ticks at every tenth (0.1) of a kg, but that Joe's exact weight might be between the ticks!

Review with whole class. Ps come to BB to mark, write and say the inequality. Who agrees? Who wrote it another way? etc. T shows or elicits other forms of the inequality if all Ps wrote the same. Mistakes discussed and corrected.

Solution: e.g. 30.5 kg $\leq$ J $<$ 31.5 kg



or 30 kg 500 g $\leq$ J $<$ 31 kg 500 g or $30\frac{1}{2}$ kg $\leq$ J $<$ $31\frac{1}{2}$ kg

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Discussion, agreement, self-correction, praising

Extension

Tell me possible values for Joe's weight.

At speed, T chooses Ps at random. Class points out errors. Praising

(e.g. 30 kg 501 g, 31.49 kg, etc.)

38 min

Y5

Lesson Plan 36

Activity | ***Notes***

8

PbY5a, page 36

Q.3 Read: *Do the calculations and compare the results in each row.*

Ps do necessary calculations in *Ex. Bks* but encourage mental calculation where possible, with Ps writing interim results above operation signs in *Pbs*. Set a time limit.

Review with whole class. Ps come to BB or dicate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected. Show details of calculations on BB if problems or disagreement.

Solution:

a) $15 \overset{120}{\times} 8 + 25 \overset{200}{\times} 8 = \underline{320}$ $\textcircled{=}$ $(15 \overset{40}{+} 25) \times 8 = \underline{320}$ $\textcircled{>}$ $15 + 25 \overset{200}{\times} 8 = \underline{215}$

b) $42 \overset{504}{\times} 12 \div 3 = \underline{168}$ $\textcircled{=}$ $(42 \overset{504}{\times} 12) \div 3 = \underline{168}$ $\textcircled{=}$ $42 \times (12 \overset{4}{\div} 3) = \underline{168}$

c) $24 + 72 \overset{24}{\div} 3 \overset{288}{\times} 12 = \underline{312}$ $\textcircled{<}$ $(24 \overset{96}{+} 72) \overset{32}{\div} 3 \times 12 = \underline{384}$ $\textcircled{>}$ $24 + 72 \overset{2}{\div} (3 \overset{36}{\times} 12) = \underline{26}$

Individual work, monitored, helped

Written on BB or SB or OHT

Discussion, reasoning, agreement, self-correction, praising

Details: e.g.

$$\begin{array}{cccc} & & 4 & 2 \\ & \times & 1 & 2 \\ \hline & & 8 & 4 \\ + & 4 & 2 & 0 \\ \hline & 5 & 0 & 4 \\ & {}_1 & & \end{array}$$

$$\begin{array}{cccc} & & 2 & 4 \\ & \times & 1 & 2 \\ \hline & & 4 & 8 \\ + & 2 & 4 & 0 \\ \hline & 2 & 8 & 8 \end{array}$$

$$\begin{array}{c|ccc} & 1 & 6 & 8 \\ \hline 3 & 5 & 0 & 4 \\ & {}_2 & {}_2 & \end{array}$$

36 min

9

PbY5a, page 36

Q.4 Read: *Which is more? Try to fill in the missing signs without doing the calculations.*

Let's see how many you can do in 2 minutes! Start . . . now! . . . Stop!

Review with whole class. Ps come to BB or dicate to T, explaining reasoning, or class shows signs on scrap paper or slates on command and Ps answering correctly explain at BB to Ps who were wrong. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

a) $(32 + 18) - 16$ $\textcircled{=}$ $32 + (18 - 16)$

b) $518 - (281 - 81)$ $\textcircled{>}$ $(518 - 281) - 81$

c) $480 + 237$ $\textcircled{=}$ $482 + 235$

d) $6512 - 6227$ $\textcircled{>}$ $6510 - 6329$

e) $(17 + 5) \times 7$ $\textcircled{>}$ $17 + 5 \times 7$

f) $(6 \times 8) \times 2$ $\textcircled{<}$ $(6 \times 2) \times (8 \times 2)$

g) 480×60 $\textcircled{=}$ $400 \times 60 + 80 \times 60$

h) 480×60 $\textcircled{=}$ $500 \times 60 - 20 \times 60$

Individual work, monitored, helped

Written on BB or use enlarged copy master or OHP

Differentiation by time limit

Discussion, reasoning, agreement, self-correction, praising

T helps Ps to explain reasoning and repeats in a clearer way if necessary.

Only show calculations on BB if there is disagreement.

40 min

10

PbY5a, page 36

Q.5 Read: *Solve the equations. Do the calculations in your exercise book. Write the results here.*

Set a time limit of 3 minutes. Remind Ps to check that their answers make the statements true.

Review with whole class. Ps come to BB or dicate to T, explaining reasoning. Class checks that statement is true. Mistakes corrected. Show solutions on relevant sections of the number line drawn on BB, or on class number line.

Solution:

a) $\square + 35.2 = 209$

$\square = 209 - 35.2$

$\square = \underline{173.8}$

$$\begin{array}{ccccc} & 2 & \overset{10}{0} & 9\,. & \overset{10}{0} \\ - & {}_1 & 3 & 5_1\,. & 2 \\ \hline & 1 & 7 & 3\,. & 8 \end{array}$$

Check:

$$\begin{array}{ccccc} & 1 & 7 & 3\,. & 8 \\ + & & 3 & 5\,. & 2 \\ \hline & 2 & 0 & 9\,. & 0 \\ & {}_1 & & {}_1 & \end{array} \quad ✔$$

Individual work, monitored, (helped)

(or whole class activity if time is short)

Written on BB or SB or OHT

Differentiation by time limit

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

Show details of calculations on BB if problems or disagreement.

Feedback for T

Activity ***Notes***

10 (Continued)

b) ▨ – 756 = 158

▨ = 158 + 756

▨ = <u>914</u>

$$\begin{array}{rccc} & 1 & 5 & 8 \\ + & 7 & 5 & 6 \\ \hline & 9 & 1 & 4 \\ & {}_1 & {}_1 & \end{array} \qquad \textit{Check:} \quad \begin{array}{rccc} & 9 & \overset{10}{1} & \overset{10}{4} \\ - & 7_1 & 5_1 & 6 \\ \hline & 1 & 5 & 8 \end{array} \ ✔$$

c) $x + x + 0.4 = 1$

$x + x = 1 – 0.4 = 0.6$

$x = \underline{0.3}$ *Check:* $0.3 + 0.3 + 0.4 = 1$ ✔

d) $34\frac{1}{2} – y = – 11,$ (as from $34\frac{1}{2}$ to zero is $34\frac{1}{2}$, then we have to step down another 11 to reach – 11)

$y = 34\frac{1}{2} + 11 = 45\frac{1}{2}$

Check: $34\frac{1}{2} – 45\frac{1}{2}$

$= 34 – 45 = – 11$ ✔

e) $z \times 35 = 2100$

$z = 2100 \div 35$

$= 300 \div 5 = \underline{60}$

Check:

$60 \times 35 = 6 \times 350 = 2100$ ✔

Or $z = \dfrac{2100}{35} = \dfrac{420}{7} = \underline{60}$

f) $x \div x + 40 = 41$

$x \div x = 41 – 40 = 1$

x can be any number except zero. $x \neq 0$

e.g.

$5 \div 5 + 40 = 1 + 40 = 41$

45 min

Y5

R: Calculations. Numbers

C: Practice. Word problems

E: Combinatorial, set and logic problems

Lesson Plan 37

Activity 1

Missing signs

Give a meaning for these numbers, then fill in the missing sign.

Ps come to BB to explain meaning of LHS and RHS of each statement by drawing a diagram or showing on number line, or explaining in words, then to fill in the missing sign. Class agrees/disagrees.

BB:

a) $\frac{2}{3}\ \boxed{=}\ \frac{4}{6}$ b) $1\frac{4}{5}\ \boxed{=}\ \frac{9}{5}$ c) $\frac{5}{8}\ \boxed{>}\ \frac{2}{4}$

d) $0.8\ \boxed{>}\ 0.08$ e) $1.2\ \boxed{=}\ 1\frac{1}{5}$ f) $-0.9\ \boxed{<}\ \frac{1}{2}$

5 min

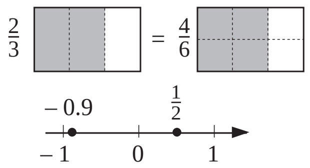
Notes

Whole class activity

Written on BB or SB or OHT

Reasoning, agreement, praising

Explanation: e.g.



2

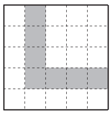
Fractions and decimals

What part of each square is shaded? Ps come to BB to explain reasoning. Class agrees/disagrees or suggests another way to do it. Allow Ps to use their own ideas if they are on the right track, otherwise T gives hints or directs Ps' thinking if they are stuck.

Once Ps have found the fraction shaded, allow the use of calculators to obtain the equivalent decimal.

BB: e.g.

a)



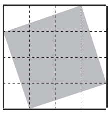
Area:

$5 \times 5 = 25$ (grid squares)

Part shaded:

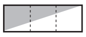
$\enclose{circle}{\frac{7}{25}} = \frac{14}{50} = \frac{28}{100} = \underline{0.28}$

b)



Area:

$4 \times 4 = 16$ (grid squares)

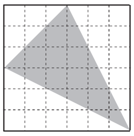
 $1\frac{1}{2} = 1.5$

Grid squares shaded:

$4 + 4 \times 1.5 = 4 + 2 \times 3 = 4 + 6 = 10$

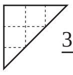
Part shaded: $\frac{10}{16} = \enclose{circle}{\frac{5}{8}} = \underline{0.625}$ (by calculator)

c)

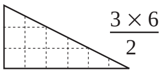


Area:

$6 \times 6 = 36$ (grid squares)



$\frac{3 \times 3}{2} = \frac{9}{2} = 4\frac{1}{2} = 4.5$ (grid squares) (or 1 eighth of 36)



$\frac{3 \times 6}{2} = \frac{18}{2} = 9$ (grid squares) (or 1 quarter of 36)

Grid squares shaded:

$36 - 4.5 - 2 \times 9 = 36 - 4.5 - 18 = 31.5 - 18 = 13.5$

Part shaded: $\frac{13.5}{36} = \frac{27}{72} = \enclose{circle}{\frac{3}{8}} = \underline{0.375}$ (using a calculator)

Or $1 - \frac{1}{8} - \frac{1}{4} - \frac{1}{4} = 1 - \frac{1+2+2}{8} = 1 - \frac{5}{8} = \enclose{circle}{\frac{3}{8}}$

11 min

Notes

Whole class activity

(Or if Ps wish, allow them to try a) and b) in *Ex. Bks* first)

Drawn on BB or use enlarged copy master or OHT

(Ps could have copies on desks too.)

Discussion, reasoning, agreement, praising

Extra praise for clever ideas.

(Required fraction circled and required decimals underlined)

Or

$16 - 4 \times 1.5 = 16 - 6 = 10$

Elicit that $0.625 = \frac{625}{1000}$

T writes $\frac{1}{8}$ and $\frac{1}{4}$ on relevant parts of diagram.

Elicit that $0.375 = \frac{375}{1000}$

Y5

Lesson Plan 37

Activity

Notes

3

Combinatorics

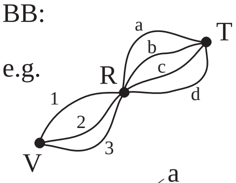
V is a village at the bottom of the mountain, R is a rest hunt half-way up and T is the top of the mountain. How many possible routes are there from the village to the top of the mountain?

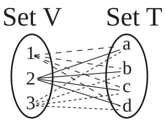
Allow Ps to think about it for a minute. If you have an answer, show me . . . now! (12) P answering correctly explains reasoning at BB. (For each of the 3 possible routes from the village to the rest hut, there are 4 possible routes from the rest hut to the top of the mountain, i.e. 3 × 4 = <u>12</u> possible routes.) Mistakes discussed and corrected.

How could we show all the routes? T suggests using 1, 2, 3 for routes from V to R and a, b, c, d, for routes from R to P. Who has an idea what we could do now? (e.g. list them, put them in 2 sets and join them up, draw tree diagrams) T gives hints about those not suggested by Ps.

BB:

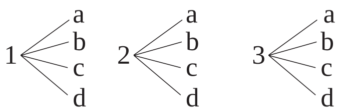
e.g.





<u>Possible routes</u>

1a 1b 1c 1d
2a 2b 2c 2d
3a 3b 3c 3d



Answer:
There are 12 possible routes.

15 min

Individual trial first

Drawn on BB or SB or OHT (but without routes numbered or labelled)

In unison

Reasoning, agreement, praising

Praising, encouragement only

Feedback for T

4

Sets

This Venn diagram shows the initial letters of the names of Ps who joined the Maths Club and Art Club. Think about what the diagram means!

T asks questions and Ps come to BB to show on diagram and list the relevant letters. Class agrees/disagrees.

a) *Which Ps belong to the Maths club?* (All of them)

BB: M: P, Z, K, B, L, J, S, T, F (9 pupils)

We write the number of element in set M like this. BB: n (M) = 9

b) *Which Ps belong to the Art Club?*

BB: A: F, J, S, T (4 pupils)

We write the number of elements in set A like this. BB: n (A) = 4

T: We say that A is a <u>sub-set</u> of M and write it like this.
It means that set A is part of set M.

c) *Which Ps belong to both clubs?*

BB: M + A: F, J, S, T (4 pupils)

d) *Which Ps belong to the Maths Club but <u>not</u> the Art Club?*

BB: M but <u>not</u> A: P, Z, K, B, L (5 pupils)

T: We call this set the <u>complement</u> of A and write it like this.

We write the number of elements in the complement of A like this.

Who could write an addition and subtraction about the sets?

BB: $M = A + \overline{A}$ (read as, ' M = A + the <u>complement</u> of A.'

or $n(M) = n(A) + n(\overline{A}) = 4 + 5 = \underline{9}$

$A = M - \overline{A}$ or $\overline{A} = M - A$

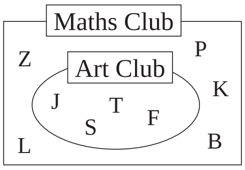
or $n(A) = n(M) - n(\overline{A}) = 9 - 5 = \underline{4}$

20 min

Whole class activity

Drawn on BB or SB or OHT:

BB:



Reasoning, agreement, praising

BB: <u>Sub-set</u>

$A \subset M$

BB: <u>Complement of A</u>

$\overline{A}$

$n(\overline{A}) = 5$

Have no expectations but praise any P who makes a good attempt!

Do not expect Ps to learn this notation yet – just to become familiar with it!

Y5

Lesson Plan 37

Activity

Notes

5

Sequences competition

T says the first 3 terms of a sequence and Ps write as many of the following terms in *Ex. Bks*. Allow 1 minute per sequence.

Review with whole class. Ps stand up and dictate the terms in order round class. Class points out errors. Ps sit down when they have made a mistake or reached the end of their terms. Last P(s) standing dictate their remaining terms and say the rule. If all correct, class gives them a round of applause.

a) $-5.1,\ -3.9,\ -2.7,\ (-1.5,\ -0.3,\ 0.9,\ 2.1,\ 3.3,\ 4.5,\ 5.7,\ \ldots)$

Rule: increasing by 1.2

b) $2\frac{3}{4},\ 2.5,\ 2\frac{1}{4},\ (2,\ 1\frac{3}{4},\ 1.5,\ 1\frac{1}{4},\ 1,\ \frac{3}{4},\ 0.5,\ \frac{1}{4},\ 0,\ -\frac{3}{4},\ \ldots)$

Rule: decreasing by $\frac{1}{4}$ or 0.25.

Individual work, monitored

(or whole class activity done orally at speed round class.)

Differentiation by time limit

Agreement, (self-correcting), praising

In good humour!

Accept terms as decimals or fractions.

25 min

6

PbY5a, page 37

Q.1 Read: *How many different 4-digit numbers can you make from these cards? Continue listing them in order.*

Set a time limit. Less able Ps have number cards on desks.

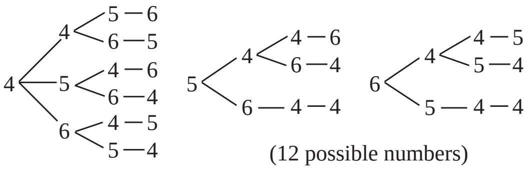
Review with whole class. Ps dictate numbers to T. Class points out errors, duplications or missed numbers. Mistakes corrected or Ps write out again correctly in <u>increasing</u> order in *Ex. Bks*. if several numbers were missed or another order was used.

Solution:

4456, 4465, 4546, 4564, 4645, 4654, 5446, 5464, 5644, 6445, 6454, 6544 (12 possible numbers)

In what other way could we have shown the possible numbers? (Tree diagrams) Let's draw them on the BB. Ps come to BB or dictate to T. Class points out errors.

BB:



(12 possible numbers)

How many numbers start with:

- 4 (6, as the next 3 digits, 4, 5, 6, can be ordered in 6 ways)
- 5 (3, as the next 3 digits, 4, 4, 6, can be ordered in 3 ways)
- 6? (3, as the next 3 digits, 4, 4, 5, can be ordered in 3 ways)

Individual work, monitored helped

Written or stuck on BB:

$\boxed{4}\ \boxed{4}\ \boxed{5}\ \boxed{6}$

Discussion, reasoning, agreement, self-correction, praising

Whole class activity

If Ps do not suggest a tree diagram, T starts diagram and Ps continue.

Agreement, praising

(T prompts Ps to give reasoning too.)

Extension

How many 4-digit numbers could you make from these number cards? Try to work it out without listing all the numbers.

After a minute, ask several Ps what they think (or Ps could show on number cards or slates on command).

Elicit that for each of the <u>4</u> possible thousands digits, there are <u>3</u> possible hundreds digits, and for each of the 3 possible tens digits there are <u>2</u> possible tens digits, and for each of the 2 possible tens digits there is only <u>1</u> possible units digit.
i.e. The number of possible numbers is:

BB: $4 \times 3 \times 2 \times 1 = \underline{24}$

Individual trial first, monitored, then whole class discussion

BB: $\boxed{3}\ \boxed{4}\ \boxed{5}\ \boxed{6}$

Reasoning, agreement, praising

Discuss the connection with the digits 4, 4, 5, 6.

Elicit that if 2 cards are equal, the number of possibilities is halved.

31 min

Y5

Lesson Plan 37

Activity ***Notes***

7

PbY5a, page 37

Q.2 Read: *The five members of a comittee, A, B, C, D and E, elected one member as chairman and another as secretary. List the possible outcomes in the table.*

Set a time limit of 2 minutes. Review at BB with whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes/ommissions corrected.

Solution:

Chairman	**A**	**A**	A	A	B	B	B	B	C	C	C	C	D	D	D	D	E	E	E	E
Secretary	**B**	**C**	D	E	A	C	D	E	A	B	D	E	A	B	C	E	A	B	C	D

Read: *How could you have worked out the answer without listing all the possibilities?*

I will give you 1 minute to think about it and to write the operation you would use. Show me it . . . now! ($5 \times 4 = \underline{20}$)

Who can explain it? (e.g. For each of the 5 possible members as chairman, there are 4 possible members as secretary.)

Individual work, monitored

on BB or use enlarged copy master or OHP

Agreement, self-correction, praising

In unison

Reasoning, agreement, praising

35 min

8

PbY5a, page 37

Q.3 Read: *Peter invented a trick for guessing numbers and he is trying it out on his classmates.*

Everyone think of a number. T reads instructions and Ps follow them step by step.

Think of a number. Add 5. Double the result. Subtract 10. Subtract your original number. You are left with your original number, aren't you?

Stand up if you ended up with a different number from the one that you that you started with! (Everyone remains seated!)

Now write down your calculations in a mathematical way using

a) your own number b) 21 c) any number, *n*.

Set a time limit. Review with whole class. P comes to BB to say their own number and write their calculation. Class points out any mistakes in the order of operations. Ps correct own answers where necessary and then agree on correct answers for b) and c).

Solution:

a) e.g. $\underline{6}$: $(6 + 5) \times 2 - 10 - 6 = 11 \times 2 - 16 = 22 - 16 = \underline{6}$

b) $\underline{21}$: $(21 + 5) \times 2 - 10 - 21 = 26 \times 2 - 31 = 52 - 31 = \underline{21}$

c) $\underline{n}$: $$\begin{aligned}(n + 5) \times 2 - 10 - n &= 2 \times n + 10 - 10 - n \\ &= 2 \times n - n \\ &= \underline{n}\end{aligned}$$

Whole class activity to start

(or all done as individual work)

At a quick pace

Ps calculate mentally and nod their heads when they have each step.

(T teases Ps who stand up and asks them to try their calculation again!)

Individual work, monitored, helped

Discussion, reasoning, agreement, self-correction, praising

T asks a P to explain in words.

(e.g. Doubling any number, then adding and subtracting 10 leaves the number still doubled, then subtracting the number from its double leaves the number itself.)

40 min

Y5

Lesson Plan 37

Activity ***Notes***

9

PbY5a, page 37

Q.4 Read: *Solve the problems. Use the diagrams to help you.*

Let's see how many you can do in 3 minutes! Remember to check your answer in the context of the question.
Start . . . now! . . . Stop!

Review with whole class. Ps come to BB to wite plans, do calculations and say the answer in a sentence. Who agrees? Who did it another way? Who made a mistake ? What did you do? Who did the same? etc.

Solutions: e.g.

Individual work, monitored, helped

Diagrams drawn on BB or SB or OHT

Differentiation by time limit.

Discussion, reasoning, agreement, self-correction, praising

a) *Kate has £94.50 and Eve has £34.50. How much should Kate give to Eve so that they both have the same amount?*

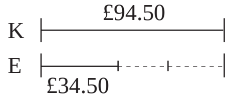
Plan: (£94.50 – £34.50) ÷ 2 = £60 ÷ 2 = £30

Check: £94.50 – £30 = £64.50 = £34.50 + £30 ✔

Answer: Kate should give £30 to Eve.

Accept any valid method but show the simplest too.

BB:



b) *Joe and Sam have £92.50 altogether but Sam has £12.50 more than Joe. How much money do they each have?*

Plan: J: (£92.50 – £12.50) ÷ 2 = £80 ÷ 2 = £40

S: £40 + £12.50 = £52.50

or S: (£92.50 + £12.50) ÷ 2 = £105 ÷ 2 = £52.50

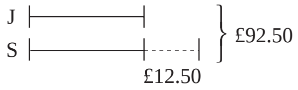
J: £52.50 – £12.50 = £40

Check: J + S: £40 + £52.50 = £92.50 ✔

Answer: Joe has £40 and Sam has £52.50.

It is easier to take off the extra money first, then halve the remaining money, so T should show this method if no P has used it.

BB:



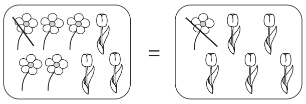
c) *These two bunches of flowers cost the same.*
How many daisies is a tulip worth?

Ps come to BB to cross out (remove) flowers at each step.

BB: 5D + 3T = 1D + 5T

Subtract 1D from each side:

4D + 3T = 5T



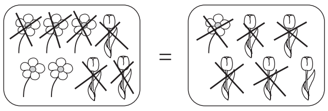
Subtract 3T from each side:

4D = 2T

Halve each side (or divide each side by 2):

2D = 1T

(and 1D = $\frac{1}{2}$ T)



Answer: One tulip is worth 2 daisies.
(and 1 daisy is worth half a tulip)

Drawn (stuck) on BB or use enlarged copy master or OHP

If any Ps got correct answer , ask them how they worked it out, then show the method opposite, involving Ps where possible.

Stress that LHS and RHS of equations must always balance, so whatever is done to one side must also be done to the other side.

[Preparation for solution of equations with 2 unknowns]

45 min

Y5

R: Numbers

C: Practice: mental and written calculations. Word problems

E: Combinatorics, logic, set problems

Lesson Plan 38

Activity | ***Notes***

1

Components in operations

What is the name of the underlined component in each operation?
Ps come to BB to point to whatever is underlined and to say and write its name. Class agrees/disagrees or corrects spelling.

BB:

a) $842 + 158 = \underline{1000}$	(sum)
b) $\underline{452} \times 14 = 6328$	(multiplicand or mulitplier or factor)
c) $7542 - 1542 = \underline{6000}$	(difference)
d) $\underline{9145 + 455} = 5600$	(sum, or terms of addition)
e) $\underline{9872 - 972} = 8900$	(difference, or reductand and subtrahend)
f) $6432 \div 32 = \underline{201}$	(quotient)
g) $645 \times 100 = \underline{64\,500}$	(product)
h) $\underline{5656} \div \underline{28} = 202$	(dividend and divisor, or quotient)

Check that my answers are correct with your calculator. Ps point out errors if T has made any deliberate mistakes.

5 min

Whole class activity

Operations written on BB or SB or OHT (some could have deliberate mistakes, though only correct equations are shown opposite)

(Or names of components written on flash cards and stuck to side of BB and Ps choose correct card)

At a good pace

Agreement, praising

Practice in using, and reading from, calculators.

2

Problem 1

Who can think of a word problem about this diagram? T asks Ps for their contexts. Class chooses one of Ps' contexts or T has one already prepared on BB or SB or OHT. e.g.

Jenny weighs 40 kg 500 g (rounded to the nearest 10 g). Sean weighs 4 kg 500 g more than Jenny and Bill weighs 2 kg 500 g less than Jenny. If they all stand on a weighing machine, what would it read?

Solve the problem in your *Ex. Bks*. and show me the answer when I say! . . . Show me . . . now! (123.5 kg)

P with correct answer comes to BB to explain their reasoning. Who agrees? Who did it another way? etc. Mistakes discussed and corrected.

BB: e.g. J: 40.5 kg   S: 45 kg   B: 38 kg

J + S + B: 40.5 kg + 45 kg + 38 kg = $\underline{123.5\text{ kg}}$

or $40\frac{1}{2} \times 3 + 4\frac{1}{2} - 2\frac{1}{2} = 120 + 1\frac{1}{2} + 2 = 123\frac{1}{2}$ (kg)

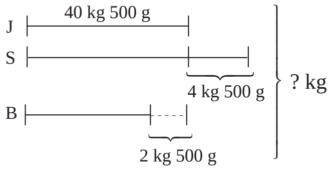
Answer: The weighing machine would read 123.5 kg.

9 min

Whole class activity

Drawn on BB or SB or OHT

BB:



Responses shown in unison on scrap paper or slates.

Discussion, reasoning, agreement , self-correction, praising

Accept 123 kg 500 g but point out that in the diagram, the missing total is in kg, not kg and g.

3

Problem 2

Ps suggest contexts for each equation, then solve it in their *Ex. Bks.*

If you have an answer, show me . . . now! P answering correctly comes to BB to explain solution. Class checks that the answer makes the statement true. Mistakes discussed and corrected

BB: e.g. [operation in square brackets done to each side]

a) $4 \times x + 40 = 200$ [– 40]
$4 \times x = 160$ [÷ 4]
$x = \underline{40}$

Ch: $4 \times \underline{40} + 40 = 160 + 40$
$= 200$ ✔

b) $15 \times y + 450 = 600$ [– 450]
$15 \times y = 150$ [÷ 15]
$y = \underline{10}$

Ch: $15 \times 10 + 450 = 150 + 450$
$= 600$ ✔

15 min

Whole class discussion of context first, then individual work, monitored

Written on BB or SB or OHT

Reasoning, agreement, self-correction, praising

c) $350 \div (30 + z) = 10$
$30 + z = 350 \div 10 = 35$
$z = 35 - 30 = \underline{5}$

Ch: $350 \div (30 + 5)$
$= 350 \div 35 = 10$ ✔

Y5

Lesson Plan 38

Activity

Notes

4

Combinatorics

BB:

O	R	A	N
R	A	N	G
A	N	G	E

In how many ways can we read ORANGE from this grid? Ps come to BB to point them out.

Agree that there are <u>10</u> ways (as below).

O	R	A	N
			G
			E

O	R	A	
		N	G
			E

O	R	A	
		N	
		G	E

O	R		
	A	N	G
			E

O	R		
	A	N	
		G	E

O	R		
	A		
	N	G	E

O			
R	A	N	G
			E

O			
R	A	N	
		G	E

O			
R	A		
	N	G	E

O			
R			
A	N	G	E

We could have listed them in a quicker way.

Which movements does each route involve? (3 steps to the right and 2 steps down) We could write it like this:

BB: R R R D D

and the 10 ways are the 10 different possible orders of these letters. Ps dictate the orders above and T writes on BB.

BB: RRRDD, RRDRD, RRDDR, RDRRD, RDRDR,
RDDRR, DRRRD, DRRDR, DRDRR, DDRRR

Here is another way to do it! Let's write in each grid square the number of different ways there are to get to it if we start in the top RH corner. T points to each grid square (letter) in turn and Ps dictate the number of possible ways to get there. (Some Ps might remember method from Y4.)

BB:

O_1	R_1	A_1	N_1
R_1	A_2	N_3	G_4
A_1	N_3	G_6	E_{10}

What do you notice?

(The number in each grid square is the sum of the numbers in the grid square above it and to the left of it.)

[Note to Ts only: The diagonal pattern of numbers follows that of <u>Pascal's Triangle</u> – see opposite.]

20 min

Whole class activity

(or individual trial first in squared *Ex. Bks.*)

Drawn on BB or use enlarged copy master or OHP

Encourage a logical listing.

At a good pace

If done with whole class,
Ps could show the routes by writing out the letters again on blank grids (use enlarged copy master or OHT)

Discussion, reasoning, agreement, praising

At a fast pace

Class shouts out in unison, or T chooses Ps at random.

Ps could copy in *Ex. Bks.* too.

Agreement, praising

<u>Pascal's Triangle</u>

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1 etc.

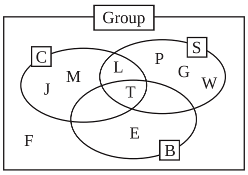
5

Venn diagram

A T asked a group of children what they ate as soon as they got home from school yesterday and showed the results in this diagram.

What do you think the letters stand for? (Children's names) How many Ps are in the group? (9) Study the diagram and answer these questions.

BB:



B = {children who ate biscuits}
C = {children who ate chocolate}
S = {children who ate sweets}

b) How many children ate chocolate? (4)
b) How many children ate chocolate <u>and</u> biscuits? (1)
c) Who ate none of them? (F)
d) How many children ate all of them? (1)
e) How many children ate chocolate <u>or</u> sweets <u>or</u> biscuits? (8)
f) Who ate only sweets? (P. G, W)
g) Who ate sweets and biscuits but not chocolate? (Nobody)

24 min

Whole class activity

Drawn on BB or use enlarged copy master or OHP

(If possible, Ps have copies on desks too.)

Quick discussion on meaning of diagram.

T asks some questions and Ps think of others to ask.

Ps chosen at random, or Ps show answers on scrap paper or slates in unison.

In good humour!

Extra praise for creative questions!

Y5

Lesson Plan 38

Activity

Notes

6

PbY5a, page 38

Q.1 Read: *Five friends (A, B, C, D and E) said goodbye to each other after a party and shook hands with each other.*

T chooses 5 Ps to come to front of class to be A, B, C, D and E and to stand around as if at a party. Then they say goodbye to each other and shake hands with each other, and go back to their seats.

Read: *Complete the diagrams and fill in the answers.*

a) How many goodbyes were said?

b) How many handshakes were there?

Elicit that in the table, each square represents a 'goodbye' and in the digram, each line represents a handshake. Why are some squares in the table shaded? (They are not needed, as you don't say goodbye to yourself!)

Set a time limit. Review with whole class. Ps come to BB to complete diagrams and explain reasoning. Class agrees/ disagrees. Mistakes discussed and corrected.

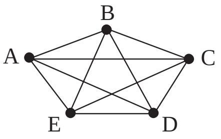
Solution:

a)

	A	B	C	D	E
A	▨	●	●	●	●
B	●	▨	●	●	●
C	●	●	▨	●	●
D	●	●	●	▨	●
E	●	●	●	●	▨

$\boxed{20}$ 'Goodbye's

b)



$\boxed{10}$ handshakes

Reasoning: e.g.

a) each of the 5 friends said goodbye to each of the other 4 friends, i.e. (5 × 4 = <u>20</u>) goodbyes were said,

b) the 1st friend shakes hands with 4 others, the 2nd friend shakes hands with 3 others (as he has already shaken hands with the 1st), the 3rd shakes hands with 2 others, and the 4th shakes hands with 1 other, i.e. (4 + 3 + 2 + 1 = <u>10)</u> handshakes.

or

each of the 5 friends shakes hands with 4 others, but each handshake involves 2 people, so the number must be halved, i.e. (5 × 4 ÷ 2 = 20 ÷ 2 = <u>10</u>) handshakes

Whole class introduction

In good humour!

Make sure that Ps understand the diagrams.

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

Extra praise if Ps think of

5 × 4 a nd 5 × 4 ÷ 2

without prompting from T.

30 min

7

PbY5a, page 38

Q.2 Read: *Form two 3-digit numbers from the digits 2, 5, 8, 0, 1, 4, so that one of them is the smallest possible and the other is the greatest possible.*

Calculate their sum and difference.

Set a time limit. Review with whole class. Ps come to BB to show calculations, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

Smallest: 102

Greatest: 854

Sum:
$$\begin{array}{cccc} & 1 & 0 & 2 \\ + & 8 & 5 & 4 \\ \hline & 9 & 5 & 6 \end{array}$$

Difference:
$$\begin{array}{cccc} & 8 & 5 & 4 \\ - & 1 & 0 & 2 \\ \hline & 7 & 5 & 2 \end{array}$$

Individual work, monitored, (less able helped)

Reasoning, agreement, self-correction, praising

Feedback for T

Extension for quick Ps:

Form two numbers which are the closest possible to each other on the number line.

(204 – 185 = 19, or

501 – 482 = 19)

34 min

Y5

Lesson Plan 38

Activity | **Notes**

8

PbY5a, page 38

Q.3 Read: *Practise calculation.*

Let's see how many you can do in 3 minutes! Use any method of calculation you wish and work in your *Ex. Bks* if necessary. Remember to check your answers. Start . . . now! . . . Stop!

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Who agrees? Who did it a different way? Who made a mistake? What was your mistake? Who did the same? etc. Stand up if you had all 8 correct (only 1 mistake). Let's give them a clap!

Solution:

a) $$\begin{array}{r} 198 \\ 2040 \\ +\ 99903 \\ \hline 102141 \\ \hline {\scriptstyle 1\ 1\ 1\ 1\ 1\ \ } \end{array}$$

b) $$\begin{array}{r} 44\overset{10}{8}9 \\ -\ 12_{1}94 \\ \hline 3195 \\ \hline \end{array}$$

c) $$\begin{array}{r} 306 \\ \times\ 35 \\ \hline 1530 \\ +\ 9180 \\ \hline 10710 \\ \hline {\scriptstyle 1\ \ \ 1\ \ \ \ \ } \end{array}$$

d) $$\begin{array}{r} 796 \\ \times\ 41 \\ \hline 796 \\ +\ 31840 \\ \hline 32636 \\ \hline {\scriptstyle 1\ 1\ \ \ \ \ } \end{array}$$

e) $$\begin{array}{r} 64\ \text{r}\,6 \\ 7\,\overline{)\,450} \\ -\ 42 \\ \hline 34 \\ -\ 28 \\ \hline \textcircled{6} \end{array}$$

f) $$\begin{array}{r} 337\ \text{r}\,7 \\ 10\,\overline{)\,5377} \\ -\ 50 \\ \hline 37 \\ -\ 30 \\ \hline 77 \\ -\ 70 \\ \hline \textcircled{7} \end{array}$$

g) $$\begin{array}{r} 10101 \\ 11\,\overline{)\,111111} \\ -\ 11 \\ \hline 011 \\ -\ 11 \\ \hline 011 \\ -\ 11 \\ \hline 0 \\ \hline \end{array}$$

h) $$\begin{array}{r} 465\ \text{r}\,30 \\ 100\,\overline{)\,46530} \\ -\ 400 \\ \hline 653 \\ -\ 600 \\ \hline 530 \\ -\ 500 \\ \hline \textcircled{30} \end{array}$$

40 min

Individual work, monitored (less able Ps helped with divisions)

Written on BB or use enlarged copy master or OHP

Differentiation by time limit.

Reasoning, agreement, self-correction, praising

Deal with all methods used by Ps and accept any giving correct answer.

Show details of checking calculation on BB if problems or disagreement.

In f) and h) discuss other ways of showing the remainder:

f) $337\frac{7}{10} = 337.7$

h) $465\frac{30}{100} = 465\frac{3}{10} = 465.3$

9

PbY5a, page 38

Q.4 Read *Solve these problems in your exercise book.*

First elicit/tell the meaning of B.C. and A.D. (B.C. means <u>before</u> the birth of Christ; A.D. stands for the Latin 'Anno Domini', meaning 'in the year of our Lord', i.e. <u>after</u> birth of Christ)

Set a time limit. Ps read questions themselves and solve them. (T could suggest that it might help to draw a diagram first.)

Review at BB with whole class. Ps could show results on scrap paper or slates. Ps answering correctly come to BB or dictate calculations to T. Class agrees/disagrees. Show on number line to clarify. Mistakes discussed and corrected.

Solutions:

a) *Yesterday, the temperature at mid-day was 12 °C but at dawn today it is – 3.5 °C. By how many degrees has the temperature cooled down?*

Plan: 12 + 3.5 = <u>15.5</u> (°C)

Answer: The temperature has cooled down by 15.5 degrees.

b) *Augustus Caesar was born in 63 B.C. and died in 14 A.D. How long did he live?*

Plan: 63 + 14 = <u>77</u> (years)

Answer: Augustus Caesar lived for 77 years.

c) *The Roman Empire lasted for 1229 years and ended in 476 A.D. In what year did the Roman Empire begin?*

Plan: 1229 – 476 = <u>753</u> (years before the birth of Christ)

Answer: The Roman Empire began in 753 B.C.

45 min

Individual work, monitored, helped

Differentiation by time limit

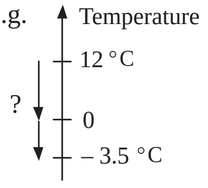
Discussion, reasoning, agreement, self-correction, praising

T chooses a P to say answer in a sentence.

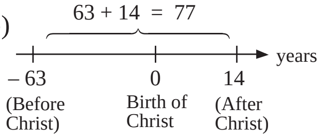
(Ps could be asked to find out information about Augustus Caesar and the Roman Empire.)

BB: e.g.

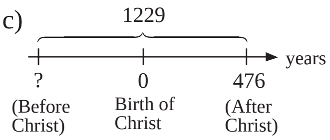
a)



b)



c)



Y5

R: Numbers and calculations
C: Calculation practice. Word problems
E: Combinatorics, logic and set problems

Lesson Plan 39

Activity | *Notes*

1

Calculations

Study these operations. What do you think about them? Are they correct? What reasoning has been used? Ps go through calculations mentally, or use estimation to determine whether answer is corrrect.

a) BB:

$$\begin{array}{ccccccccccc} & & & 4 & 1 & 2 & 0 & \times & 3 & 0 & 1 \\ 1 & 2 & 3 & 6 & 0 & & & & & & \\ \hline 1 & 2 & 4 & 0 & 1 & 2 & 0 & & & & \end{array} \checkmark$$

By estimation:
$4000 \times 300 = \underline{1200\,000}$

1st row: A line has not been drawn under the multiplicand, so we can think of it as being multiplied by 1U.

2nd row: To show multiplication by 0T, a blank has been left in tens column. Multiplication by 3H starts in the hundreds column.

3rd row: Results of mulitplications by 1U and 3H are then added.

b) BB: $6231 \div 31 = 21$ ✗

By estimation, $6000 \div 30 = 600 \div 3 = \underline{200}$

Let's do the calculation again correctly! Ps come to BB to write division, explaining reasoning in detail. Class points out errors.

c) BB:

$$\begin{array}{rccccc} & & & 4 & 5 & 8 \\ & & & \times & 7 & 3 \\ \cline{3-6} & & 3 & 2 & 0 & 6 \\ + & 1 & 3 & 7 & 4 & \\ \hline & 1 & 6 & 9 & 4 & 6 \end{array} \times \quad \rightarrow$$

Correction:

$$\begin{array}{rccccc} & & & 4 & 5 & 8 \\ & & & \times & 7 & 3 \\ \hline & & 1 & 3 & 7 & 4 \\ + & 3 & 2 & 0 & 6 & \\ \hline & 3 & 3 & 4 & 3 & 4 \\ & & & 1 & & \end{array} \checkmark$$

It is not correct because by estimation, $500 \times 70 = 35\,000$.

Let's write the calculation again correctly! Ps come to BB, explaining reasoning in detail. Class agrees/disagrees.

Whole class activity

Written on BB or SB or OHT

(or Ps do correct calculations in *Ex. Bks.*)

Discussion, reasoning, agreement, checking, praising

T repeats Ps' reasoning in a clearer way if necessary.

Agree that it is a shortcut – but correct.

b) Correct calculation:

$$\begin{array}{cc|cccc} & & & 2 & 0 & 1 \\ \cline{3-6} 3 & 1 & 6 & 2 & 3 & 1 \\ & - & 6 & 2 & & \\ \cline{3-4} & & & 0 & 3 & 1 \\ & & & - & 3 & 1 \\ \cline{5-6} & & & & & 0 \end{array}$$

c) Elicit the mistakes:

- digits in 2nd row should be moved 1 place to the left: ($458 \times 70 = 3206\underline{0}$)
- digits in 3rd row should be moved 1 place to the right. ($458 \times 3 = 1374$)

6 min

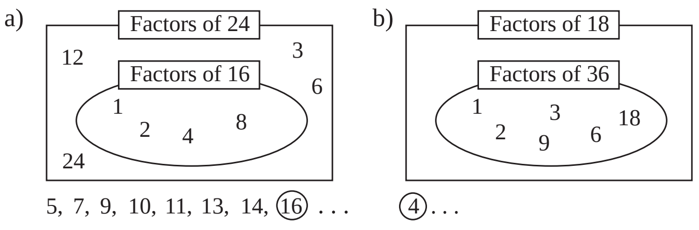
2

Venn diagrams

Study these Venn diagrams. Are they correct or is there something wrong with them? T asks several Ps what they think and why.

Let's check them together! What range of numbers should we check? (e.g. in a) 1 to 24, as 1 is the smallest and 24 is the greatest possible factor) Class checks the numbers one after the other until a mistake or anomoly is reached, then discusses what to do about it.

BB:



5, 7, 9, 10, 11, 13, 14, ⑯ . . . ④ . . .

a) 16 should be in the diagram as it is a factor of 16 – but where can we put it as it is not a factor of 24! Agree that it is not a good diagram.

b) 4, 12 and 36 are missing from the diagram although they are all factors of 36 – but where can we put them as they are not factors of 18? Again agree that it is not a good diagram.

Who can think of better diagrams? Ps come to BB to draw new Venn diagrams or dictate to T. Class checks that all relevant numbers have a place on the new diagrams.

Whole class activity

Drawn on BB or SB or OHT

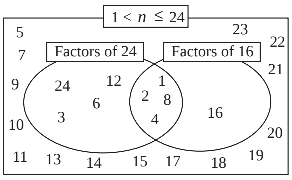
Checking, agreement, praising

Ps come to BB or dictate to T.

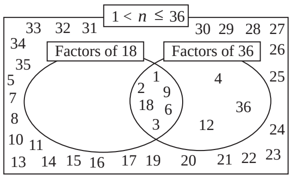
Ps say what is wrong with the diagrams and how they could be made better. Involve several Ps.

Better diagrams:

a)



b)



11 min

Y5

Lesson Plan 39

Activity | ***Notes***

3

Combinatorics 1

In a box there are 1 *red*, 2 *white* and 3 *green* marbles. Draw a diagram in your *Ex Bks*. First P finished comes to BB to draw a diagram on BB.

If you took 3 marbles out of the box with your eyes shut, what colours could they be? List all the possiblities in your *Ex. Bk.*

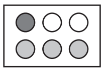
Review with whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes corrected. Elicit that <u>6</u> cases are possible:

BB: *RWW, RWG, RGG, WWG, WGG, GGG*

15 min

Individual work, monitored, helped

BB:



(or T uses real mables and box)

Discussion, agreement, self-correction, praising

Feedback for T

4

Combinatorics 2

Four children, A, B, C and D are spending the night in a tent in a field. They want to keep a 2-man watch. In how many ways could they do it?

List the possibilities in your *Ex. Bk.*

Review with whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes corrected. Agree that there are <u>6</u> possibilities.

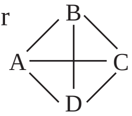
18 min

Individual work, monitored

Discussion, agreement, self-correction, praising

BB: AB, AC, AD, BC, BD, CD

or



5

Problem

Look at this picture. How many envelopes is a pencil worth?

Let's write an equation first. What should I write? Ps dictate.

BB: $1e + 4p = 6e + 1p$

We say that the two sides <u>balance</u> each other and as it is an <u>equation</u>, we must keep them balanced. Let's take away the same number of pencils or envelopes on each side. Ps come to BB to cross out (or remove) appropriate number of envelopes/pencils and write equations (with T's help).

Ps write initial equation and lines of solution in *Ex. Bks.*

BB: Subtract 1*p* from each side: $1e + 3p = 6e$ $[-1p]$

Subtract 1*e* from each side: $3p = 5e$ $[-1e]$

If 3 pencils → 5 envelopes.

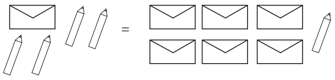
then 1 pencil → $\frac{5}{3}$ envelopes $= 1\frac{2}{3}$ envelopes

Answer: A pencil is worth 1 and 2 thirds envelopes.

21 min

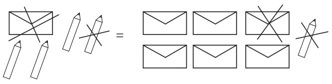
Whole class activity

Drawn or stuck on BB or use enlarged copy master or OHP:



If Ps are stuck, T gives hints about what to do.

Envelopes/pencils crossed out or removed from BB:



Discussion, reasoning, agreement, praising

What is 1 envelope worth? (3 fifths of a pencil)

6

Calculation practice

Do these calculations in your *Ex. Bk.* as quickly as you can, using any method you wish. Remember to estimate first, then check your answer.

BB: a) 417 × 92 b) 784 ÷ 8 c) 5253 ÷ 70 d) 856 × 103

Set a time limit. Review with whole class. Ps come to BB, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected. Deal with all calculation methods used by Ps.

Solution: e.g.

a) $$\begin{array}{r} 417 \\ \times\ 92 \\ \hline 834 \\ +\ 37530 \\ \hline 38360 \\ {\scriptstyle 1} \end{array}$$

b) $$\begin{array}{r} 98 \\ 8\overline{)784} \\ {\scriptstyle 6} \end{array}$$

c) $$\begin{array}{r} 75\ \text{r}\ 3 \\ 70\overline{)5253} \\ -\ 490 \\ \hline 353 \\ -\ 350 \\ \hline \textcircled{3} \end{array}$$

d) $$\begin{array}{r} 856 \\ \times\ 103 \\ \hline 2568 \\ +\ 85600 \\ \hline 88168 \\ {\scriptstyle 1} \end{array}$$

25 min

Individual work, monitored [c) and d) helped]

Written on BB or SB or OHT

Differentiation by time limit

Reasoning, agreement, self-correction, praising

Extra praise if a P suggests for c): $75\frac{3}{70}$

Feedback for T

Activity

Notes

7

PbY5a, page 39

Q.1 Read: *Solve the problems in your exercise book.*
Write the answer in a sentence here.

Deal with one at a time. Ps read question themselves and solve it under a time limit.

Review with whole class. Ps could show results on scrap paper or slates on command. P responding correctly explains at BB to Ps who were wrong. Who agrees? Who did it another way? etc. Mistakes discussed and corrected.

Solutions:

a) *The farmer harvested 983 kg of wheat. He put the wheat into sacks which held 75 kg each.*

How many sacks did he need?

Plan: 983 kg ÷ 75 kg

C:

$$\begin{array}{r} 13 \text{ r } 8 \text{ (kg)} \\ 75\,\overline{)\,983} \\ -\ 75 \\ \hline 233 \\ -\ 225 \\ \hline \textcircled{8} \end{array}$$

Answer: He needs $\underline{14}$ sacks.

(13 full sacks and 1 sack holding only 8 kg of wheat)

b) *If 30 cans of lemonade are packed in 5 boxes, how many boxes should we buy if we need 44 cans of lemonade for a party?*

Plan: 5 boxes → 30 cans

1 box → 30 ÷ 5 = 6 (cans)

44 cans ÷ 6 cans = 7 (times), r 2 cans

Answer: We should buy $\underline{8}$ boxes (although we will have 4 cans more than we need).

c) *3 metres of a certain type of material cost £6.00. What would be the price of 12 metres of the same material?*

Plan: 3 m → £6.00

1 m → £6 ÷ 3 = £2

12 m → £2 × 12 = £24

Answer: The price of 12 m of material is £24.

30 min

Individual work, monitored (helped)

Discussion, reasoning, agreement, self-correction, praising

Extra praise for Ps who realise the significance of the remainders in a) and b)

or 12 m = 3 m × 4,
so will cost:
£6 × 4 = $\underline{£24}$

Feedback for T

8

Erratum

In *Pbs* in d): (19 8) should be (19 – 8)

PbY5a, page 39

Q.2 Read: *Do the calculations in your exercise book and write the results here.*

Set a time limit. Review with whole class. Ps come to BB to or dictate to T, explaining reasoning. Class agrees/disagrees.

Mistakes discussed and corrected. Show details of calculations in column form on BB if problems or disagreement.

Solutions:

a) $1273 - 27 \times 19 - 8 = 1273 - 513 - 8 = 1273 - 521 = \underline{752}$

b) $(1273 - 27) \times (19 - 8) = 1246 \times 11 = \underline{13706}$

c) $1273 - (27 \times 19 - 8) = 1273 - (513 - 8) = 1273 - 505 = \underline{768}$

d) $1273 - 27 \times (19 - 8) = 1273 - 27 \times 11 = 1273 - 297 = \underline{976}$

35 min

Individual work, monitored

Written on BB or SB or OHT

Differentiation by time limit

Discussion, reasoning, agreement, self-correction, praising

Extra praise for Ps who notice connection between a) and c):

In a), the 8 has been subtracted, in c) it has been added, so result is $\underline{\text{16 more}}$ than result in a).

Y5

Lesson Plan 39

Activity | **Notes**

9

PbY5a, page 39

Q.3 Read: *Continue each sequence for 5 more terms. Write the rule that you used.*

Set a time limit. Review with whole class.

Ps come to BB or dictate to T and give the rule. Who agrees? Who used a different rule? etc. Mistakes discussed and corrected.

Solutions:

a) 0, 1, – 2, 3, – 4, 5, – 6, (7, – 8, 9, – 10, 11)

Rule: <u>Absolute value</u> (i.e. distance from 0) increasing by 1, and signs alternating between + and –

Show on the the class number line. What else do you notice?

Elicit that it can be separated into 2 sequences, one increasing and the other decreasing:

1, 3, 5, 7, 9, 11, . . . (+ 2)

0, – 2, – 4, – 6, – 8, – 10, . . . (– 2)

b) $-\frac{1}{3},\ 0,\ \frac{1}{3},\ \frac{2}{3},\ (1,\ 1\frac{1}{3},\ 1\frac{2}{3},\ 2,\ 2\frac{2}{3})$ *Rule*: $+\ \frac{1}{3}$

c) 0.1, 0.2, 0.4, 0.8, (1.6, 3.2, 6.4, 12.8, 25.6) *Rule*: × 2

d) 1, 3, 6, 10, 15, 21, (28, 36, 45, 55, 66)

Rule: Difference between terms is increasing by 1.

e) 0, 1, 3, 7, 15, (31, 63, 127, 255, 511,)

Rule: Difference between terms is increasing by 2 times, or 'Each following term is 1 more than twice the previous term.'

40 min

Individual work, monitored, helped

Written on BB or SB or OHT

Differentiation by time limit.

Discussion, reasoning, agreement, self-correction

Praising, encouragement only

Accept 'digits increasing by 1', but T mentions absolute value.

Extra praise if Ps suggest this without help of T.

To Ts only:

b) is a <u>geometric</u> sequence

c) is an <u>arithmetic</u> sequence

d) or $d_n = \frac{n\ (n+1)}{2}$

e) or $e_n = 2^{n-1} - 1$

10

PbY5a, page 39*, *Q.4

Read: *In how many ways can you read the word EXETER in these grids if you can only move one step down or one step to the right?*

Ps come to BB to indicate the ways on the grids, and to write numbers in the boxes. Class agrees/disagrees and points out missed routes.

Solution:

a) ↓

E
X
E
T
E
R

$\boxed{1}$

b) → ↓

E	X
X	E
E	T
T	E
E	R

$\boxed{5}$

c) → ↓

E	X	E
X	E	T
E	T	E
T	E	R

$\boxed{10}$

In what other ways could we check the routes? T gives hints if necessary. Ps come to BB to write and explain, with T's help.

c) Each route involves 2 steps to the right and 3 steps down:

BB: RRDDD, RDRDD, RDDRD, RDDDR,
DRRDD, DRDRD, DRDDR, DDRRD, DDRDR, DDDRR (10)

or Write in each grid square the number of ways to reach it from the top RH corner. Ps come to BB or dictate to T.

Elicit that the number of routes to each letter is the sum of the routes to the letters directly above it and to the left of it.

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

Demonstration, agreement praising

Extra praise if Ps remember these methods without help from T.

(the different possible orders of the 5 steps)

BB:

E_1	X_1	E_1
X_1	E_2	T_3
E_1	T_3	E_6
T_1	E_4	R_{10}

(10)

Y5

Lesson Plan
40

Activity

Notes

Tables and calculation practice, revision, activities, consolidation

PbY5a, page 40

Solutions:

Q.1 a) $3210 - 738 + 49 - 262 + 4051$

$= 3210 - (738 + 262) + (49 + 4051)$

$= 3210 - 1000 + 4100 = 2210 + 4100 = \underline{6310}$

b) $220 + 65 \times 3 - 95 \div 5 - 729 \div 9$

$= 220 + 195 - 19 - 81 = 220 + 195 - 100$

$= 220 + 95 = \underline{315}$

c) $25 \times 9 + (150 - 25) \div 25 - 175 \div 5$

$= 225 + 125 \div 25 - 35$

$= 225 + 5 - 35 = 230 - 35 = \underline{195}$

Q.2

Route	Departs	Arrives	Journey time
London – Birmingham	09:15	**10:35**	1 hour 20 minutes
London – Manchester	10:05	12:03	**1 hour 58 minutes**
Liverpool – London	**07:26**	09:37	2 hours 11 minutes
Manchester – Glasgow	08:49	**11:12**	2 hours 23 minutes
London – Carlisle	**11:55**	15:12	3 hours 17 minutes
Glasgow – London	17:30	**21:42**	4 hours 12 minutes

Q.3 a) $(29 - 8) \div 3 = 21 \div 3 = \underline{7}$

John gave each of his friends 7 sweets.

b) $35 \times 6 + 60 = 210 + 60 = 270$ (p) $= \underline{\text{£}2.70}$

Harvey was given £2.70 as pocket money.

c) $23 \times 3 + 40 \times 6 + 49 = 69 + 240 + 49 = 358$ (p) $= \underline{\text{£}3.58}$

Suzy had £3.58 at first.

d) i) 6 litres $\rightarrow$ 8 bottles

3 lires $\rightarrow$ 4 bottles

15 litres $\rightarrow 4 \times 5 = \underline{20}$ (bottles)

I need to buy 20 bottles of wine.

ii) 8 bottles $\rightarrow$ 6 litres

1 bottle $\rightarrow 6 \div 8 = \dfrac{6}{8} = \dfrac{3}{4}$ (litres) $= \underline{75 \text{ cl}}$

Each bottle contains 75 cl of wine.

Q.4 e.g. Three friends pooled all their money and went to town. They had £1.83 when they left home, spent 36 p on bus fares, then bought a packet of sweets for 27 p.
They shared what was left equally when they got home.
How much money did they each have left?

$(183 - 36) \div 3 - 27 \div 3 = 61 - 12 - 9 = \underline{40}$ (p)

Q.5 *R, A, G, A, R; R, AG, G, A, R; R, RA, G, GA, R*

Y5

R: Straight lines, half-lines/rays, line segments

C: 2–D and 3–D shapes. Using compasses to copy and measure line segments

E: Various shapes. Creating shapes

Lesson Plan *41*

Activity

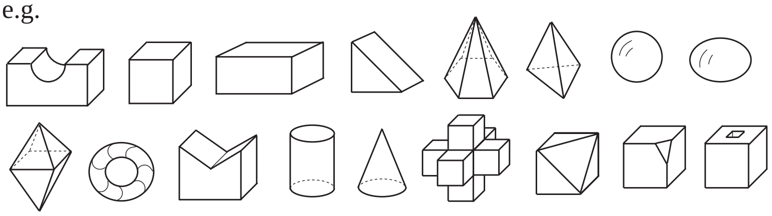
Notes

1

Solids

Let's look at these solids. T has large models on display at front of class.

e.g.



Let's talk about this one. (T holds one up.) Who can tell us something about it? Who knows something else about it? T asks questions about any features not mentioned by Ps. [e.g. name of solid, curved or plane surfaces, number and type of faces (plane or curved, name of shape); number of vertice and edges; whether there is a hole through it; convex/ concave, etc]

How would you put the solids into sets? Ps suggest how it could be done. Class agrees/disagrees. Who can think of another way to do it? Where possible, Ps find real objects in the classroom which belong in the different sets.

Agree that a <u>solid</u> is a shape which has 3-dimensions (length, breadth and height) but is <u>not</u> hollow. e.g. a wooden cube is a solid but a box shaped like a cube on the outside but empty inside is <u>not</u> a solid.

8 min

Whole class activity

T need not use all the solids shown but make sure that there is a variety of curved and straight edges and plane and curved surfaces.

At a good pace

Discussion, agreement, praising

T uses, and encourages Ps to use, correct mathematical names and terms. e.g.

pyramid, cube, sphere, cylinder, cone, polyhedron (shape with many plane faces), prism, etc.

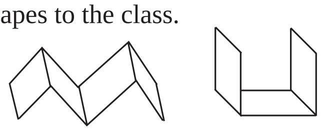
Possible sets: plane and curved surfaces; straight and curved edges; vertices and no vertices; has a triangular face and has no triangular face, etc.)

2

Other 3-D shapes

a) Ps have strips of coloured paper on desks. T has large strips for demonstration. Let's make 3-D shapes which are not solids by folding your strips of paper in different ways. T can demonstrate a shape first, then Ps make their own shapes. T chooses Ps to show their shapes to the class.

e.g.



Elicit that these shapes have 3 dimensions (i.e. height, breadth, depth) but they are <u>not</u> solids, as the paper is so thin that we can disregard its thickness.

Here is a special shape. T makes 1 twist in a strip of paper and Ps copy. (Use glue or a paper clip to keep the 2 edges together).

This shape is called a <u>Möbius strip</u>.

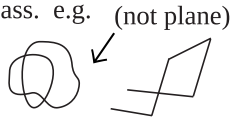
How many faces and edges do you think it has? T asks several Ps what they think. Imagine an ant starting at one point and walking all around the surface. Will the ant cross any edges? (No)

Agree that this shape has 1 edge and 1 face but is 3–D.

If we make such a shape with 2 twists, does it make a difference to the number of edges and faces? (Yes, it has 2 edges and 2 faces)

b) T has shapes made from wire to show to class. e.g.

What kind of shapes are these?
Are they plane shapes? (No)
Are they solids? (No)



Agree that they are 3-D shapes but they are not solids.

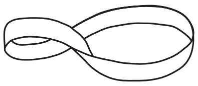
12 min

Individual work in making shapes, followed by whole class discussion

Extra praise for unusual shapes

Discussion, agreement. praising

BB: <u>Möbius strip</u>.



1 edge, 1 face

Agreement, praising

Or Ps have wire or pipe-cleaners on desks and make their own shapes. T chooses some Ps to show their shapes to the class.

Discussion, agreement, praising

Y5

Lesson Plan 41

Activity

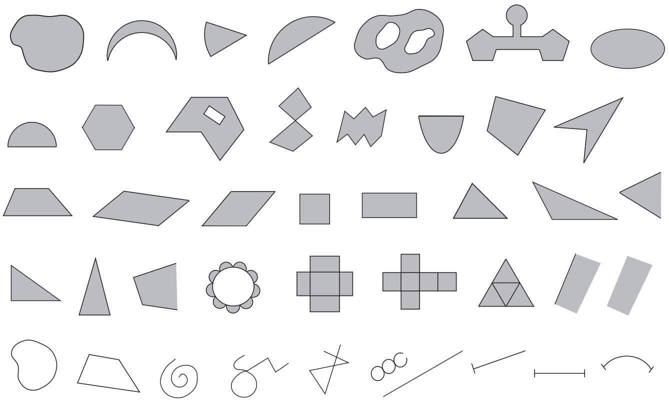
Notes

3

Plane shapes (2-D)

Study these shapes and think how you could put them into groups.

BB: e.g.



Ps suggest labels for sets and might mention e.g.:

base set: plane shapes; *subsets:* curved sides, polygons (i.e. plane shapes with straight sides), quadrilaterals, triangles, shapes with holes, closed or open shapes, line shapes, bounded or unbounded (i.e. endless in a certain direction), etc. Class agrees/disagrees.

T points to to certain shapes and asks Ps to say what they know about them. Who agrees/ Who knows something else? etc.

For example, Ps might mention:

name of shape if known (triangle, crescent, oval, semicircle, quadrilateral, rectangle, square, parallelogram, trapezium, triangle, hexagon); number of sides and vertices; concave or convex, symmetrical or not, parallel or perpendicular lines; angles (right, acute, obtuse); line (stretches to infinity in both directions); line segment (part of a line – begins and ends at certain points, ray (line drawn from a certain point and stretching to infinity in one direction); part of a plane (flat surface), etc.)

Whole class activity

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

Involve all Ps in the discussion.

Ps explain what they know.

T helps with mathematical names and terms where necessary and writes the more difficult names on the BB.

Agreement, praising

Accept only those suggested by Ps– there is no need to cover all possibilities.

T helps and corrects.

Encourage Ps to use correct mathematical names and terms.

Revise properties or meanings of any Ps have forgotten.

Praising, encouragement only

Feedback for T

20 min

4

Drawing and cutting plane shapes

Ps have coloured paper and scissors on desks.

Ps have 2 minutes to create their own plane shapes by cutting and drawing. T chooses Ps to stand up and describe the shape that they have made. They then show their shape and class points out any errors or omissions in the descriptions. T helps with language.

Individual work, monitored, helped

Whole class review.

In good humour!

Praising, encouragement only

25 min

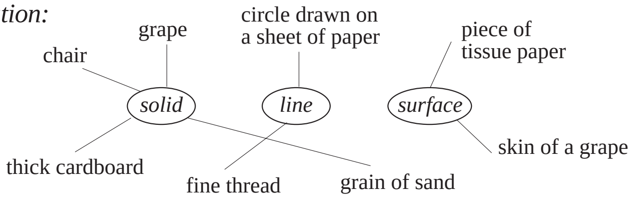
5

PbY5a, page 41

Q.1 Read: *Join up each item to the matching label.*

Set a time liimit. Review with whole class. Ps come to BB to draw joining lines and explain reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:



Individual work, monitored

Written on BB or use enlarged copy master or OHP

At a good pace

Reasoning, agreement, self-correction, praising

Discuss the circle: its border (<u>circumference</u>) is a line but its area is a surface)

Feedback for T

28 min

Y5

Lesson Plan 41

Activity

6

PbY5a, page 41

Q.2 Read: *Use a ruler and a pair of compasses. Draw on plain paper. Follow the instructions.*

T chooses a different P to read each step, then Ps carry out the instruction on plain sheets of paper and T helps a P to work at BB, using BB instruments. T uses and explains correct mathematical terms for lines and parts of lines.

Steps:

a) *Draw a straight line with a ruler.*

b) *Mark a point on the line and label it Q.*

c) *Draw over one part of the line in red and the other part in blue.*

T tells Ps that we can think of the parts of a line on either side of a point as half lines, as they both stretch to infinity in either direction.

What colour is the point Q?

T asks several Ps what they think and why. (Accept half *red* and half *blue*, or one of them, or none of them, with correct reasoning.)

d) *Draw another straight line. Mark two different points on the line and label them A and B. Draw over the segement between A and B in red. Draw over the other parts of the line in green.*

T tells class that the red part of the line is a line segment because it has a start point at A and an end point at B. We would name it AB.

The *green* parts of the line are called rays, because they start at a point and stretch to infinity in one direction.

e) *Using the pair of compasses, copy your segment AB on to the line below. Estimate its length first, them measure its actual length to the nearest mm.*

Elicit that the line beginning at point A' (read as A dash) is really a ray, as it starts at point A' and stretches endlessly to the right.

T explains and demonstrates how to set the compasses to the required width and then use them to mark A'B' on the ray.
Ps copy what T does. Then Ps write estimated length in *Pbs*, measure the exact length with a ruler and write result in *Pbs*.

T asks several Ps for the lengths of their lines (in cm and mm) and how close they were to their estimates.

We can also use our compasses to measure! Who can think how to do it? If no P knows, T demonstrates and explains:

The compasses set to the width of A'B' can be laid on top of the ruler, with the LH arm resting exactly on zero. The point where the RH arm rests is where to read the length.

35 min

Notes

Individual work but class kept together at each step

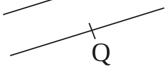
Agree that the paper is plain and plane!

Do not expect Ps to use the new terms just yet!

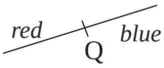
BB:

a)

b)

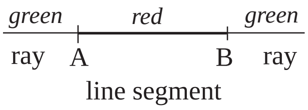


c)



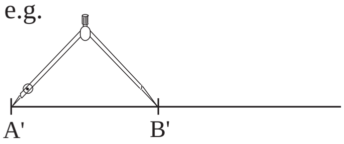
Discussion, reasoning, agreement, praising

d)

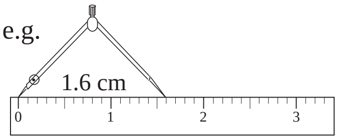


e)

e.g.



e.g.



BB: AB = A'B' = 1.6 cm

Y5

Lesson Plan 41

Activity

Notes

7

PbY5a, page 41

Q.3 Read: *Estimate the length of each line segment in cm, then measure it accurately to the nearest mm.*

Fill in the table.

Individual work, monitored

Lines and table drawn on BB or use enlarged copy master or OHP for demonstration only!

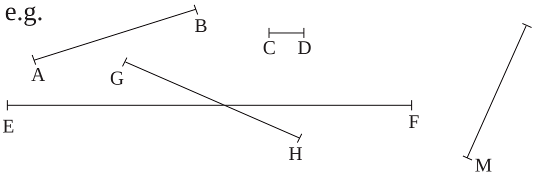
Ps estimate the lines first and write lengths in table. Then they measure them with rulers (or rulers and compasses) in mm and complete the table. Warn Ps about converting their estimates to mm before calculating the differences. Set a time limit.

Differentiation by time limit.

Review at BB with whole class. Ps come to BB or dictate to T. Who had a different estimate? Who had a different measurement? Allow a generous leeway for estimates and ± 1 mm in measurements. Ps with obviously incorrect results measure the lines again more carefully and correct their table. Ps with closest estimates explain how they estimated so well.

Discussion, reasoning, agreement, self-correction, praising

Solution: e.g.



e.g.

	AB	CD	EF	GH	MN
Estimated (cm)	3	1	8	4	3
Measured (mm)	34	7	81	38	29
Difference (mm)	4	3	1	2	1

40 min

8

PbY5a, page 41

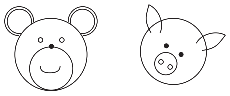
Q.4 Read: *Draw a copy of these shapes on plain paper using only a pair of compasses.*

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

T demonstrates how to set the compasses to different widths on BB first, using BB compasses, and how parts of a curve can be used for ears and mouths. (If class is not very able, T could work on BB and Ps copy what T does on sheets of paper.)

BB:



Set a time limit of 3 minutes. T helps and corrects, guiding Ps' hands while they draw if necessary.

Praising, encouragement only

Review with whole class. T asks some Ps to show their drawing to class and asks them which parts they found most difficult and which easiest. Who likes the pig (bear) best? Why?

In good humour!

Discussion on results

Extension

Ps could plan, draw and colour other animals' faces at home or in *Lesson 45* (e.g. lion, monkey, rabbit) and T could exhibit them in the classroom or corridor.

[Practice in using compasses to copy and draw]

45 min

Y5

R: Rectangle, square

C: Plane shapes, polygons. Right angle. Parallel and perpendicular lines

E: Common notation on diagrams

Lesson Plan 42

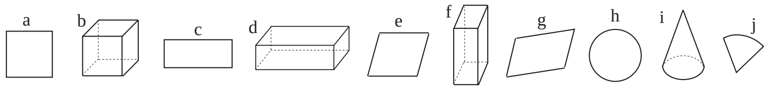
Activity *Notes*

1

Classifying shapes

T shows a a range of various shapes on BB (or their images on an OHP).

BB:



How could we put them into two groups (i.e. classify them)?
Ps suggest criteria and list the two sets accordingly. e.g.

- 2–D and 3–D shapes, or plane shapes and solids
  Ps dictate: 2-D: a, c, e, g, h, j; 3–D: b, d, f, i
- curved surface (i) and only plane surfaces (all the rest)
- curved side and no curved sides: (h, i, j) and (all the rest)

Elicit the name of each shape. (square, cube, rectangle, cuboid, rhombus, cuboid, parallelogram, circle, cone, segment of a circle)

4 min

Whole class activity

Drawn on BB or use enlarged copy master or OHP

(or real objects placed on OHP so that only shadows are seen on the screen)

(Ps could have copies of copy master on desks.)

Discussion, agreement, praising

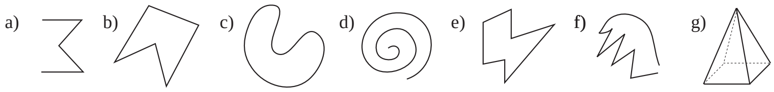
T writes on BB any name Ps cannot remember and revises its properties.

2

Shapes

Which of these shapes are plane shapes?

BB:



T asks several Ps what they think and why. Elicit or tell that:

- a plane shape consists of all the points in the same plane inside a closed line, so only b), c) and e) are plane shapes;
- a), d) and f) are line shapes, not plane shapes, because they are not an enclosed part of the plane;
- g) is not a plane shape because it is 3-dimensional, i.e. it is in more than one plane. It is a solid and its name is a pyramid or a prism.

7 min

Whole class activity

Drawn on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, praising

Agree on a definition:

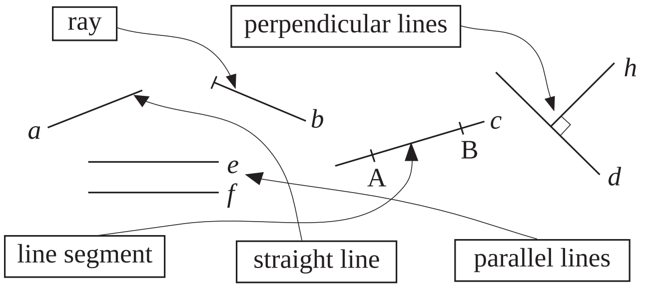
A part of a plane bordered by a closed line is called a plane shape.

3

Lines

Let's join up the name cards to the matching diagrams. Ps come to BB to draw joining lines, explaining meaning of the terms (with T's help). Class agrees/disagrees.

BB:



T elicits meanings and shows short notation on BB.

- perpendicular lines form a right angle where they meet (shown by drawing a small square in the angle they make)
- parallel lines stay the same perpendicular distance apart, however far they are extended, and will never meet.

10 min

Whole class activity

Drawn on BB or use enlarged copy master or OHP

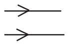
At a good pace

T repeats Ps' explanations in a clearer way if necessary.

Agreement, praising

Who remembers how to show parallel lines on a diagram?

P comes to BB ro draw arrow-heads on lines *e* and *f*.



BB: $d \perp h$ (read as 'line *d* is perpendicular to line *h*')

$e \parallel f$ (read as 'line *e* is parallel to line *f*')

Y5

Lesson Plan 42

Activity

Notes

4

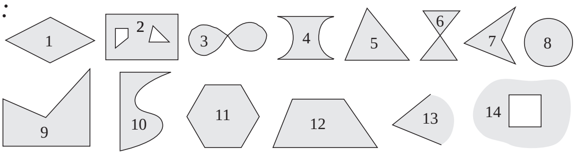
PbY5a, page 42

Q.1 Read: *List the numbers of the plane shapes which match the descriptions.*

Deal with one part at a time. T chooses a P to read the description, then Ps list numbers in *Pbs*. Review with whole class. Ps dictate answers to T, explaining reasoning. Class points out errors or missed shapes. Mistakes discussed/corrected.

Tell me the name of any of these shapes that you know. Ps come to BB to point to a shape and name it. Class agrees/ disagrees. T reminds Ps of names that they have forgotten.

Solution:



a) *It is enclosed only by straight lines.* (1, 2, 5, 6, 7, 9, 11, 12)

b) *It is enclosed by straight and curved lines.* (4, 10)

c) *It is enlcosed only by curved lines.* (3, 8)

d) *It is not enclosed.* (13, 14)

e) *It has parallel sides.* (1, 2, 4, 6, 9, 11, 12, 14)

f) *It has perpendicular sides.* (2, 9, 10, 14)

g) *It has exactly 4 straight sides.* (1, (6), 7, 12)

h) *It has exactly 6 vertices.* (11)

Elicit that shapes 1, 5, 7, 9, 11 and 12 are also called polygons (i.e. plane shapes bounded by a continuous set of many straight sides)
T amends the definition to say that the line segements cannot cross and only 2 can meet at a vertex, so 6 is not a polygon.

Who remembers what convex and concave mean? If Ps cannot explain clearly, T reminds class.

Imagine the shapes 1 to 12 as being clearings in a forest. Could two people be hidden from each other inside them? If they can, the shapes are concave and if they can't, the shapes are convex. You could imagine a convex shape as being a courtyard with high walls, so there is no place to hide.

T points to each shape in turn and Ps say whether it is concave or convex. If disagreement, Ps come to BB to show where two people could be hidden from each other

Extension

T puts forward these ideas for Ps to think about.

- A plane shape is part of a plane bordered by a closed line, but shapes 2 and 6 are plane shapes and are made up of parts of the plane bordered by straight lines, so we should amend our definition to:

  A plane shape is a part or parts of a plane bordered by a closed line or lines.

- In a wider sense, shapes 13 and 14 are also plane shapes because *Shape 13* is bordered by 2 rays which extend endlessly, or to infinity; *Shape 14* is bordered by the square on the inside and then extends to infinity in all directions.

20 min

Individual work but class kept together throughout.

Drawn on BB or use enlarged copy master or OHP

Discussion, agreement, self-correction, praising

Names of shapes Ps have met already and might remember:

1: rhombus (equal sides and opposite sides parallel)

2: rectangle (with quadrilateral and triangle cut out of it)

5: triangle (acute-angled)

7: deltoid (adjacent sides equal) or concave quadrilateral

8: circle

9: pentagon (irregular)

11: hexagon (regular)

12: trapezium (quadrilateral with only 1 pair of || sides)

g) Depending on whether you think of shape 6 as having 4 sides, with 2 of its sides crossing, or whether you think of it as having 6 sides, with 4 sides meeting at a point. Accept both answers.

Extra praise for Ps who can explain without T's help.

BB:

Convex: 1, 5, 8, 11, 12
(no hiding places)

Concave: 2, 3, 4, 5, 7, 9, 10
(hiding places)

Whole class discussion

Ps might disagree with T and if so, allow them to explain their thinking to class.
Who agrees? Who disagrees?

Involve several Ps in the debate.

BB: infinity: ∞

(Ps might notice that *shape 3* is this symbol.)

Y5

Lesson Plan 42

Activity | *Notes*

5

Making plane shapes

Let's see if you can draw (cut out) the shapes that I describe.

T reads the descriptions one at a time, while walking around class closely monitoring Ps work. T chooses Ps to show their shapes to class. (Some might be incorrect, and hopefully class will say what is wrong with them.)

a) convex triangle, (quadrilateral, pentagon)

b) concave triangle, (quadrilateral, pentagon) [Concave Δ impossible!]

c) plane shape with straight sides but <u>not</u> a polygon

d) plane shape enclosed not only by straight lines

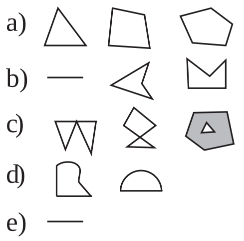
e) a polygon with two sides (Ps laughing – it is impossible!)

Individual or paired work, monitored, helped

Ps have scissors and scrap paper on desks, or Ps use rulers to draw shapes in *Ex. Bks*.

Discussion, agreement, praising

BB: e.g.



25 min

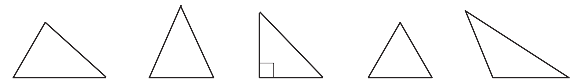
6

Plane shapes

a) <u>Triangles</u>

T draws different types of triangle on BB, one at a time. After each drawing, T asks Ps if they know what kind of triangle it is, then Ps draw a similar type in *Ex. Bks*. T gives names if Ps do not remember.

BB: e.g.



acute-angled isosceles right-angled equilateral obtuse-angled

- What features are common to all the triangles? (3 sides, 3 angles, 3 vertices)
- What can you say about the border of a triangle? (Closed straight, broken line in 3 segments)
- How many points are inside a triangle (on its border line)? (An endless or infinite number)
- Let's label the vertices and sides of the triangles we have drawn. T demonstrates on BB first, then Ps label own triangles.

  We usually label the vertices with capital letters, starting with A at the bottom LHS and moving <u>anti-clockwise</u>.

  We usually label sides with lower case letters, with *a* oppsite vertex A, *b* opposite vertex B and *c* opposite vertex C.

b) <u>Quadrilaterals</u>

Draw different quadrilaterals in your *Ex. Bks*. T chooses Ps to draw one of their quadrilaterals on BB and name it if they can.

(e.g. irregular, *rectangle* (opposite sides parallel and adjacent sides perpendicular), *parallelogram* (opposite sides parallel), *rhombus* (opposite sides parallel and all sides equal), *trapezium* (only 1 pair of opposite sides parallel), *square* (regular rectangle), *deltoid* (concave or convex quadrilateral with adjacent sides equal)

Elicit common features (4 angles, 4 sides, 4 vertices, 2 diagonals)

T again shows Ps how to label vertices and sides. (As for triangles, but sides labelled anti-clockwise starting with *a* as line joining A and B, *b* as line joining B and C, etc.

c) <u>Pentagons</u>

Repeat as for b). (5 sides, 5 angles, 5 vertices, 5 diagonals)

Whole class discussion, but individual drawing in *Ex. Bks*. monitored

Drawn on BB or SB or OHT

<u>acute-angled</u>: all angles < 90°

<u>isosceles</u>: 2 equal sides

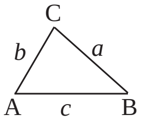
<u>right-angled</u>: 1 angle = 90°

<u>equilateral</u>: 3 equal sides (and 3 equal angles)

<u>obtuse-angled</u>: 1 angle > 90°

Discussion, agreement, praising

BB:

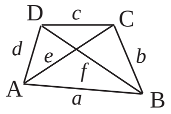


Sides join 2 <u>adjacent</u> vertices.

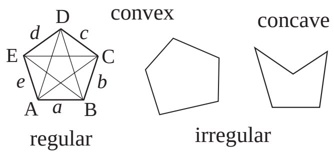
Individual work, monitored, then whole class review and discussion

Deal only with those drawn by Ps.

BB:



Diagonals join 2 <u>non-adjacent</u> vertices.



32 min

Y5

Lesson Plan 42

Activity

Notes

7

PbY5a, page 42

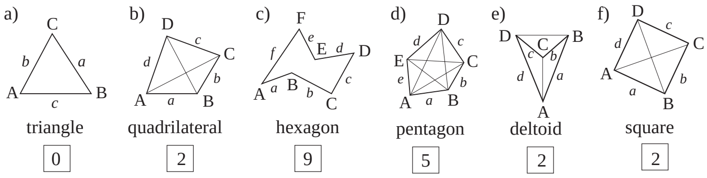
Q.2 Read: *Label the vertices. Write the name of the shape and how many diagonals it has below it.*

Label the sides of the shapes too and draw the diagonals. Use your rulers! Set a time limit

Review with whole class Ps come to BB to label, write and draw. Class agrees/disagrees. Mistakes discussed and corrected.

In c), expect only the ablest Ps to give the correct number of diagonals. T helps by drawing a convex hexagon on BB and Ps come to BB to draw the diagonals. Agree that each of the 6 vertices is joined to 5 other vertices, but 2 of the 5 vertices are adjacent, so the joining lines are sides. This leaves joining lines to 3 vertices as diagonals but 2 vertices are needed for each diagonal, so number must be halved.

Solution:



T ask other questions about the shapes. e.g.

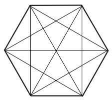
- Which of them are convex? (a, b, d, f)
- Which of them are symmetrical? (a, e, f)
- Which of them has a right angle? (b, c, d*, f) *at A
- Which of them has parallel lines? (f) etc.

Individual work, monitored, (less able Ps helped)

Drawn on BB or use enlarged copy master or OHP

Discussion reasoning, agreement, self-correction, praising

BB:



9 diagonals

$6 \times 3 \div 2 = 18 \div 2 = \underline{9}$

or $\frac{6 \times 3}{2} = \frac{18}{2} = \underline{9}$

Stress that in polygons, lines joining 2 adjacent vertices are sides; lines joining non-adjacent vertices are diagonals.

or e) concave quadrilateral

Ps can think of questions too!

T asks Ps at random.

Agreement, correcting, praising

Feedback for T

37 min

8

PbY5a, page 42

Q.3 Read: a) *Write what the labels S and P might mean.*
b) *Draw one more element in each set.*
c) *Fill in the missing words.*

Allow Ps to work with their neighbour if they wish. Set a time limit.

Review with whole class. Deal with one part at a time. Ask several Ps what they wrote (drew). Ps come to BB to draw their extra elements. Class decides whether they belong in the set.

A, read your completed sentence. Who agrees? Who wrote something different? Class agrees on correct solution and reads the sentence.

Solution:

a) S = {plane shapes}, P = {polygons}

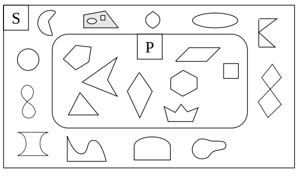
b) Accept any valid shapes.

c) Every polygon is a plane shape but not every plane shape is a polygon.

T: We can say that the set of polygons is a subset of the set of plane shapes.

Individual or paired trial first, monitored (helped)

Drawn on BB or use enlarged copy master or OHP:



Discussion on the common features of the diagrams in each set

Reasoning, agreement, self-correction, praising

Ps choose a polygon and say what they know about it.

41 min

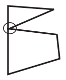
9

Hexagons

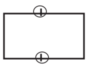
Which of these diagrams are hexagons? (None) Why not?

Ps come to BB to draw correct hexagons.

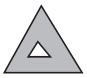
BB:



only 2 sides should meet at each vertex



quadrilateral, (points circled are not vertices)



bounded by 2 closed lines instead of 1

Whole class activity

Drawn on BB or SB or OHT

Discussion, reasoning, agreement, praising.

Feedback for T

45 min

Y5

R: Sequences with integers, fractions, decimals. Calculations

C: Perimeter of polygons. Perimeter of rectangle and square

E: Border line (fence) and surface. Perimeter and area

Lesson Plan 43

Activity

Notes

1

Sequences

T says the first few terms of sequence. Ps continue the sequence. If a P makes a mistake, the next P must correct it. Final P gives the rule.

a) 1, 4, 9, 16, (25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, . . .)

[Rule: the square numbers in increasing order]

b) 150, 120, 90, (60, 30, 0, – 30, – 60, – 90, – 120, – 150, . . .)

[*Rule:* decreasing by 30]

c) $2\frac{1}{5}$, $2\frac{3}{5}$, 3, ($3\frac{2}{5}$, $3\frac{4}{5}$, $4\frac{1}{5}$, $4\frac{3}{5}$, 5, $5\frac{2}{5}$, $5\frac{4}{5}$, $6\frac{1}{5}$, $6\frac{3}{5}$, . . .)

[*Rule:* increasing by 2 fifths]

d) – 0.45, – 0.32, – 0.19, (– 0.06, 0.07, 0.2, 0.33, 0.46, 0.59, . . .)

[Rule: increasing by 0.13]

Whole class activity

At speed, in order round class

T decides when Ps should stop.

Class points out missed errors.

In good humour!

Praising, encouragement only

Feedback for T

5 min

2

Plane shapes

Ps have set of cut-out shapes on desks. T has larger shapes stuck to BB.

I will give you 2 minutes to write the name of each shape on the back of it and think of as many of its properties as you can. List them in your *Ex. Bks*. if it will help you to remember them. Dicuss it with your neighbour if you wish.

Review with whole class. Ps come to BB to choose a shape, name it and say what they know about it. Who agrees? Who thought of something else about it? etc. Class points out errors. e.g.

a) triangle (equilateral or regular, 3 vertices, 3 equal sides, 3 equal acute angles, convex, symmetrical)

b) trapezium (quadrilateral, 4 vertices, 4 angles – 2 acute and 2 obtuse, 4 sides – 1 pair of opposite sides parallel, 2 diagonals, convex)

c) rectangle (quadrilateral, parallelogram, 4 vertices, 4 right angles, 4 sides – opposite sides equal and parallel, 2 diagonals, convex, symmetrical)

d) triangle (isosceles, 3 vertices, 3 acute angles – 2 equal, 3 sides – 2 equal, convex, symmetrical)

e) square (quadrilateral, parallelogram, regular rectangle, etc.)

f) circle (bordered by 1 curved closed line around a central point.)

g) triangle (right-angled – 1 right-angle and 2 acute angles, 3 vertices, 3 sides – 2 adjacent sides perpendicular, etc.)

Hold up the equilateral triangle. Trace its border line with your finger. Show its surface with your palm. What do we mean by its perimeter? (total length of its sides, or the length of its border line)

Measure its sides and calculate its perimeter in your *Ex. Bk*. Do the same for all the other shapes except the circle. Set a time limit.

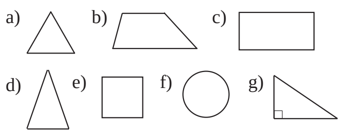
Review quickly orally with whole class. T holds up shape and Ps dictate its sides and perimeter lengths. Class agrees/disagrees.

How can we measure the border line on the circle? Ps (T) suggests: Make a mark on its border, draw a ray from that mark and turn the circle along the ray until the mark meets the ray again. The distance between the two marks is the perimeter. Ps do it in *Ex. Bks* and tell their results.

Paired trial to start, then whole class activity

Cut from coloured paper, or from copy master, enlarged and cut out.

BB:



Reasoning, agreement. praising

Extra praise for clever features such as symmetry.

At a good pace

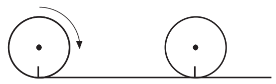
Ps could stand to do this.

Agreement, praising

Ps use rulers, or compasses and rulers, to measure to the nearest mm.

Accept approximate lengths.

Discussion, agreement



12 min

Y5

Lesson Plan 43

Activity

3

Constructing polygons with straws

Ps each have coloured straws of different lengths on desks, with the same length of straw the same colour.

e.g. 2 cm, 3 cm, 3.5 cm and 4 cm straws.

a) i) Make a triangle from the 3 shortest straws. What is its perimeter?

(BB: P = 2 cm + 3 cm + 3.5 cm = <u>8.5 cm</u>)

ii) Make a triangle from three 3.5 cm straws. What is its perimeter?

(BB: P = 3 × 3.5 cm = <u>10.5 cm</u>)

Elicit that it is an <u>equilateral</u> triangle, as it has equal sides.

Repeat for other combinations of straws.

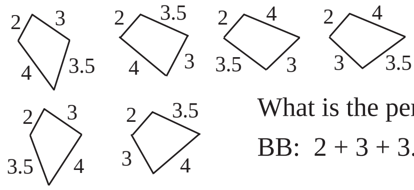
b) i) Form an <u>open</u> broken line with the 4 different straws. In how many different ways can you order them?

(BB: $4 \times 3 \times 2 \times 1$ = <u>24</u>)

ii) Form a <u>closed</u> broken line with the 4 different straws. What shape have you made? (quadrilateral) How many different orders of sides are possible (going in 1 direction)? (6)

T shows them on BB, as dictated by Ps.

BB:



What is the perimeter of each one?

BB: 2 + 3 + 3.5 + 4 = <u>12.5</u> (cm)

20 min

Notes

Individual or paired work in manipulation of straws, tmonitored, then whole class discussion

(4 different triangles can be formed)

Reasoning, agreement, praising

Ps could suggest them.

(in one direction)

(Ps could show on slates or scrap paper on command.)

Discussion, agreement, praising

(or T has possibilities already prepared)

What did you have to do to make sure that adjacent straws touched each other?

(Change the angles at the vertices.)

4

PbY5a, page 43

Q.1 Read: *Measure the length of each side of the polygon and calculate the length of its perimeter.*

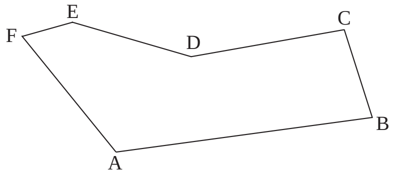
Set a time limit. Ps write lengths in *Pbs*, do the necessary calculation in *Ex. Bks*. then write the result in *Pbs*.

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

Elicit that the perimeter is the <u>total</u> length of all the sides.

What can you tell me about the shape? (hexagon, concave, plane shape, polygon, 6 sides, 6 angles 6 vertices)

Solution:



AB = 5 cm

BC = 1.8 cm

CD = 3 cm

DE = 2.4 m

EF = 1 cm

FA = 2.9 cm

P = 5 + 3 + 1 + 1.8 + 2.4 + 2.9 = 14 + 2.1 = <u>16.1 cm</u>

24 min

.

Individual work, monitored, (helped with measuring)

Drawn on BB or use enlarged copy master or OHP

Ps measure with rulers (or compasses and rulers) in cm or mm

Reasoning, agreement, self-correction, praising

Accept lengths of ± 1 mm on each side.

T points to a vertex and Ps say what kind of angle is formed by the two adjacent sides.

Y5

Lesson Plan 43

Activity

5

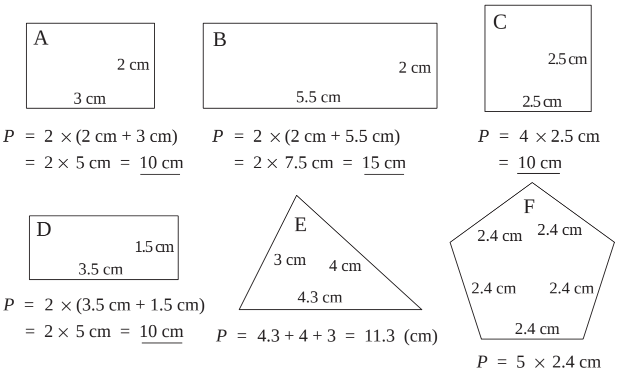
Perimeters

Ps have set of polygons on desks and T has set (enlarged by 5 or 10 times) drawn or stuck on BB.

a) Measure the sides of each of your polygons and calculate its perimeter in your *Ex Bks*. Set a time limit. Ps take turns measuring and recording, then both do calculation and check their results.)

Review with whole class. T holds up one shape at a time and Ps say its perimeter. Who agrees? Who thinks something else? Accept slight differences in measurements but ask Ps with wildly inaccurate results to measure and calculate again.

BB:



$P = 2 \times (2\text{ cm} + 3\text{ cm}) = 2 \times 5\text{ cm} = \underline{10\text{ cm}}$

$P = 2 \times (2\text{ cm} + 5.5\text{ cm}) = 2 \times 7.5\text{ cm} = \underline{15\text{ cm}}$

$P = 4 \times 2.5\text{ cm} = \underline{10\text{ cm}}$

$P = 2 \times (3.5\text{ cm} + 1.5\text{ cm}) = 2 \times 5\text{ cm} = \underline{10\text{ cm}}$

$P = 4.3 + 4 + 3 = 11.3$ (cm)

$P = 5 \times 2.4\text{ cm} = \underline{12\text{ cm}}$

b) Let's measure the large shapes stuck on the BB. What do you notice? (similar to Ps' shapes but enlarged)

Ps come to BB to measure each side of A and do calculations. After the 1st shape, T asks if Ps if they know by how much the shapes have been enlarged. (By 5 (or 10) times, so the perimeters will be 5 (or 10) times more. T points to each of the other enlarged shapes and Ps give their perimeters by muliplying their own perimeters by 5 (or 10).

c) T draws rectangle on BB. This is the plan of a garden. (T writes only *a* and *b* on the sides.) Who can write a plan for its perimeter using the letters? P comes to BB. Class agrees/disagrees.

BB: $P = a + a + b + b = 2 \times a + 2 \times b = 2 \times (a + b)$

We measured its real sides with a tape measure and got these lengths. (T writes values for *a* and *b* on diagram.) What is its perimeter?

P comes to BB to write calculation. Class agrees/disagrees.

BB: $P = 2 \times (120 + 43) = 2 \times 163 = \underline{326}$ (m)

Why would we need to know its perimeter in real life? (e.g. To find out how much wood to buy for a fence, or how many bricks to buy for a wall, or how many plants to buy for a hedge, etc.)

If we wanted an accurate scale drawing of the garden, so that we could plan where to lay turf for the lawn, or where to make paths or where to plant shrubs, how could we do it? T asks several Ps what they think.

(e.g. Change the unit of measure to cm, i.e. reduce the sides by 100 times, so that $a = 120$ cm and $b = 43$ cm; or reduce the sides by 1000 times so that $a = 120$ mm and $b = 43$ mm)

Who remembers how to write a scale? P dictates or comes to BB. What does it mean? (Every 1 mm on the diagram represents 1 m in real life.) Let's see if you can draw the garden to scale in your *Ex. Bks.*

31 min

Notes

Paired work to start, monitored

Use copy masters copied onto coloured paper and shapes cut out. (Shapes on copy master enlarged by 5 times, so double the size if T wants enlargement of 10 times)

Ps write lengths beside relevant sides.

Reasoning, agreement, self-correction, praising

Elicit that:

A, B, C, D are rectangles

C is a square

E is an acute-angled triangle

F is a regular (or equilateral) pentagon

Whole class actity

Discussion, reasoning, agreement, praisng

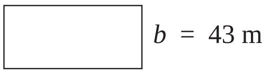
At a good pace

(Use enlargement of 10 times if possible to make calculation of perimeters easier.)

Whole class activity to start, then individual drawing

Drawn on BB or SB or OHT

BB:



Discussion, reasoning, agreement, praising

Involve several Ps.

Or Ps suggest reasons for why a scale drawing would be needed.

Praise all positive contributions.

BB: Scale: 1 mm → 1 m

Individual work, monitored, helped.

Praising, encouragement only

Y5

Lesson Plan 43

Activity ***Notes***

6

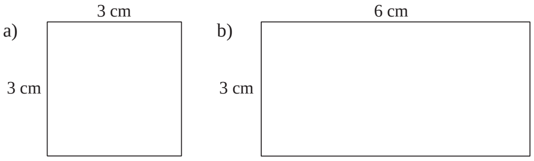
PbY5a, page 43

Q.2 Read: *Meaure the sides then calculate the length of each perimeter.*

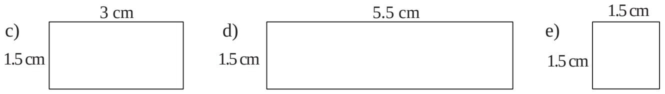
Ps write lengths beside relevant sides on diagrams in *Pbs*, calculate perimeter in *Ex.Bks*, then write the result in *Pbs*.

Set a time limit. Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Who agrees? Who had a different length of perimeter? etc. Accept small differences in lengths but Ps who are obviously wrong find and correct their mistakes (with neighbour's help if necessary).

Solution:



$P = 4 \times 3 \text{ cm} = \underline{12 \text{ cm}}$ $P = 2 \times (3 \text{ cm} + 6 \text{ cm}) = 2 \times 9 \text{ cm} = \underline{18 \text{ cm}}$



$P = 2 \times (1.5 \text{ cm} + 3 \text{ cm}) = 2 \times 4.5 \text{ cm} = \underline{9 \text{ cm}}$

$P = 2 \times (1.5 \text{ cm} + 5.5 \text{ cm}) = 2 \times 7 \text{ cm} = \underline{14 \text{ cm}}$

$P = 4 \times 1.5 \text{ cm} = \underline{6 \text{ cm}}$

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Ps measure with rulers (or compasses and rulers) to the nearest mm.

Differentiation by time limit

Reasoning, agreement, self-correction, praising

Who could write a general plan for the perimeter of a rectangle? Who agrees? Who could wite it another way? T shows short form.

BB: <u>Rectangle</u>:

$P = 2 \times (a + b)$

$= 2 \times a + 2 \times b = \underline{2a + 2b}$

<u>Square</u>: $4 \times a = \underline{4a}$

35 min

7

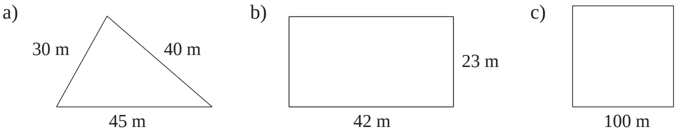
PbY5a, page 43

Q.3 Read: *What length of fence (including the gate) is needed to enclose each of these gardens?*

Set a time limit. Ps do calculations in *Ex. Bks*, and write only results in *Pbs*.

Reviewwith whole class. Ps could show perimeters on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Mistakes discussed and corrected.

Solution:



$P = 45 + 40 + 30 = \underline{115 \text{ (m)}}$

$P = 2 \times (42 \text{ m} + 23 \text{ m}) = 2 \times 65 \text{ m} = \underline{130 \text{ m}}$

$P = 4 \times 100 \text{ m} = \underline{400 \text{ m}}$

Individual work, monitored

Drawn on BB or use enlarged copy master or OHP

Differentiation by time limit

Reasoning, agreement, self-correction, praising

Extension (or as homework)

Ps make scale drawings of the gardens in *Ex. Bks.* and write the scale they have used above each one.

40 min

Y5

Lesson Plan 43

Activity

8

PbY5a, page 43*, *Q.4

a) Read: *Calculate the perimeter of a rectangle if:*

i) one side is 17 cm and the other is 38 cm
ii) one side is 2 m 10 cm and the other is 130 cm
iii) each side is 31 cm.

Deal with one at a time. T reads out question. Ps do calculations mentally or in in *Ex. Bks*, and show result on command.
P answering correctly explains reasoning to Ps who were wrong. Class agrees/disagrees. Correct result written in *Pbs.*

Solution:

i) $P = 2 \times (17 + 38) = 2 \times 55 = \underline{110}$ (cm) = 1 m 10 cm

ii) $P = 2 \times (210 + 130) = 2 \times 340 = \underline{680}$ (cm) = 6 m 80 cm

iii) $P = 4 \times 31$ cm = $\underline{124 \text{ cm}}$ = 1 m 24 cm (a square)

b) Read: *Calculate the length of the other side of a rectangle if one side is 70 cm and its perimeter is 350 cm.*

Show me the answer . . now! (105 cm) P who responded correctly explains reasoning at BB. Class agrees/disagrees. If no P was correct, T helps class to solve it together on BB.

Solution: e.g.

Plan: $P = 2 \times (a + b)$, 350 cm = $2 \times (70 \text{ cm} + b)$

b = 350 cm $\div\, 2 - 70$ cm = 175 cm – 70 cm = $\underline{105 \text{ cm}}$

c) Read: *Calculate the side of a square if its perimeter is:*

i) 360 cm Show me . . . now! (90 cm)
ii) 1 m 4 cm. Show me . . . now! (26 cm)

Ps who responded correctly explain reasoning. Class agrees or disagrees. Ps write correct operations and answers in *Pbs.*

Solution: i) a = 360 cm $\div$ 4 = $\underline{90 \text{ cm}}$
ii) a = 104 cm $\div$ 4 = $\underline{26 \text{ cm}}$

Let's write the general rules for perimeters of rectangles in your *Ex. Bks.* Try to learn them by heart! T writes on BB and Ps copy in *Ex. Bks*.

45 min

Notes

Whole class activity (or individual work, monitored, helped if Ps prefer)

T repeats slowly to give Ps time to think and calculate.

Results written on scrap paper or slates and shown in unison.

Reasoning, agreement, (self-correction), praising

Ps write correct operation in *Pbs.*

Encourage mental calculation by brighter Ps but *Ex. Bks* or slates can be used if necessary.

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

Ps write correct operation in *Pbs.*

Again, encourage mental calculation if possible.

Reasoning, agreement, (self-correction), praising

BB: General rules

Rectangle $P = 2 \times (a + b)$
$= 2 \times a + 2 \times b = 2a + 2b$

Square $P = 4 \times a = 4a$

Y5

R: Mental calculation. Perimeter

C: Measurement of area. Comparing units of measure

E: Estimation. Calculating area of a rectangle (square)

Lesson Plan 44

Activity | *Notes*

1

Mental practice

T says a multiplication or division. Ps say result. e.g.

6 × 4, 9 × 7, 81 ÷ 9, 70 × 3, 400 ÷ 10, 279 × 0, 0 ÷ 17,
413 ÷ 1, 355 ÷ 5, 100 ÷ 4, 1000 ÷ 4, 320 ÷ 0 (impossible!), etc.

Ps can give think of operations too! Class points out errors missed by the next Ps.

3 min

Whole class activity

At speed in order round class

If a P makes a mistake, next P must correct it.

Praising, encouragement only! In good humour!

2

Coordinate grid

Ps draw axes in *Ex. Bks* (or have already-prepared grid sheets on desks).

a) Mark these points on your grid and then join them up.

BB: A (1, 0), B (6, 0), C (6, 6), D (1, 6)

What shape have you drawn? (a rectangle)

Calculate its perimeter. **X**, come and show us your calculation. Who agrees? etc. What is the unit of measure? (grid units)

BB: $P = 2 \times (5 + 6) = 2 \times 11 = \underline{22}$ (grid units)

What is the area of the rectangle? Agree on the unit of measure. (grid squares) Elicit that there are 5 rows of 6 grid squares, so

BB: $A = 5 \times 6 = \underline{30}$ (grid squares)

b) Repeat for: BB: E (– 8, 0), F (– 3, 0), G (– 3, 5), H (– 8, 5)

Elicit that it is a square with area and perimeter:

BB: $P = 4 \times 5 = \underline{20}$ (grid units)

$A = 5 \times 5 = \underline{25}$ (grid squares)

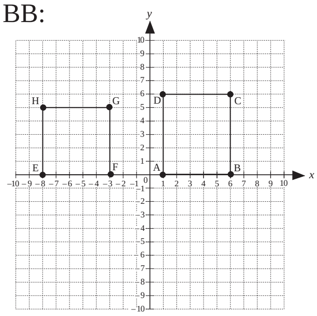
10 min

Individual work, monitored, then whole class review and discussion.

Grid drawn on BB or use enlarged copy master or OHP

Discussion, agreement, self-correction, praising.

BB:



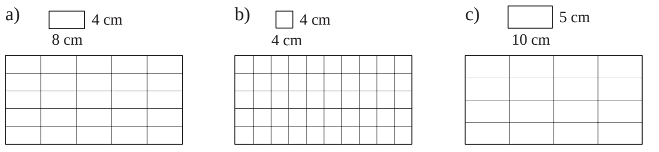
3

PbY5a, page 44

Q.1 Read: *The floor of a doll's house can be covered by three different shapes of tiles. What is the unt of area used in each case and how many such units are needed?*

Set a time limit. Review with whole class. Ps dictate to T or come to BB, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected. Agree that the area of the floor is the same in all 3 cases, but the number of units of area (i.e. tiles) needed changes according to their size.

Solution:



a) Unit used: $8 \times 4 = 32 \text{ cm}^2$ | Units needed: $5 \times 5 = 25$

b) Unit used: $4 \times 4 = 16 \text{ cm}^2$ | Units needed: $5 \times 10 = 50$

c) Unit used: $10 \times 5 = 50 \text{ cm}^2$ | Units needed: $4 \times 4 = 16$

What are the actual dimensions of the room? Who knows how to work it out? Come and explain. Who agrees? Elicit that:

Actual dimensions

a: 5 × 8 cm (or 10 × 4 cm, or 4 × 10 cm) = 40 cm

b: 5 × 4 cm (or 4 × 5 cm) = 20 cm

$P = 2 \times (40 \text{ cm} + 20 \text{ cm}) = 2 \times 60 \text{ cm} = \underline{120 \text{ cm}}$

$A = 40 \text{ cm} \times 20 \text{ cm} = \underline{800 \text{ cm}^2}$

15 min

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Do part a) with whole class first if Ps are unsure what to do.

Discussion, reasoning, agreement, self-correcting, praising

Whole class discussion

Involve several Ps

Reasoning, agreement, praising

Check:

$25 \times 32 = 50 \times 16 = 16 \times 50$
$= \underline{800}$ ✔

Y5

Lesson Plan 44

Activity

Notes

4

Perimeter and area 1

Draw a shape following my instructions. Start near the top of the page and close to the LHS. Draw a dot where the grid lines cross. From the dot, move your pencil by the number of units in the direction I say.

a) 5 units to the right, 8 units down, 2 units to the left, 3 units up, 3 units to the left and 5 units up.

What shape have you drawn? (hexagon)

What is its <u>perimeter</u>? Count the units or calculate in your *Ex. Bk* and show me . . . now! (26 units) P answering correctly explains.

BB: $P = 5 + 8 + 2 + 3 + 3 + 5 = 26$ (units)

What is its <u>area</u>? Show me . . . now! (31 unit squares)

P answering correctly explains reasoning. Who agrees? Who did it another way? etc. Mistakes discussed and corrected.

BB: $A = 5 \times 5 + 3 \times 2 = 25 + 6 = \underline{31}$ (unit squares)

Similarly for:

b) 2 right, 2 up, 3 right, 8 down, 3 left, 2 up, 2 left and 4 up

$P = 26$ units; $A = 3 \times 8 + 2 \times 4 = 24 + 8 = \underline{32}$ (unit squares)

c) 5 right, 3 down, 2 left, 2 down, 2 right, 3 down, 5 left, 3 up, 2 right, 2 up, 2 left and 3 up

$P = 26 + 4 \times 2 = 26 + 8 = \underline{34}$ (units); [P of 5 by 8 rectangle + 4]

$A = 2 \times 3 \times 5 + 2 = 30 + 2 = \underline{32}$ (unit squares)

20 min

Whole class aactivity

Ps work on sheets of squared paper or in squared *Ex. Bks*.

At a good pace

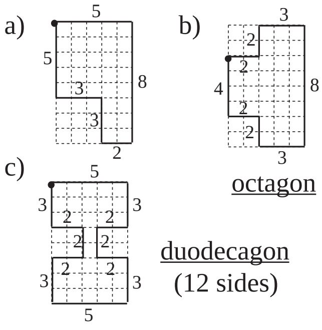
Discussion, agreement on names of shapes and their perimeter and area.

Discuss alternative ways to calculate the areas, e.g.

a) $A = 5 \times 8 - 3 \times 3$

$= 40 - 9 = \underline{31}$

Ps draw on BB or T has shapes already prepared:



<u>octagon</u>

<u>duodecagon</u> (12 sides)

5

Perimeter and area 2

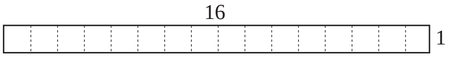
In your *Ex. Bks*, draw different rectangles which have:

a) area 16 unit squares and calculate their perimeters.

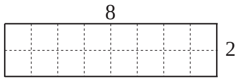
Set a time limit. BB:

Review with whole class. Ps come to BB or dictate to T.

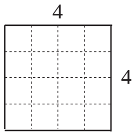
Elicit that possible side lengths are factor pairs of 16, and that the rectangle with the <u>shortest perimeter</u> is the most regular, i.e. a square.



$P = 2 \times (16 + 1) = 2 \times 17 = \underline{34}$ (units)



$P = 2 \times (8 + 2) = 2 \times 10 = \underline{20}$ (units)

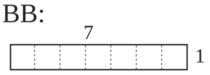


$P = 4 \times 4 = \underline{16}$ (units)

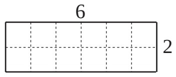
b) perimeter 16 units and calculate their areas. BB:

Repeat as with a).

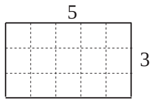
Elicit that the rectangle with the <u>greatest area</u> is the most regular, i.e. a square.



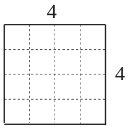
$A = 7 \times 1 = \underline{7}$ (units squares)



$A = 6 \times 2 = \underline{12}$ (units squares)



$A = 5 \times 3 = \underline{15}$ (units squares)



$A = 4 \times 4 = \underline{16}$ (unit squares)

26 min

Individual work, monitored, helped

T has square grid drawn on BB or SB or OHT

Discussion, reasoning, agreement, self-correcting, praising

Involve as many Ps as possible in the review and discussion.

Elicit the general rules for perimeter and area of a rectangle and square:

BB:

<u>Rectangle</u>: $P = 2 \times (a + b)$

$A = a \times b$

<u>Square</u>: $P = 4 \times a$

$A = a \times a$

Y5

Lesson Plan 44

Activity

Notes

6

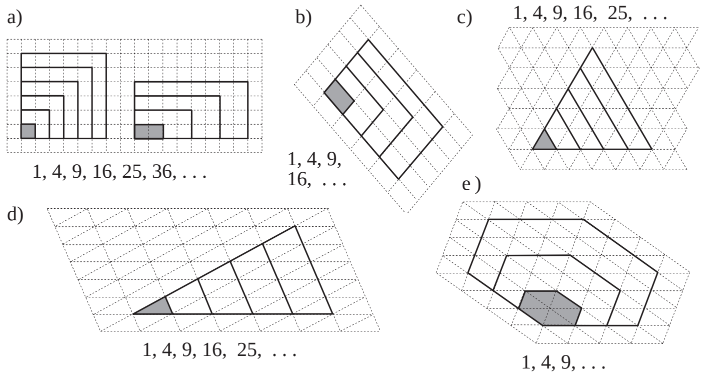
PbY5a, page 44

Q.2 Read: *How does the area of a polygon change if each side is enlarged by the same number of times? (In each part, the shaded shape is 1 unit.)*

Ps list the number of units of area in each enlargement beside each diagram in *Pbs* or in *Ex. Bks.* if they need more space. Set a time limit or deal with one part at a time if class is not very able.

Review with whole class. Ps come to BB to nameeach shape and say by how many times its sides and area have been enlarged. Who agrees? Who thinks something else? etc.

Solution:



30 min

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Discuss the unit of area to be used compared with grid unit.

Reasoning, agreement, self-correction, praising

What do you notice? (The sequences formed in all cases are the square numbers.)

In e), elicit that if the unit of area used is the grid unit, the sequence of enlargement is:

6, 24, 54, . . . (i.e. × 6)

Extra praise if Ps can generalise their findings. e.g.

'If the sides of a polygon are increased by *n* times, its area is increased by $n \times n$ times.

but do not expect this!

7

PbY5a, page 44

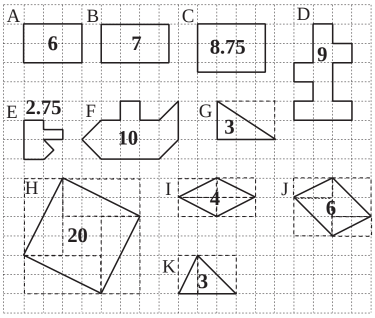
Q.3 Read: *Count or calculate the areas of these polygons and write them in your exercise book.*

What units of area will you use? (grid squares or grid triangles)
Set a time limit. Remind Ps that half units can be counted too.

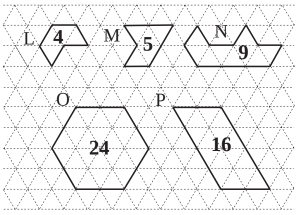
Review with whole class. Ps come to BB to write areas and explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

T shows how difficult shapes can be broken up into smaller shapes which are halves of rectangles or squares and the areas added together.

Solution:



Unit of area: grid squares



Unit of area: grid triangles

Extension

If we use 2 grid triangles as the unit of measure, i.e. a diamond, what are the areas of shapes L to P? T points to each shape in turn and Ps shout out the number of units of area.

35 min

Individual work, monitored, G to K helped (or done with whole class)

Drawn on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, self-correction, praising

A to C using calculation:

A: $2 \times 3 = \underline{6}$

B: $2 \times 3\frac{1}{2} = 6 + 1 = \underline{7}$

C: $2 \times 3 + 5 \times \frac{1}{2} + \frac{1}{4}$

$= 6 + 2\frac{1}{2} + \frac{1}{4} = \underline{8\frac{3}{4}}$

(Dashed lines in diagram show how shapes G to K can be broken up.)

BB: Unit of area: ◇

In unison. Praising

Y5

Lesson Plan 44

Activity ***Notes***

8

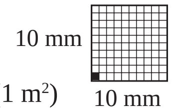
Standard units of area

What is the area of a square with sides 1 cm long? (1 cm square, or 1 square cm) How do we write it mathematically? P comes to BB. Class agrees/disagrees. (BB: $1 \text{ cm} \times 1 \text{ cm} = \underline{1 \text{ cm}^2}$ **)**

What is the area of a square with sides 1 mm long? P comes to BB.

How many mm^2 are equal to 1 cm^2? Let's write it on the BB. Ps dictate what T should write.

BB: $1 \text{ cm}^2 = 10 \times 10 \text{ mm}^2 = \underline{100} \text{ mm}^2$



What is the area of a square with sides 1 m? (1 m^2)

How many cm^2 (mm^2) are equal to 1 m^2? Ps dictate what T should write.

BB: $1 \text{ m}^2 = 100 \times 100 \text{ cm}^2 = 10\,000 \text{ cm}^2$ (10 thousand: 4 zeros)

$1 \text{ m}^2 = 1000 \times 1000 \text{ mm}^2 = \underline{1\,000\,000 \text{ mm}^2}$

(1 million: 6 zeros))

What is the area of a square with sides 1 km long? (1 km^2)

How many m^2 are equal to 1 km^2? Ps come to BB or dictate what T should write. BB: $1 \text{ km}^2 = 1000 \times 1000 \text{ m}^2 = \underline{1\,000\,000 \text{ m}^2}$

Let's practise using these standard units of area.

a) T says the lengths of 2 sides of a rectangle. Ps calculate its area mentally or in *Ex. Bks* and show on command (or dictate to T), giving the unit of area too. Show details of calculations on BB if problems.

i) $a = 15$ cm, $b = 21$ cm [$A = 15 \text{ cm} \times 21 \text{ cm} = 315 \text{ cm}^2$]

ii) $a = 30$ cm, $b = 21$ cm [$A = 30 \text{ cm} \times 21 \text{ cm} = 630 \text{ cm}^2$]

iii) $a = 30$ cm, $b = 42$ cm [$A = 30 \text{ cm} \times 42 \text{ cm} = 1260 \text{ cm}^2$]

b) How long is the other side of a rectangle if one side is 70 cm and its area is 3500 cm^2?

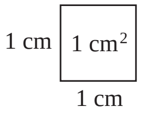
P comes to BB or dictate what T should write. Class agrees/disagrees.

BB: $a = 70$ cm, $A = 3500 \text{ cm}^2$

$b = 3500 \text{ cm}^2 \div 70 \text{ cm} = 350 \text{ cm}^2 \div 7 \text{ cm} = \underline{50 \text{ cm}}$

Whole class acitivy

BB:



▫ $1 \text{ mm} \times 1 \text{ mm} = \underline{1 \text{ mm}^2}$

T asks Ps to think of 10 rows of 10 mm squares. Elicit that area of each row is 10 mm^2.

Ask Ps to think of

- 100 rows of 100 cm squares
- 1000 rows of 1000 mm squares

[T might tell Ps of other units of area used in some countries:

1 <u>are</u> = $10 \times 10 \text{ m}^2 = \underline{100 \text{ m}^2}$

1 <u>hectare</u> = $100 \times 100 \text{ m}^2$

$= \underline{10\,000 \text{ m}^2}$

Individual work, monitored, reviewed, or continue as whole class activity

At a good pace

Responses shown on scrap paper or slates in unison.

Discussion, reasoning, agreement, self-correction, praising

Ps write operation in *Ex. Bks.*

42 min

9

PbY5a, page 44, Q.4

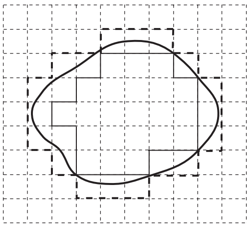
Read: *The area of this shape is i) more than what ii) less than what?*

How can we work it out? Give Ps a minute to think about it, and if no P has thought of a strategy, T gives hints.

Draw the biggest polygons possible inside and outside the shape and count their areas. Ps come to BB to draw the polygons (with T's help) and rest of class work in *Pbs* too. Agree on the two areas (in grid squares). What should we do now? (Write an inequality)

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

BB:



BB: 22 grid squares $< A <$ 42 grid squares

How could we get closer to the exact area? (Make the grid more dense, e.g. draw grid lines at every mm.)

Whole class activity (or individual trial if Ps wish)

Drawn on BB or use enlarged copy master or OHP

Allow Ps to suggest strategies first.

Discussion, reasoning, agreement, praising

Extra praise if Ps think of drawing polygons without prompting from T.

T suggests this strategy if no P does so and asks Ps what they think of it.

45 min

Y5

Lesson Plan
45

Activity

Notes

Practice in drawing and measuring with compasses, revision, activities, consolidation

PbY5a, page 45

Solutions:

Q.1

a	5	3	4	**24**	6	17	**58.5**	8	12
b	**9**	7	6	4	**57**	7	9	8	**60**
P	28	**20**	**20**	56	126	**48**	135	**32**	144

Rule: $P = 2 \times (a + b)$ $(= 2a + 2b)$

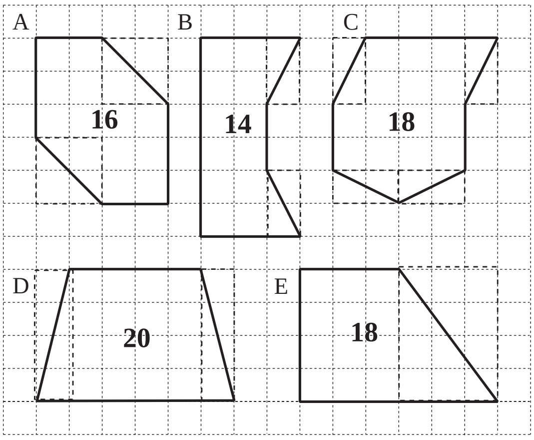
Q.2 a) i) 16 ii) 32 iii) 80 iv) 128 (tiles)

b) Area: $4\text{ m} \times 3\text{ m} = 12\text{ m}^2$ No. of tiles: $12 \times 16 = 192$

Q.3 a) and b)

a	1	2	3	4	5	6	7	8	9
b	17	16	15	14	13	12	11	10	9

Q.4 a)



b) i) greatest area: D ii) smallest area: B

c) C and E

Y5

R: Area, perimeter

C: Nets: surface area of cubes and cuboids

E: Polyhedrons and other solids

Lesson Plan

46

Activity

Notes

1

Mental relay practice

T says a 3-term multiplication. P says result and gives another 3-term multiplication to next P. e.g.

$1 \times 2 \times 2$, $4 \times 3 \times 5$, $6 \times 3 \times 3$, $9 \times 20 \times 2$, $10 \times 4 \times 6$, etc.

Class points out errors. (Multiplications can be done in easiest order.)

Whole class activity

At speed, in order round class.

In good humour!

Praising, encouragement only

3 min

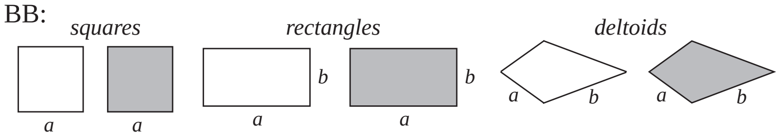
2

Area and perimeter

What do these diagrams suggest to you? (perimeter or area)

Ps come to BB to point to a shape, name it, say whether perimeter or area is shown and write an appropriate operation using the given letters. Other Ps help if necessary.

BB:



Perimeter Area Perimeter Area Perimeter Area

$P = 4 \times a$ $P = 2 \times (a + b)$ $P = 2 \times (a + b)$

$A = a \times a$ $A = a \times b$ $A = ?$

Agree that we have not yet learned how to find the area of a deltoid without the help of a grid, but we will learn it another time.

Whole class activity

Drawn on BB or SB or OHT

At a good pace

Discussion, agreement, praising

Elicit that a <u>deltoid</u> is a quadrilateral with 2 pairs of adjacent sides equal.

It is not a rectangle, so we cannot use the equation:

$A = a \times b$

5 min

3

Solids

T has a demonstration set of various solids on desk (including at least 1 cube and 2 other different types of cuboid, one with a square base)

a) **A**, come and choose the solids which have only <u>plane</u> faces. Is **A** correct? Who remembers the name we give a solid with many plane faces? (<u>polyhedron</u>) T tells class that 'poly' means 'many' and 'hedron' means 'plane faces'. What other word that you know begins with poly? (polygon, a plane shape with many straight sides)

B, come and choose the polyhedrons which have rectangular faces. Is **B** correct? Who remembers what we call such solids? (<u>cuboids</u>)

C, come and choose a cuboid which has both square and rectangular faces. We call this a <u>square-based</u> cuboid.

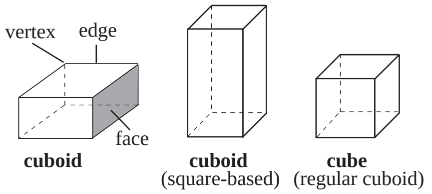
D, come and choose a cuboid which has <u>only</u> square faces. What do we call it? (a <u>cube</u>)

b) Let's show these 3 types of cuboid in a Venn diagram. Ps dictate what T should draw. Let's check it is correct.

Agree that every cube is a cuboid, but not every cuboid is a cube.

c) Eveyone hold up a cuboid. Show me one of its faces with your hand. How many faces does it have? (6 faces) P comes to BB to label a face on one of the diagrams. Repeat for edges (12) and vertices (8).

BB:



<u>Cuboids</u>

6 faces

12 edges

8 vertices

Whole class activity

Ps have a smaller version of T's set on desks too, or at least have models of the 3 cuboids.

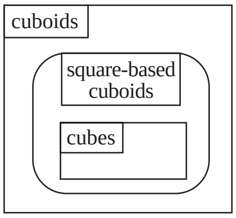
Agree that a plane face is a flat surface.

BB: <u>polyhedron</u>

Agreement, praising

T has axiomatic diagrams already prepared on BB or SB or OHT and uncovers each cuboid as it is identified, adding its name too.

BB:



Demonstration, agreement, praising

T could also show a frame model of a cuboid and Ps come to front of class to identify the components.

10 min

Y5

Lesson Plan 46

Activity | ***Notes***

4

Surface area of cuboids

a) This cuboid has edges 4 cm, 2 cm and 3 cm Let's show the measurements in a larger diagram. T shows drawing of cuboid on BB and Ps come to BB to write lengths beside appropriate edges.

What sizes of rectangles cover its surface?

(Two 4 cm × 3 cm rectangles, two 4 cm × 2 cm rectangles and two 3 cm × 2 cm rectangles, i.e. 6 rectangles altogether)

What lengths are its edges? (Four 4 cm edges, four 3 cm edges and four 2 cm edges, i.e. 12 edges altogether)

Elicit that adjacent faces (edges) are perpendicular to each other and opposite faces (edges) are equal and parallel to each other.

What can you tell me about each vertex? (3 edges join at each vertex and any 2 of them are perpendicular to one another.)

T shows a net for the cuboid and folds it around the cuboid to show that it covers its surface exactly, with no overlaps. Here is a larger diagram of the net. Class discusses which part of the net relates to which part of the cuboid's surface. Ps come to BB to point and explain, referring to model and to both diagrams on BB. Class agrees/disagrees. After agreement, Ps write lengths on net too.

Agree that the area of the net equals the area of the surface of the cuboid. How can we calculate the area of the net? (Add up the areas of the 6 rectangles) Ps dictate what T should write. Class agrees/ disagrees.

BB: $A = (4 \times 3 + 4 \times 2 + 3 \times 2) \times 2 = (12 + 8 + 6) \times 2$

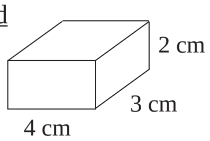
$= 26 \times 2 = \underline{52}$ (cm^2)

So what is the surface area of the cuboid? (52 cm^2)

Whole class activity

T shows model and has diagram already prepared on BB or SB or OHT:

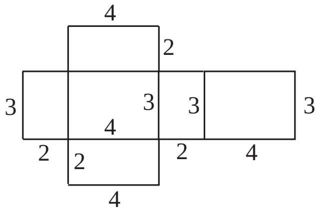
Cuboid



Also elicit that opposite faces are congruent (i.e. same shape and size).

Agreement, praising

BB: Net for cuboid



Discussion, reasoning, agreement, praising

b) Repeat the procedure with a cube of sides 3 cm. First discuss its faces, edges and vertices. (6 faces are congruent squares)

Draw a net for a cube and write an operation to calculate its area in your *Ex. Bks*. Set a time limitt. (Ps can work in pairs if they wish.)

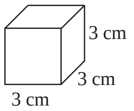
Review with whole class. T shows a net and wraps it around the cube to check that it covers the surface exactly. Who drew a different net? Deal with all cases. Agree that many nets are possible.

X, come and write an operation to calculate its area. Who agrees? Who wrote a different one? etc Mistakes discussed and corrected.

BB: $A = 6 \times (3 \times 3) = 6 \times 9 = \underline{54}$ (cm^2)

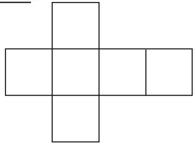
Whole class discussion to start

BB: Cube



Net for a cube:

e.g.



20 min

5

PbY5a, page 46

Q.1 a) Read: *Complete the drawing of the net. Calculate the area of each face and then the surface area of the cuboid.*

Ps use the diagram of the cuboid to help them. Set a time limit.

Review with whole class. P comes to BB to complete the net and dictate the areas of the faces, explaining reasoning. Class points out errors. Mistakes corrected.

Solution: ABCD = 4 × 2 = $\underline{8}$ DCGH = 4 × 1 = $\underline{4}$

EFGH = 4 × 2 = $\underline{8}$ ADHE = 2 × 1 = $\underline{2}$

ABFE = 4 × 1 = $\underline{4}$ BCGF = 2 × 1 = $\underline{2}$

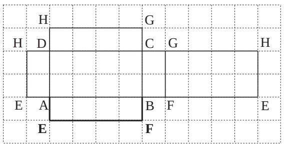
Total area = 2 × (8 + 4 + 2) = 2 × 14 = $\underline{28}$ (grid squares)

Individual work, monitored, helped in completing the net

Drawn on BB or use enlarged copy master or OHP

Discussion, agreement, self-correction, praising

BB:



Y5

Lesson Plan 46

Activity

Notes

5

(Continued)

b) Read: *In your exercise book, draw a net for each of these cuboids, then calculate the area of each face and its total surface area. Write the surface area here.*

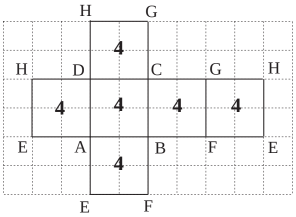
Deal with one at a time. Set a time limit.

Review with whole class. T has grids already prepared. T chooses 2 Ps to come to BB to draw their (different) nets. Who drew another one? Come and show us. Class decides whether nets are correct.

What is the surface area of the cube (cuboid)?
Show me . . . now! Ps answering correctly explain at BB to Ps who were wrong. Mistakes discussed and corrected.

Solution:

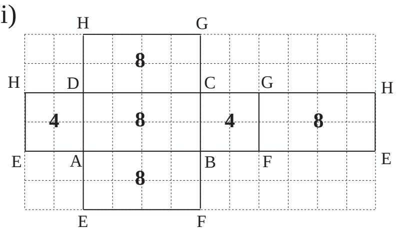
i)



$A = 6 \times 4$

$= \underline{24}$ (grid squares)

ii)



$A = 2 \times 4 + 4 \times 8$

$= 8 + 32$

$= \underline{40}$ (grid squares)

30 min

T could have models already made up to show to class.

Grids drawn on BB or use enlarged copy master or OHP

(Less able Ps could use copy master instead of *Ex. Bks.*)

Or to save time, T could have some nets already prepared and ask who drew them.

T helps with labelling vertices on the nets

Discussion, reasoning, agreement, self-correction, praising

Extra praise for unexpected but correct nets.

6

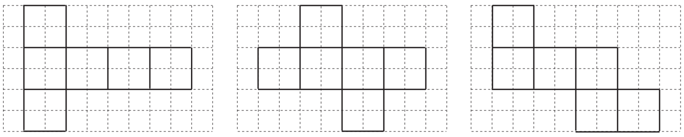
PbY5a, page 46

Q.2 Read: *In your exercise book, draw 3 different nets for a cube of side 2 units.*

Try to think of 3 nets which are different from the net that you drew in Q.1b. Try it out roughly on scrap paper first.

Set a time limit of 3 minutes. Review with whole class. T has 3 nets already prepared on BB. T points to each in turn and asks who drew it. Who drew a net which is different from these? Come and draw it for us. Class decides whether it is correct.

Solution: e.g.



35 min

Individual work, monitored, helped

Less able Ps could use grid sheets from copy master in *LP 46/5.*

Agreement, self-correction, praising

(If disagreement, check nets by drawing on grids, cutting out and folding to see if they form cubes.)

Y5

Lesson Plan 46

Activity

Notes

7

PbY5a, page 46

Q.3 Read: *Calculate the surface area of each cuboid if a, b and c are the lengths of its edges.*

T helps by showing a diagram and net (see copy master) on BB and labelling them with a, b and c. Set a time limit.

Review with whole class. Ps come to BB to write operations and explain reasoning. Who agrees? Who did it another way? etc. Mistakes discussed and corrected.

Solution:

a) $a = 5$ cm, $b = 10$ cm, $c = 3$ cm

$A = 5 \times 10 \times 2 + 5 \times 3 \times 2 + 10 \times 3 \times 2$

$= 100 + 30 + 60 = \underline{190}$ (cm^2), <u>or</u>

$A = 2 \times (5 \times 10 + 5 \times 3 + 10 \times 3)$

$= 2 \times (50 + 15 + 30) = 2 \times 95 = \underline{190}$ (cm^2)

b) $a = 8$ m, $b = 7$ m, $c = 10$ m

$A = 2 \times (8 \times 7 + 8 \times 10 + 7 \times 10)$

$= 2 \times (56 + 80 + 70) = 2 \times 206 = \underline{412}$ (m^2)

c) $a = 1$ m, $b = 1$ m, $c = 7$ m 50 cm

$A = 2 \times (1 \times 1 + 1 \times 7.5 + 1 \times 7.5)$

$= 2 \times (1 + 7.5 + 7.5) = 2 \times 16 = \underline{32}$ (m^2)

Extension

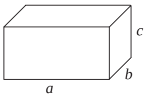
Who could write for the <u>general</u> rule for the surface area of any cuboid, using only letters? Ps come to BB or dictate to T.

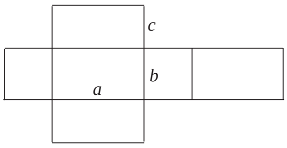
BB: $A = 2 \times (a \times b + a \times c + b \times c)$

Individual work, monitored, helped

BB:

e.g.





Discussion, reasoning, agreement, self-correction, praising

Discuss what the cuboids could be in real life. e.g.

a) a box

b) a building

c) a pillar

Whole class activity

T could show short form:

BB: $A = 2\,(ab + ac + bc)$

40 min

8

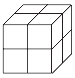
PbY5a, page 46, Q.4

Read: *How many unit cubes are needed to build these cubes?*

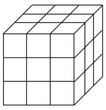
Ps could show on slates or scrap paper on command. Ps come to BB to explain on diagrams (or on model). Elicit/tell that the number of unit cubes is the <u>volume</u> of the cube, i.e. the amount of space it takes up.

What is the surface area of each cube? Ps come to BB or dictate to T, explaining reasoning. (If nobody knows, T gives hints: What is the area of each face? How many faces does it have?)

Solution:

a)  8 unit cubes

$A = 6 \times 2 \times 2 = \underline{24}$ unit squares

b)  27 unit cubes

$A = 6 \times 3 \times 3 = \underline{54}$ unit squares

Extension

Let's compare the surface area of a) with 8 separate unit cubes and that of b) with 27 separate unit cubes.

BB: 1 unit cube: $A = 6 \times (1 \times 1) = \underline{6}$ (unit squares)

a) 8 unit cubes: $A = 8 \times 6 = 48$ unit squares $>$ 24 unit squares ($\times$ 2)

b) 27 unit cubes: $A = 27 \times 6 = 162$ unit squares $>$ 54 unit squares ($\times$ 3)

Whole class activity

Drawn on BB or use enlarged copy master or OHP

If possible, T has real models made from multi-link cubes.

BB: <u>volume</u>

unit of volume: unit cube

(Ps could do calculations in *Ex. Bks*. first before coming to BB.)

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

Ps dictate what T should write.

Agreement, praising

(Or done as homework if there is not enough time.)

45 min

Y5

R: Parallel, perpendicular lines. Calculations

C: Shapes (1-D, 2-D). Right angles

E: Problems

Lesson Plan 47

Activity | ***Notes***

1

Surface area 1

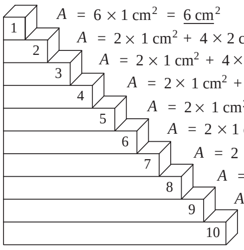
Use Cuisennaire rods if T and Ps have them, otherwise T has already prepared strips made from multi-link 1 cm cubes.

Let's calculate the area of the Cuisennaire rods (plastic strips).

Ps measure own rods or strips (1 cm to 10 cm) and dicate lengths to T, or Ps come to T's desk to measure T's rods (strips) and tell class the lengths. Ps dictate calculations for the surface areas (or come to BB to write some). Class points out errors. What do you notice?

BB:

(Surface areas form a sequence, increasing by 4 cm^2)



$A = 6 \times 1\text{ cm}^2 = \underline{6\text{ cm}^2}$

$A = 2 \times 1\text{ cm}^2 + 4 \times 2\text{ cm}^2 = 2\text{ cm}^2 + 8\text{ cm}^2 = \underline{10\text{ cm}^2}$

$A = 2 \times 1\text{ cm}^2 + 4 \times 3\text{ cm}^2 = 2\text{ cm}^2 + 12\text{ cm}^2 = \underline{14\text{ cm}^2}$

$A = 2 \times 1\text{ cm}^2 + 4 \times 4\text{ cm}^2 = 2\text{ cm}^2 + 16\text{ cm}^2 = \underline{18\text{ cm}^2}$

$A = 2 \times 1\text{ cm}^2 + 4 \times 5\text{ cm}^2 = 2\text{ cm}^2 + 20\text{ cm}^2 = \underline{22\text{ cm}^2}$

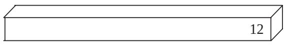
$A = 2 \times 1\text{ cm}^2 + 4 \times 6\text{ cm}^2 = 2\text{ cm}^2 + 24\text{ cm}^2 = \underline{26\text{ cm}^2}$

$A = 2 \times 1\text{ cm}^2 + 4 \times 7\text{ cm}^2 = 2\text{ cm}^2 + 28\text{ cm}^2 = \underline{30\text{ cm}^2}$

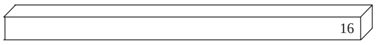
$A = 2 \times 1\text{ cm}^2 + 4 \times 8\text{ cm}^2 = 2\text{ cm}^2 + 32\text{ cm}^2 = \underline{34\text{ cm}^2}$

$A = 2 \times 1\text{ cm}^2 + 4 \times 9\text{ cm}^2 = 2\text{ cm}^2 + 36\text{ cm}^2 = \underline{38\text{ cm}^2}$

$A = 2 \times 1\text{ cm}^2 + 4 \times 10\text{ cm}^2 = 2\text{ cm}^2 + 40\text{ cm}^2 = \underline{42\text{ cm}^2}$



$A = 2 \times 1\text{ cm}^2 + 4 \times 12\text{ cm}^2 = 2\text{ cm}^2 + 48\text{ cm}^2 = \underline{50\text{ cm}^2}$



$A = 2 \times 1\text{ cm}^2 + 4 \times 16\text{ cm}^2 = 2\text{ cm}^2 + 64\text{ cm}^2 = \underline{66\text{ cm}^2}$

What do you think the surface area of a 12 cm (16 cm) rod (strip) would be? Show me . . . now! (50 cm^2, 66 cm^2)

Ps answering correctly explain how they worked it out.

(12 cm rod: $42\text{ cm}^2 + 2 \times 4\text{ cm}^2 = 42\text{ cm}^2 + 8\text{ cm}^2 = \underline{50\text{ cm}^2}$)

(16 cm rod: $50\text{ cm}^2 + 4 \times 4\text{ cm}^2 = 50\text{ cm}^2 + 16\text{ cm}^2 = \underline{66\text{ cm}^2}$)

Let's check by doing the calculations for surface area. Ps dictate operations and T writes beside 12 and 16 cm strips in diagram on BB.

Notes:

Whole class activity

T has models and also diagram drawn on BB (or use enlarged copy master or OHP)

If Ps have multilink cubes on desks, they make each strip it is dealt with.

At a good pace

Involve as many Ps as possible.

Reasoning, agreement, praising, encouragement only

(Surface areas of 12 cm and 16 cm rod added to diagram later – see opposite and below)

Allow Ps time to think about it In unison, on scrap paper/slates

Reasoning, agreement, praising (as 11, 13, 14, 15 cm terms have been missed out)

Agreement, praising

Extension

T lays the 1 cm to 10 cm rods one on top of the other, (or sticks the multilink strips together) as in the top part of the diagram.

What shape have I made? (polyhedron) Elicit that a <u>polyhedron</u> is a solid with many plane faces.

- How many cm cubes are in this polyhedron? Ps dictate the addition.

  BB: $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 5 \times 11 = \underline{55}$
- What is its surface area? Ps suggest how to work it out. T gives hints if necessary. (55 on front, 55 on back, 10 on bottom, 10 on LHS, 10 on tops of steps and 10 on fronts of steps on RHS) i.e.

  BB: $A = 2 \times 55 + 4 \times 10 = 110 + 40 = \underline{150}$ (cm^2)
- How many faces, edges and vertices does it have? (f: 24, e: 66, v: 44)

Notes:

Whole class activity

Ps make the polyhedron too if they have the rods/strips on desks.

T points out easy way to calculate if no P remembers.

$1 + 10 = 2 + 9 = \ldots = 11$

Number of faces, edges, etc. is difficult, so T should help.

To Ts only: (as a check)

Euler's formula: $f + v - e = 2$

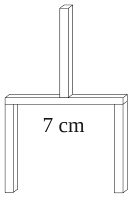
10 min

2

Surface area 2

Let's calculate the surface area of this polyhedron made from 7 cm rods (or strips of seven 1 cm multilink cubes). T shows model and also a diagram on BB or OHT. Discuss the best way to do the calculation.

BB:



If no P suggests method below, T gives hints.

1 rod: $A = 2 + 4 \times 7 = 2 + 28 = \underline{30}$ (cm^2)

Polyhedron: $A = 4 \times 30 - 3 \times 2 = 120 - 6 = \underline{114}$ (cm^2)

$\uparrow$

[As there are (1 cm^2 + 1 cm^2) hidden 3 times.]

Notes:

Whole class activity

Drawn on BB or SB or OHT

If possible, Ps build shape on desks with rods or cubes.

Discussion involving several Ps, reasoning, agreement, praising

Extra praise if Ps think of this idea without help from T.

15 min

Activity

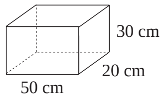
3

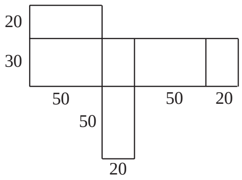
Find the mistakes!

I did these calculations in a hurry. Do you think that they are correct, or can you find any mistakes? Give Ps a minute to think about it and discuss with their neighbour's if they wish.

Ps come to BB to analyse each calculation and say whether they think it is correct or not. If incorrect, Ps correct the mistakes. Class agrees/ disagrees.

a) BB:





$$\begin{aligned} A &= 2 \times (50 \times 20) + 140 \times 30 \\ &= 2 \times 1000 + 4200 \\ &= 2000 + 4200 \\ &= \underline{6200\ (\text{cm}^2)}\ ✔ \end{aligned}$$

(It is correct, as 4 of the faces laid next to each other horizontally make a longer rectangle measuring 140 cm by 30 cm.)

b) I wanted to paint the wall and ceiling of my living room, so I worked out the surface area in order to buy the right amount of paint. My living room is 6 m long, 5 m wide and 3.5 m high, so this is the calculation I did to work out the area I wanted to paint.

BB: $A = 2 \times (6 \overset{30}{\times} 5 + 6 \overset{21}{\times} 3.5 + 5 \overset{17.5}{\times} 3.5) = 2 \times 68.5 = \underline{137}\ (\text{m}^2)$

(Calculation is correct but this is the surface area of the whole room – the floor does not need to be painted! Surface area of the walls and ceiling is:

BB: $A = 137 - 30 = \underline{107}\ (\text{m}^2)$

but the area to be painted will be <u>less</u> than this, because of doors, windows, fireplace, etc.)

c) My fish tank is 60 cm long, 300 mm wide and 40 cm high and I did this calculation to work out its surface area.

BB: $$\begin{aligned} A &= 60 \times \underline{300} + 2 \times (60 \times 40) + 2 \times (\underline{300} \times 40) \\ &= 18\,000 + 2 \times 2400 + 2 \times 12\,000 \\ &= 18\,000 + 4800 + 24\,000 \\ &= \underline{46\,800}\ (\text{cm}^2)\ ✗ \end{aligned}$$

(It does not have a lid!)

(Method is correct, but calculation is wrong, as 300 mm = <u>30 cm</u>)

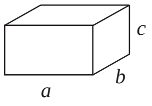
Who can do the calculation correctly? Ps come to BB or dictate to T, explaining reasoning. Class checks that they are correct.

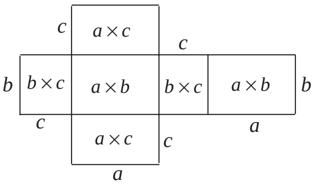
BB: $$\begin{aligned} A &= 60 \times 30 + 2 \times (60 \times 40) + 2 \times (30 \times 40) \\ &= 1800 + 2 \times 2400 + 2 \times 1200 \\ &= 1800 + 4800 + 2400 = \underline{9000}\ (\text{cm}^2)\ ✔ \end{aligned}$$

Extension

How could we write the general rule for the surface area of a cuboid?

BB:





T draws cuboid and its net on BB and Ps come to BB to label them and write the calculation, with help of other Ps and T where necessary.

$$\begin{aligned} A &= 2 \times (a \times b) + 2 \times (a \times c) + 2 \times (b \times c) \\ &= 2 \times (a \times b + a \times c + b \times c) \quad [= 2\,(ab + ac + bc)] \end{aligned}$$

25 min

Notes

Whole class activity

Drawn/written on BB or use enlarged copy master or OHP

Pscan work in *Ex. Bks* or use scrap paper if necessary.

Allow the use of calculators for checking.

Reasoning, debate, agreement, checking, praising

BB: 50 cm + 20 cm + 50 cm + 20 cm = <u>140 cm</u>

T has the net already cut out and folds it to confirm that it makes a cuboid.

BB: Length: 6 m
Width: 5 m
Height: 3.5 m

If Ps do not think of this, T gives hints.

BB: $A < 107\ \text{m}^2$

Extra praise if Ps realise this.

BB: Length: 60 cm
Width: 300 mm
Height: 40 cm

Calculation written on BB or SB or OHT

Ps come to BB to underline the mistakes and explain reasoning.

Ps may check result with a calculator.

Some Ps might remember this as the extension to *Lesson 46, Activity 7*.

Have no expectations and do not expect Ps to learn it.

[T might show short form in order that Ps become familiar with the meaning of the notation, but do not expect them to use it yet.]

Activity ***Notes***

4

PbY5a, page 47

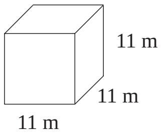
Q.1 Read: *Calculate the surface area of these cuboids.*

Deal with one part at a time under a time limit. Ps write operation and calculate the result in *Pbs*. Remember to write the unit too!

Review with whole class. Ps come to BB to show their solution, explaining reasoning. Who agrees? Who wrote something else? etc. If disagreement, allow Ps to check with a calculator. Mistakes discussed and corrected.

Solution:

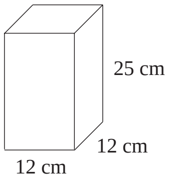
a)



$A = 6 \times (11 \times 11)$

$= 6 \times 121 = \underline{726\ (\text{m}^2)}$ (cube)

b)



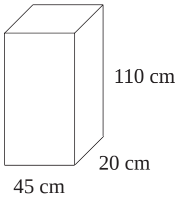
$A = 2 \times (12 \times 12) + 4 \times (12 \times 25)$

$= 2 \times 144 + 4 \times 300$

$= 288 + 1200 = \underline{1488\ (\text{cm}^2)}$

(square-based cuboid)

c)



$A = 2 \times (45 \times 20 + 45 \times 110 + 20 \times 110)$

$= 2 \times (900 + 4950 + 2200)$

$= 1800 + 9900 + 4400 = \underline{16\,100\ (\text{cm}^2)}$

$(= 1\ \text{m}^2\ \ 6100\ \text{cm}^2)$

33 min

Individual work, monitored, (helped)

Drawn on BB or use enlarged copy master or OHP

Difficult interim calculations can be done in *Ex.Bks.*

Discussion, reasoning, agreement, self-correction, praising

Show details on side of BB if problems, e.g.

BB:

$$\begin{array}{r} 2\ 5 \\ \times\ 1\ 2 \\ \hline 5\ 0 \\ 2\ 5\ 0 \\ \hline 3\ 0\ 0 \end{array}$$

$$\begin{array}{r} 4\ 5 \\ \times\ 1\ 1\ 0 \\ \hline 4\ 5\ 0 \\ 4\ 5\ 0\ 0 \\ \hline 4\ 9\ 5\ 0 \end{array} \qquad \begin{array}{r} 1\ 1\ 0 \\ \times\ 2\ 0 \\ \hline 0 \\ 2\ 2\ 0\ 0 \\ \hline 2\ 2\ 0\ 0 \end{array} \qquad \begin{array}{r} 1\ 8\ 0\ 0 \\ 9\ 9\ 0\ 0 \\ +\ 4\ 4\ 0\ 0 \\ \hline 1\ 6\ 1\ 0\ 0 \\ {}_{2}\ \ \ \ \ \ \ \end{array}$$

As $10\,000\ \text{cm}^2 = 1\ \text{m}^2$

5

PbY5a, page 47

Q.2 Read: *Calculate the surface area of these solids in your exercise book. Write the answers here.*

How many unit cubes is each of them made from? This is its *<u>volume</u>*.

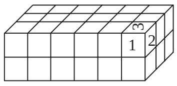
Agree that the unit of area is unit squares and the unit of volume is unit cubes. Ps count the squares on the visible faces to determine the dimensions of the cuboids. Set a time limit or deal with one at a time if class is not very able.

Review with whole class. Ps could show areas and volumes on command. Ps answering correctly come to BB to explain reasoning. Class agrees/ disagrees. Mistakes discussed/corrected.

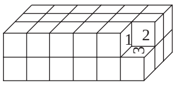
Compare the surface areas and volumes. What do you notice?

Solution:

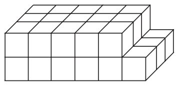
a)



b)



c)



A =	<u>72</u> square units	⊜	A =	<u>72</u> square units	⧁	A =	<u>70</u> square units
V =	<u>36</u> unit cubes	⧁	V =	<u>35</u> unit cubes	⧁	V =	<u>33</u> unit cubes

Reasoning: e.g.

a) $A = 2 \times (6 \times 2 + 3 \times 2 + 6 \times 3) = 2 \times (12 + 6 + 18)$

$= 2 \times 36 = \underline{72}\ (\text{unit}^2)$

b) $A = 72 - 3 + 3 = \underline{72}$ (unit squares)

c) $A = 72 - 8 + 6 = 72 - 2 = \underline{70}$ (unit squares)

38 min

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

T has large models already made up for demonstration.

Discussion, reasoning, agreement, self-correcting, praising

[b) is 1 cube less than a) but its surface area is the same because the 3 newly exposed squares take the place of the 3 original squares lost]

Extra praise if Ps notice that:

b) 3 unit squares lost, 3 gained

c) 8 unit squares lost, 6 gained

Y5

Lesson Plan 47

Activity		*Notes*

6

PbY5a, page 47

Q.3 Read: *A box is shaped like a cuboid but is open at the top. Inside, it is 1.4 m long, 1 m wide and 80 cm high. What is its inner surface area?*

Ps can draw a diagram in *Ex. Bks* or on scrap paper to help them. Set a time limit.

Review with whole class. Ps could show result on scrap paper or slates on command. Ps answering correctly explain at BB to to those who were wrong. Class agrees/disagrees. Ps can check with a calculator. Mistakes discussed and corrected.

Solution:

1.4 m = 140 cm, 1 m = 100 cm

$A = (140 \times 100) + 2 \times (140 \times 80) + 2 \times (100 \times 80)$

$= 14\,000 + 2 \times 11\,200 + 2 \times 8000)$

$= 14\,000 + 22\,400 + 16\,000$

$= \underline{52\,400\ (\text{cm}^2)}$

[= 5 m^2 2400 cm^2] (as 10 000 cm^2 = 1 m^2)

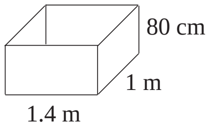
Answer: Its inner surface area is 52 400 cm^2.

41 min

Individual work, monitored, helped

Discussion, reasoning, agreement, self-correction, praising

BB: e.g.



$140 \times 80 = 1400 \times 8$

$$\begin{array}{r} 1\,4\,0\,0 \\ \times\ 8 \\ \hline 1\,1\,2\,0\,0 \\ \hline {}_{3} \end{array} \qquad \begin{array}{r} 1\,4\,0\,0\,0 \\ 2\,2\,4\,0\,0 \\ +1\,6\,0\,0\,0 \\ \hline 5\,2\,4\,0\,0 \\ \hline {}_{1} \end{array}$$

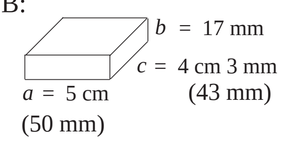
7

PbY5a, page 47, Q.4

Read: *Calculate the surface area of a small box which has these measurements. a = 5 cm, b = 17 mm, c = 4 cm 3 mm*

What should we do first? (Draw a digram.) Ps come to BB to draw cuboid and write the lengths beside the relevant edges.

BB:



Now what should we do? (Convert the lengths to the same unit.)

Ps come to BB or dictate to T.

Now let's calculate the area. Ps come to BB to write operations, doing necesssary calculations at side of BB. Class agrees/disagrees.

BB: $A = 2 \times (50 \times 17 + 50 \times 43 + 17 \times 43)$

$= 2 \times (850 + 2150 + 731)$

$= 2 \times 3731$ ↙ Elicit that: 100 mm^2 = 1 cm^2

$= \underline{7462\ (\text{mm}^2)}$ [= 74 cm^2 62 mm^2 = 74.62 cm^2]

Extension

Who could write the general rule (formula) for the area of the surface of a cuboid (cube)? Ps come to BB to try it with help of class and T.

BB: Area of a cuboid = $2 \times (a \times b + a \times c + b \times c)$ [= $2(ab + ac + bc)$]

Area of a cube = $6 \times a \times a$ [= $6a^2$] T could show short forms.

45 min

Whole class activity

(or individual work if Ps wish, with calculation finished at home if time runs out)

At a good pace

Discussion, reasoning, checking, agreement, praising

(Other Ps check calculations with calculators.)

BB: e.g

$$\begin{array}{r} 1\,7\,0 \\ \times\ 5 \\ \hline 8\,5\,0 \\ \hline {}_{3} \end{array} \qquad \begin{array}{r} 4\,3\,0 \\ \times\ 5 \\ \hline 2\,1\,5\,0 \\ \hline {}_{1} \end{array} \qquad \begin{array}{r} 4\,3 \\ \times\ 1\,7 \\ \hline 3\,0\,1 \\ +\,4\,3\,0 \\ \hline 7\,3\,1 \end{array}$$

$$\begin{array}{r} 8\,5\,0 \\ 2\,1\,5\,0 \\ +\ 7\,3\,1 \\ \hline 3\,7\,3\,1 \\ \hline {}_{1\,1} \end{array} \qquad \begin{array}{r} 3\,7\,3\,1 \\ \times\ 2 \\ \hline 7\,4\,6\,2 \\ \hline {}_{1} \end{array}$$

Praising, encouragement only

Have no expectations!

Y5

R: Mental calculation. Divisibility. Nets and area

C: Building cuboids from unit cubes (and Cuisennaire rods)

E: Volume of cuboids(square-based cuboids, cubes)

Lesson Plan 48

Activity | *Notes*

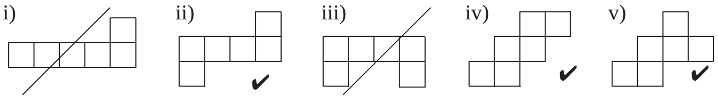
1 **Nets**

T has nets drawn on BB and Ps have cut-out nets on desks if possible.

Which nets can cover a cuboid exactly? Deal with one row at a time.

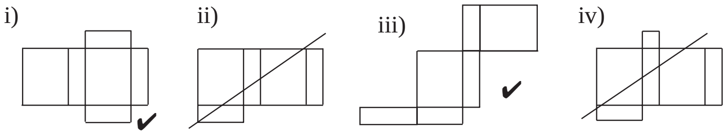
T asks one or two Ps to say which nets they think will not cover a cuboid then class folds their nets to confirm (or Ps coming to front of class to fold large nets). What can you tell me about the cuboid the nets make?

a)



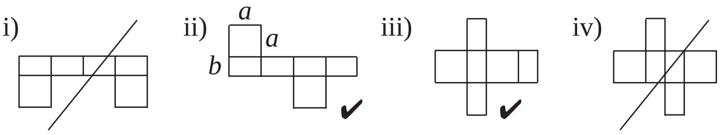
Elicit that they form a cube. If the length of each edge is 3 cm, what is its surface area? $A = 6 \times 3 \times 3 = 6 \times 9 = \underline{54}$ (cm^2)

b)



Elicit that they form a cuboid. Let's colour the opposite faces in the same colour. Ps colour own nets and/or come to BB to colour diagrams.

c)



Elicit that they form a square-based cuboid. If $a = 3$ cm and $b = 1$ cm, what is the area of the net? Ps dictate to T.

BB: $A = 2 \times (3 \times 3) + 4 \times (3 \times 1) = 2 \times 9 + 4 \times 3$

$= 18 + 12 = \underline{30}$ (cm^2)

d) Everyone stand up!

i) Show me 1 cm^2 in the air. What is the length of each side? (1 cm)

ii) Draw the outline of a square with 1 m long sides in the air.
T watches out for Ps who are obviously wrong and helps them.
(T could have a metre stick to compare against.)
What is the area of your square? (1 m^2)

Notes:

Whole class activity, but paired work in folding and checking the nets.

Drawn on BB or use enlarged copy master or OHP

Ps have nets cut from copy master (1 set per pair of Ps) and T has enlarged versions for demonstration.

Set a time limit at each stage.

Discussion, predicting, checking, confirming, reasoning, agreement

(Helps Ps to visualise the nets folded.)

If Ps are able, elicit the general rule (formula) for the surface area of a square-based cuboid.

BB:

$A = 2 \times (a \times a) + 4 \times (a \times b)$

$[= 2a^2 + 4ab]$ (T shows.)

Whole class activity

In good humour!

If possible T should have both models to show to class to give Ps a better idea of their sizes.

8 min

2 **Missing words**

a) Which words do you think are covered up? T asks several Ps what they think. Ps come to BB to uncover the words and then class reads complete sentence in unison, stressing the words which were covered.

BB:

i) A cuboid is a part of <u>space</u> which is enclosed by <u>rectangles</u>.

ii) The <u>surface</u> area of a polyhedron is the sum of the area of its <u>faces.</u>

iii) A solid occupies part of <u>space</u>.

b) This enclosed part of space is measured by <u>volume</u> (or <u>capacity</u>).

I heard this statement the other day. 'The cost of heating a room depends on how many cubic metres of air are in the room.'

What do you think a <u>cubic metre</u> is? (That part of space which is taken up by a cube with 1 m long edges.) We write it like this.

BB: 1 cubic metre = 1 m^3 T shows class a cube with sides 1 m.

Notes:

Whole class activity

Written on BB or SB or OHT

Agreement, praising

<u>Underlined</u> words should be covered up (or omitted)

BB: <u>volume</u>

(how much space something takes up)

<u>capacity</u>

(how much space something contains)

Y5

Lesson Plan 48

Activity

Notes

2

(Continued)

c) Here is a 1 cm unit cube. What is the length of each edge? (1 cm)
What is the area of each of its faces? (1 cm^2)
What is its volume? (1 cubic cm) Who can write it? (BB: 1 cm^3)

Ps should have 1 cm unit cubes on desks too (or *white* Cuisennaire rods)
Have no expectations – extra praise if a P writes it correctly.

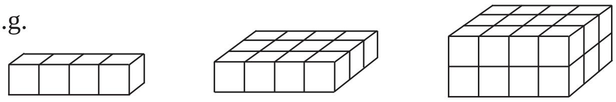
11 min

3

Building cuboids

Ps have multi-link cubes (or Cuisennaire rods) on desks (24 cubes per pair of Ps) and T has larger version for demonstration.

a) Build a cuboid which is 4 cm long, 3 cm wide and 2 cm high.
BB: 4 cm × 3 cm × 2 cm
Allow a couple of minutes, then ask Ps how they did it.
e.g.



4 cubes in a row   3 rows in a layer   2 layers

How many unit cubes did you use? (4 × 3 × 2 = <u>24</u>)

T: We say that the volume of this cuboid is 24 cubic centimetres and write it like this. BB: $V = 24 \text{ cm}^3$

What is its surface area? Ps dictate what T should write.

BB: $A = 2 \times (4 \times 3 + 4 \times 2 + 3 \times 2) = 2 \times (12 + 8 + 6)$
$= 2 \times 26 = \underline{52\ (\text{cm}^2)}$

b) Build a different cuboid using unit cubes (or cuisennaire rods).
Allow a couple of minutes, then T asks some Ps to hold up their cuboids and tell class their dimensions, volume and surface area.
(Accept 'unit squares' or 'unit cubes' from Ps as the units of measure.)

Individual or paired work, monitored, helped

(T could have a lidded box prepared so that the cuboid will fit inside it exactly to show the similarity between volume and capacity.)

Agreement, praising

At a good pace

Reasoning, agreement, praising

Choose cuboids of different types and sizes.

(with help of other Ps and T)

16 min

4

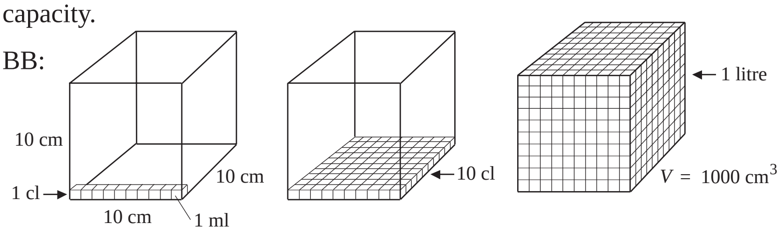
Volume and capacity 1

T has a transparent plastic or glass cube with 10 cm edges and open at the top (or the frame of such a cube).

Let's find out how many of these 1 cm cubes are needed to fill this cube (frame). T holds up a 1 cm cube. If this cube was filled with water, how much water would it hold? T reminds Ps if necessary. (1 ml)

T calls Ps to front of class to build up the cube gradually, as below. After each stage, elicit the number of cubes, their volume and their capacity.

BB:



10 cubes in a row	10 rows in 1 layer	10 layers in the whole cube
$V = 10 \times 1 \text{ cm}^3$	$V = 10 \times 10 \text{ cm}^3$	$V = 10 \times 10 \times 10 \text{ cm}^3$
$= \underline{10 \text{ cm}^3}$	$= \underline{100 \text{ cm}^3}$	$= \underline{1000 \text{ cm}^3}$

T tells class that in some countries this size of cube, which holds 1 litre of water, is called a <u>cubic decimetre</u> because each edge is 10 cm, i.e. $\frac{1}{10}$ m.

Whole class activity

Initial discussion on similarity between volume (how much space something takes up) and capacity (how much space is inside it, or how much liquid something can hold)

T has single rows and layers already prepared to save time.

T could have diagrams drawn on BB too, or use enlarged copy master or OHP.

Involve as many Ps as possible in demonstration and discussion.

Elicit that:

BB: $1000 \text{ cm}^3 \rightarrow 1$ litre
(water at 4 °C)

BB: $1000 \text{ cm}^3 = 1 \text{ dm}^3$

20 min

Y5

Lesson Plan 48

Activity ***Notes***

5

Volume and capacity 2

Let's summarise what we have learned.

A 1 cm cube, or cubic cm, can be built from 1000 1 mm cubes.

A 10 cm cube (or cubic decimetre) can be built from 1000 1 cm cubes.

A 1 m cube (or cubic m) can be built from 1000 10 cm cubes or dm cubes.

Let's write them in increasing order and compare them. T starts and at each unit, T gives Ps the chance to dictate if they can.

BB: $\underset{}{1\text{ mm}^3} \underset{\times 1000}{<} 1\text{ cm}^3 \underset{\times 1000}{<} 1\text{ dm}^3 \underset{\times 1000}{<} 1\text{ m}^3$

Or we could write it this way. (Again give Ps the chance to dictate.)

BB: $1\text{ cm}^3 = 1000\text{ mm}^3$ (capacity: 1 ml)

$1\text{ dm}^3 = 1000\text{ cm}^3 = 1\,000\,000\text{ mm}^3$ (capacity: 1 litre)

$1\text{ m}^3 = 1000\text{ dm}^3 = 1\,000\,000\text{ cm}^3 = 1\,000\,000\,000\text{ mm}^3$

23 min

Whole class activity

If possible, T holds up the appropriately sized cube as it is mentioned.

Have no expectations but allow Ps to contribute if they can.

T says the inequality and equations clearly in a loud voice to familiarise Ps with the units of volume and the large numbers.

BB: 1 000 000 = 1 million

1 000 000 000 = 1Thu million

6

PbY5a, page 48

Q.1 Read: *Pete has already made the base layer of a cuboid from unit cubes. If Pete has 72 unit cubes, how high can he build his cuboid?*

Set a time limit. Review with whole class. Ps could show height on scrap paper or slates on command. P answering corrrectly comes to BB to show solution, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

BB: Number of unit cubes in base: $3 \times 4 = \underline{12}$

Number of layers: $72 \div 12 = \underline{6}$

Height of cuboid: <u>6 units</u>

What is the volume of the cuboid? (<u>72 unit cubes</u>, or cubic units)

What is its surface area? Ps come to BB to write calculation.

BB: $A = 2 \times (4 \times 3 + 4 \times 6 + 3 \times 6)$

$= 2 \times (12 + 24 + 18) = 2 \times 54 = \underline{108\text{ (square units)}}$

Extension

If we wanted to make a frame model for this cuboid, what length of tubing would we need? Ps come to BB or dictate to T.

BB: Sum of edges of cuboid: $4 \times (4 + 3 + 6) = 4 \times 13 = \underline{52}$ (units)

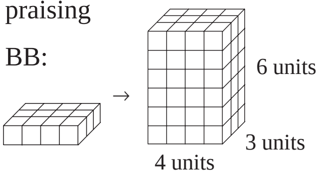
28 min

Individual work, monitored, helped

Drawn on BB and/or use real model.

Discussion, reasoning, agreement, self-correction, praising

BB:



Whole class activity

Reasoning, agreement, praising

Agreement, praising

7

PbY5a, page 48

Q.2 Read: *Calculate the volume of each of these cuboids if the length of its edges in units are:*

a) $a = 8,\ b = 5,\ c = 6$ b) $a = b = 5,\ c = 10$

c) $a = b = c = 9$

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

Solution:

a) $V = 8 \times 5 \times 6 = 40 \times 6 = \underline{240}$ (cubic units)

b) $V = 5 \times 5 \times 10 = 25 \times 10 = \underline{250}$ (cubic units) (squ.-based)

c) $V = 9 \times 9 \times 9 = 81 \times 9 = \underline{729}$ (cubic units) (cube)

Individual work, monitored, (less able Ps helped with models)

Reasoning, agreement, self-correction, praising

T asks Ps to describe the cuboids. e.g.

a) 8 cubes in a row, 5 rows in each layer and 6 layers.

Elicit the <u>general rule</u>:

V of cuboid $= a \times b \times c$ $[= abc]$

V of cube $= a \times a \times a$ $[= a^3]$

Activity *Notes*

7 **Extension**

(Continued)

What is the surface area of each cuboid?

a) $A = 2 \times (8 \overset{40}{\times} 5 + 8 \overset{48}{\times} 6 + 5 \overset{30}{\times} 6) = 2 \times 118 = \underline{236}$ (square units)

b) $A = 2 \times (5 \overset{25}{\times} 5) + 4 \times (5 \overset{50}{\times} 10) = 50 + 200 = \underline{250}$ (square units)

c $A = 6 \times (9 \overset{81}{\times} 9) = 480 + 6 = \underline{486}$ (square units)

What is the general rule for surface area of a cuboid (cube)?

BB:

$A = 2 \times (a \times b + a \times c + b \times c)$

$[= 2(ab + ac + bc)]$

and for a cube:

$A = 6 \times (a \times a)$ $[= 6a^2]$

34 min

8

PbY5a, page 48

Q.3 Read: *Use the tables to show the lengths of the edges of different cuboids which can be made from these numbers of cubes.*

Less able Ps have cubes on desks to help them. Set a time limit.

Review with whole class. Ps come to BB to complete tables. Class agrees/disagrees. Mistakes corrected. (Agree that cuboids can be turned around and over, so e,g, $a = 7$, $b = 1$, $c = 1$ is the same cuboid as $a = 1$, $b = 1$, $c = 7$)

Solution:

a) <u>7 cubes</u>

a	1				
b	1				
c	7				

Only 1 cuboid is possible.

b) <u>8 cubes</u>

a	1	1	2		
b	1	2	2		
c	8	4	2		

3 cuboids are possible.

c) <u>30 cubes</u>

a	1	1	1	1	2	
b	1	2	3	5	3	
c	30	15	10	6	5	

5 cuboids are possible.

Individual work, monitored, (helped)

Tables drawn on BB or use enlarged copy master or OHP

Differentiation by time limit

Reasoning, agreement, self-correction, praising

Extension for quicker Ps:

Calculate the surface areas in your *Ex. Bks.*

Which columns show square-based cuboids?

Which column shows a cube?

40 min

9

PbY5a, page 48, Q.4

Read: *This solid has a 1 unit square hole bored right through its centre.*

a) How many unit cubes would be needed to build the solid?

b) What is its surface area?

Deal with one part at a time. Ps suggest strategy, then come to BB to write calculation, explaining reasoning and referring to diagram on BB (or real model if T has one). Class agrees/disagrees. Rest of class write operation in *Pbs* too.

Solution:

a) The volume of the solid is the volume of the whole cuboid minus the volume of the part taken out, i.e.

$V = (5 \times 5 \times 8) - (1 \times 1 \times 8) = 200 - 8 = \underline{192}$ (unit cubes)

b) The surface area of the solid is the area of the surface of the whole cuboid minus the squares on top and bottom, plus the surface area inside the hole, i.e.

$A = 2 \times (5 \times 5) + 4 \times (5 \times 8) - 2 \times (1 \times 1) + 4 \times (1 \times 8)$

$= 2 \times 25 + 4 \times 40 - 2 \times 1 + 4 \times 8$

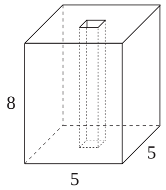
$= 50 + 160 - 2 + 32 = 210 + 30 = \underline{240}$ (unit squares)

Whole class activity

(or individual or paired trial first if Ps wish)

Diagram drawn on BB or use enlarged copy master or OHP

BB:



If possible, T has a model too.

T gives hints if Ps are stuck.

Discussion, reasoning, agreement, correcting, praising

[If time is short, surface area could be set as a challenge for homework.]

45 min

Y5

R: Perimeter and area of polygons

C: Practice: Area, nets, volume of cuboids. Capacity

E: Word problems. Challenges

Lesson Plan
49

Activity ***Notes***

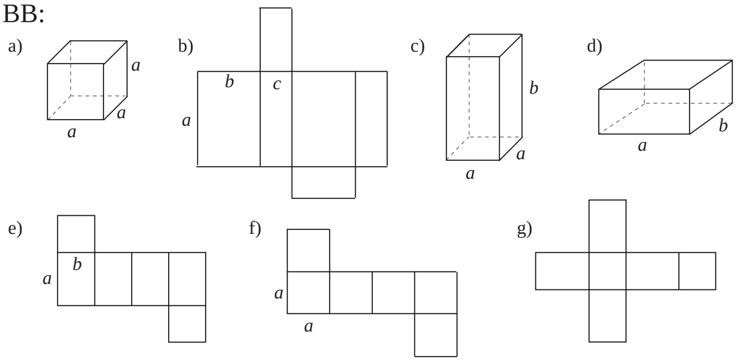
1

Formulae for area and volume

Study these solids and nets. Join them up to the matching name and fill in the missing formulae. (T elicits or explains that a <u>formula</u> is a general rule.)

Ps come to BB to join up each diagram to an appropriate name and to fill in the boxes, explaining reasoning. Class agrees/disagrees.

BB:



$V = \boxed{a \times a \times a}$ **cube** $A = \boxed{6 \times a \times a}$

$V = \boxed{a \times a \times b}$ **square-based cuboid** $A = \boxed{2 \times a \times a + 4 \times a \times b}$

$V = \boxed{a \times b \times c}$ **cuboid** $A = \boxed{2 \times (a \times b + a \times c + b \times c)}$

5 min

Whole class activity

Drawn on BB or use enlarged copy master or OHP

BB: <u>formula</u> – a general rule

At a good pace

Reasoning, agreement, praising, encouragement only

N.B.

It is neither expected nor required that Ps know the formulae by heart but in a whole class situation, with T's and other Ps' help, they might understand the ideas.

Solution:

Cubes: a) and f)

Square-based cuboids: c), e and g)

Cuboids: b) and d)

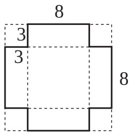
2

Surface area and capacity

Ps have 14 cm squares of paper, rulers, scissors and sellotape on desks.

Cut a 3 cm square from each corner and fold the paper to make a box

T demonstrates each step with a larger sheet, using sellotape to fix the edges together and draws on BB:



Show me your completed box . . .now!

What can you tell me about the dimensions of your box?

e.g. It has a square base, 8 cm long and 8 cm wide. It is 3 cm high.

How many 1 cm cubes could fit in it? (192)

BB: $8 \times 8 \times 3 = 64 \times 3 = \underline{192}$

BB: $\begin{array}{r} 64 \\ \times\ 3 \\ \hline 192 \\ \hline \end{array}$

We could say that its <u>capacity</u> is 192 cubic cm.

What is its surface area? Ps might point out that it has outside <u>and</u> inside surface areas. Agree that paper is so thin that we can think of both as being the same.

Inner (or outer) surface area:

BB: $A = 8 \times 8 + 4 \times (3 \times 8) = 64 + 4 \times 24 = 64 + 96 = \underline{160}$ (cm^2)

or $A = 14 \times 14 - 4 \times (3 \times 3) = 196 - 4 \times 9 = 196 - 36 = \underline{160}$ (cm^2)

10 min

Individual work in making the box.

(Or T could have sheets with squares at corner already cut out if class is not very able)

Whole class discussion

Agreement, praising

If possible, Ps use cm cubes to confirm.

Discussion, reasoning, agreement, praising

BB: e.g.

$14 \times 14 = 14 \times 10 + 14 \times 4$

$= 140 + 56 = \underline{196}$

3

Cuboids with equal volume

How many different cuboids could be built from 64 unit cubes?
Let's show them in a table. Ps come to BB or dictate to T in a logical order. Class checks that they are correct and points out missed values.

BB:

a	1	1	1	1	2	2	4	
b	1	2	4	8	2	4	4	
c	64	32	16	8	16	8	4	

Agree that 7 <u>different</u> cuboids are possible.

Which has the greatest surface area? (1st column)

15 min

Whole class activity

Drawn on BB or use enlarged copy master or OHP

At a good pace

Reasoning, agreement, praising

Extra praise if Ps remember that it is the <u>least</u> regular, i.e. 1 ×1 × 64

Y5

Lesson Plan 49

Activity

Notes

4

Problem 1

The surface of a cube with edge 3 cm was painted red, then cut into 1 cm cubes. How many of the 1 cm cubes will have 3 (2, 1, 0) faces painted red?

T illustrates with a real cube made from unit cubes, or draw a diagram on BB. Allow Ps to think about it for a minute and discuss with their neighbours if they wish.

Ps tell class their thoughts and findings. Other Ps agree or disagree, or add other points. T intervenes or give hints only if necessary.

(T could confirm by breaking down the painted 3 cm cube.)

Elicit the following points.

- At each vertex there is a unit cube with 3 *red* faces.
- At the middle of each edge there is a unit cube with 2 *red* faces.
- In the middle of each face there is a unit cube with 1 *red* face.
- The unit cube in the centre of the large cube has no *red* faces.

ie. 3 faces *red* → 8 unit cubes (as 8 vertices)
2 faces *red* → 12unit cubes (as 12 edges)
1 face *red* → 6 unit cubes (as 6 faces)
no face *red* → 1 unit cube

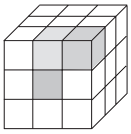
20 min

Individual or paired trial first, then whole class discussion involving as many Ps as possible.

Praise all positive contributions.

T repeats explanations more clearly when necessary.

BB:



Check:

$V = 3 \times 3 \times 3 = \underline{27}$ (unit cubes)

$8 + 12 + 6 + 1 = \underline{27}$ unit cubes ✔

[Euler's formula: $v + f - e = 2$
$8 + 6 - 12 = 2$]

5

Problem 2

Imagine an empty cuboid-shaped glass container which is 1 m high and has a 40 cm by 40 cm square base.

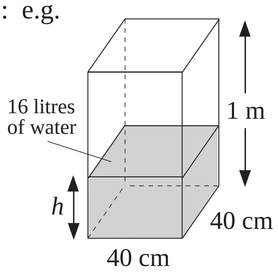
If we poured 16 litres of water into it, how high would the level of water be?

T illustrates with a diagram drawn on BB. Allow Ps a minute to think about it and discuss with their neighbours if they wish.

What do we need to remember before we can solve the problem? Elicit or tell that 1 litre of water takes up the same space as a 10 cm by 10 cm by 10 cm cube, i.e. 1 litre of water has a volume of 1000 cm^3)

Who thinks that they know how to solve it? Come and explain to us. Who agrees? Who thinks something else? etc.

BB: e.g.



litre → 1000 cm^3
16 litres → 16 000 cm^3
Let height of water level be h:
$(40 \times 40)\text{ cm}^2 \times h = 16\,000\text{ cm}^3$
$1600\text{ cm}^2 \times h = 16\,000\text{ cm}^3$
$h = 16\,000\text{ cm}^3 \div 1600\text{ cm}^2 = \underline{10\text{ cm}}$

Answer: The level of water would be 10 cm high.

25 min

Whole class activity

(or individual or paired trial first if Ps wish, monitored and reviewed with whole class)

(Do not write h on diagram until Ps suggest it – see below)

BB:

1 litre → 1000 cm^3

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

If no P has a good idea, T gives hints or leads Ps through solution opposite, involving them where possible.

Feedback for T

Y5

Lesson Plan 49

Activity

Notes

6

PbY5a, page 49

Q.1 Read: *Join up the calculation plans to the correct shapes.*

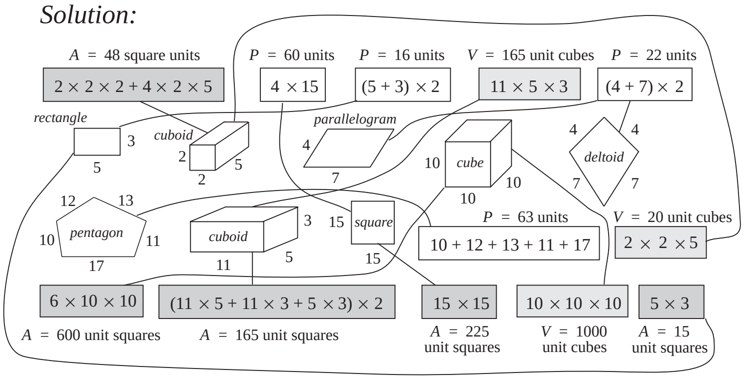
Colour the plan blue if it is a perimeter, red if it is an area and green if it is a volume.

Set a time limit. Ask quicker Ps to do the calculations in their *Ex. Bks.* and write the results above or below each calculation box in *Pbs*.

Review with whole class. Ps come to BB to draw joining lines, identify the relevant shape, say the type of calculation, and colour appropriately. Class agrees/disagrees. Mistakes discussed and corrected.

Who has done the calculation? What is your result? Who agrees? etc. (If disagreement, show details on BB.)

Solution:



Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Differentiation by time limit and extra task

Discussion, agreement, self-correcting, praising

30 min

7

PbY5a, page 49

Q.2 Read: *A rectangular-shaped garden is 22 m long and 12 m wide.*

a) How long is the fence around if if the gate is 3 m wide? Draw a diagram first.

b) What is the area of the garden?

You do not need to draw an accurate diagram – a rough sketch will do. Remember to write on it the information given in the question. Set a time limit.

Review one part at a time. Ps could show results on scrap paper or slates in unison on command. Ps answering correctly explain at BB to those who were wrong. Mistakes discussed and corrected.

Solution: e.g.

a) *Plan:* F = 2 × (22 m + 12 m) – 3 m = 68 m – 3 m = $\underline{65 \text{ m}}$

Answer: The fence around the garden is 65 m long.

b) *Plan:* *A* = 22 × 12 = 220 + 44 = $\underline{264}$ (m^2)

Answer: The area of the garden is 264 m^2.

Extension

Ps draw a scale diagram of the garden. (e.g. *Scale*: 1 cm → 1 m)

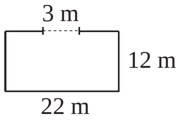
Individual work, monitored, helped

Differentiation by time limit.

(or deal wth one part at a time if class is not very able)

Discussion, reasoning, agreement, self-correction, praising

BB: *D:*



or F = 2 × 12 + 22 + (22 – 3)

= 24 + 22 + 19 = $\underline{65}$ (m)

(or this task could be set for homework)

35 min

Y5

Lesson Plan 49

Activity ***Notes***

8

PbY5a, page 49

Q.3 Read: *Solve these problems in your exercise book.*
Write only the answers here.

Set a time limit. Ps read problems themselves and solve in *Ex. Bks.*

Review with whole class. Ps could show results on scrap paper or slates in unison on command. Ps answering correctly explain at BB to those who were wrong. Who agrees? Who did it a different way? Who made a mistake? etc.

Solution:

a) *The area of the surface of a cube is 150 cm^2.*
What is its volume in centimetre cubes?

e.g. $A = 6 \times a \times a = 150$ cm^2

$a \times a = 150$ cm^2 $\div 6 = 25$ cm^2

$$\begin{array}{r} 25 \\ 6\,\overline{)\,150} \\ 3 \end{array}$$

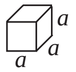
but $5 \times 5 = 25$, so a = <u>5 cm</u>

$V = a \times a \times a = 5 \times 5 \times 5 = 25 \times 5 = \underline{125}$ (cm^3)

Answer: Its volume is 125 cm^3.

b) *A cube is built from 64 one cm cubes, so its volume is 64 cm^3.*
What is its surface area in centimetre squares?

e.g. $V = a \times a \times a = 64$ cm^3 BB:



But $64 = 4 \times 4 \times 4$, so a = <u>4 cm</u>

$A = 6 \times a \times a = 6 \times 4 \times 4 = 24 \times 4 = \underline{96}$ (cm^2)

Answer: Its surface area is 96 cm^2.

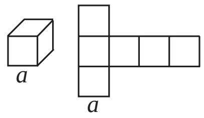
Individual work, monitored, helped

Expect only more the able Ps to solve question b).

Discussion, reasoning, agreement, self-correction, praising

Feedback for T

BB:



Extension

What is its capacity in cl?

1 cm^3 → 1 ml

125 cm^3 → 125 ml = <u>12.5 cl</u>

Ps might remember this from previous calculations, but otherwise allow trial and error (or use of calculators)

40 min

9

PbY5a, page 49, Q.4

Choose one of these problems and solve it in your *Ex. Bks.* If you have time, try another one too. I will give you 3 minutes!
Start . . . now! . . . Stop!

Who chose problem a)? **X**, come and show us how you worked out the answer. If you did not try it, watch out for any mistakes!

Repeat in a similar way for the other two questions.

Solutions:

a) *We poured water into a 10 cm cube which was open at the top.*
How much water did we pour in if the water level was:

i) 5 cm Volume of water = $10 \times 10 \times 5 = 500$ (cm^3)

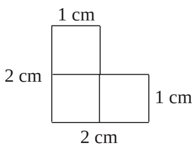
But 1 cm^3 → 1 ml, so 500 cm^3 → 500 ml = <u>50 cl</u>

ii) 3.5 cm? Volume of water = $10 \times 10 \times 3.5 = 350$ (cm^3)

But 1 cm^3 → 1 ml, so 350 cm^3 → 350 ml = <u>35 cl</u>

b) *Divide this hexagon into 4 congruent parts.*

First divide the hexagon into squares. BB:
It makes 3 congruent squares.



If we divide each square into 4 equal parts, there are 12 grid squares altogether.

If we divide the 12 grid squares into 4 equal parts, each part is made up of <u>3</u> grid squares.

c) *Make 4 congruent triangles from 6 straws of equal length.*

It is impossible in 1 plane, but can be done in space (i.e. 3-D).

Individual work, monitored, helped

(or whole class activity if time is short)

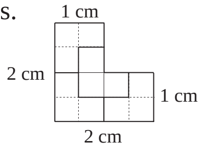
Differentation by time limit and choice. (More able Ps might attempt all 3 questions.)

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

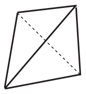
(T writes relationship beteen volume and capacity on BB if Ps are struggling.)

T advises Ps to draw diagram in *Ex. Bk*s or on squared grid sheets.

BB:



Extra praise for Ps who realised this!



45 min

Y5

Lesson Plan
50

Activity

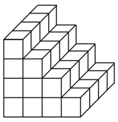
Notes

Calculation and tables practice, revision, activities, consolidation

PbY5a, page 50

Solutions:

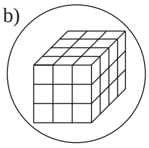
Q.1 a)



$V = \boxed{40}\ \text{cm}^3$

$A = \boxed{84}\ \text{cm}^2$

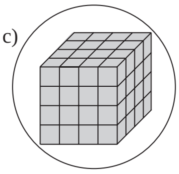
b)



$V = \boxed{36}\ \text{cm}^3$

$A = \boxed{66}\ \text{cm}^2$

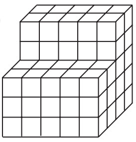
c)



$V = \boxed{64}\ \text{cm}^3$

$A = \boxed{96}\ \text{cm}^2$

d)



$V = \boxed{80}\ \text{cm}^3$

$A = \boxed{122}\ \text{cm}^2$

Q.2.

a	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	4
b	1	2	3	4	6	8	9	12	2	3	4	6	9	3	4	6	8	6
c	216	108	72	54	36	27	24	18	54	36	27	18	12	24	18	12	9	9

An extra column must be added to table in *Pbs*!

Extra praise if Ps notice this.

Q.3 a) $V = 40 \times 25 \times 30 = 1000 \times 30 = \underline{30\,000\ \text{cm}^3}$

$30\,000\ \text{cm}^3 \rightarrow \underline{30\ \text{litres}}$

Answer: There are 30 litres of water in a full tank.

b) $8\ \text{litres} \rightarrow 8000\ \text{cm}^3$

$h = 8000\ \text{cm}^3 \div (40\ \text{cm} \times 25\ \text{cm})$

$= 8000\ \text{cm}^3 \div 1000\ \text{cm}^2 = \underline{8\ (\text{cm})}$

Answer: The water level is at a height of 8 cm.

Q.4 a) $V = 512\ \text{cm}^3 = a \times a \times a$

But $8 \times 8 \times 8 = 512$, so $a = \underline{8\ \text{cm}}$

Answer: The length of each edge is 8 cm.

b) i) $h = 300\ \text{m}^3 \div (12\ \text{cm} \times 5\ \text{m})$

$= 300\ \text{m}^3 \div 60\ \text{cm}^2 = \underline{5\ \text{m}}$

Answer: The height of the reservoir is 5 m.

ii) $1000\ \text{cm}^3 \rightarrow 1\ \text{litre}$

$1\ \text{m}^3 = 1\,000\,000\ \text{cm}^3 \rightarrow 1\,000\ \text{litres}$

$300\ \text{m}^3 \rightarrow \underline{300\,000\ \text{litres}}$

Answer: The reservoir could hold 300 thousand litres of water.

iii) $300\,000\ \text{litres} \div 500\ \text{litres} = \underline{600}$ (times)

Answer: The tank will be empty after 600 days.