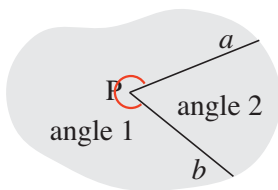


1

Imagine that this shape continues in any direction without ending, so it represents a **plane**. The rays *a* and *b* are drawn from the same starting point, P.



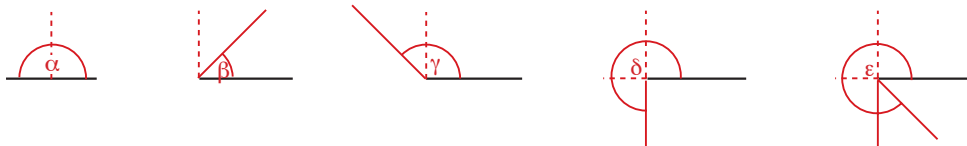
We call the two parts of the plane **angles**.
 We call the measure of them an angle too.

Mark in *red* the angle which is greater than the other.

2

Draw these angles. (r.a. means 'right angle')

$\alpha = 2 \text{ r. a.}$ $\beta = \frac{1}{2} \text{ r. a.}$ $\gamma = 1.5 \text{ r. a.}$ $\delta = 3 \text{ r. a.}$ $\epsilon = 3.5 \text{ r. a.}$



3

Start at the compass direction North and draw the rotations asked for.

| | | | |
|---|--|---|---|
| <p>a)</p> <p>3 right angles clockwise</p> | <p>b)</p> <p>2 right angles anti-clockwise</p> | <p>c)</p> <p>half a right angle clockwise</p> | <p>d)</p> <p>3 and a half right angles anti-clockwise</p> |
|---|--|---|---|

4

Write down the angle formed by the arms of the clock in right angles.

| | | | |
|---------------------------------|---|---|---|
| <p>a)</p> <p>3 right angles</p> | <p>b)</p> <p>$\frac{2}{3}$ right angle</p> | <p>c)</p> <p>$2\frac{1}{3}$ right angles</p> | <p>d)</p> <p>$2\frac{2}{3}$ right angles</p> |
|---------------------------------|---|---|---|

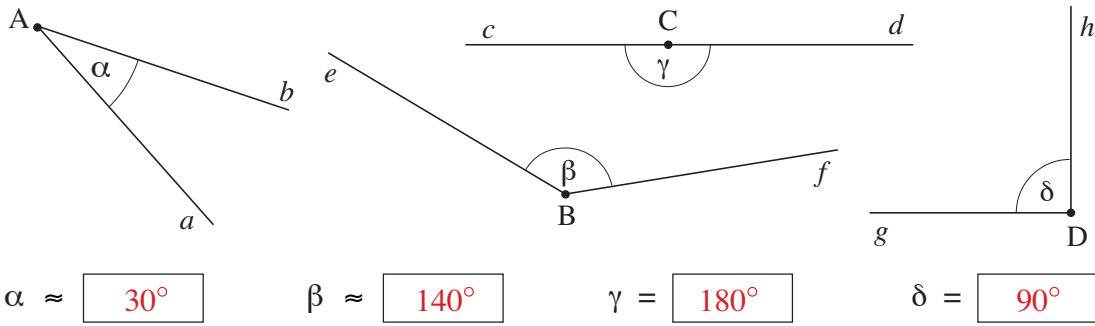
5

In your exercise book, draw a quadrilateral (if it is possible) which has:

- e.g.
- a) only one right angle
 - b) two adjacent right angles and two angles which are **not** right angles
 - c) exactly 3 right angles **Impossible**
 - d) 4 right angles. or

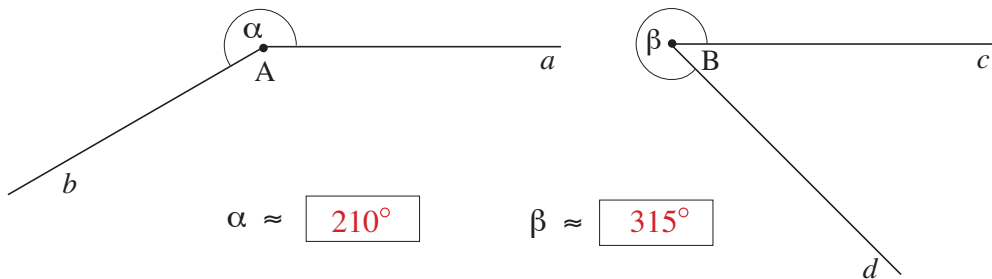
1

Measure these angles using a **protractor** and write their sizes in the boxes.



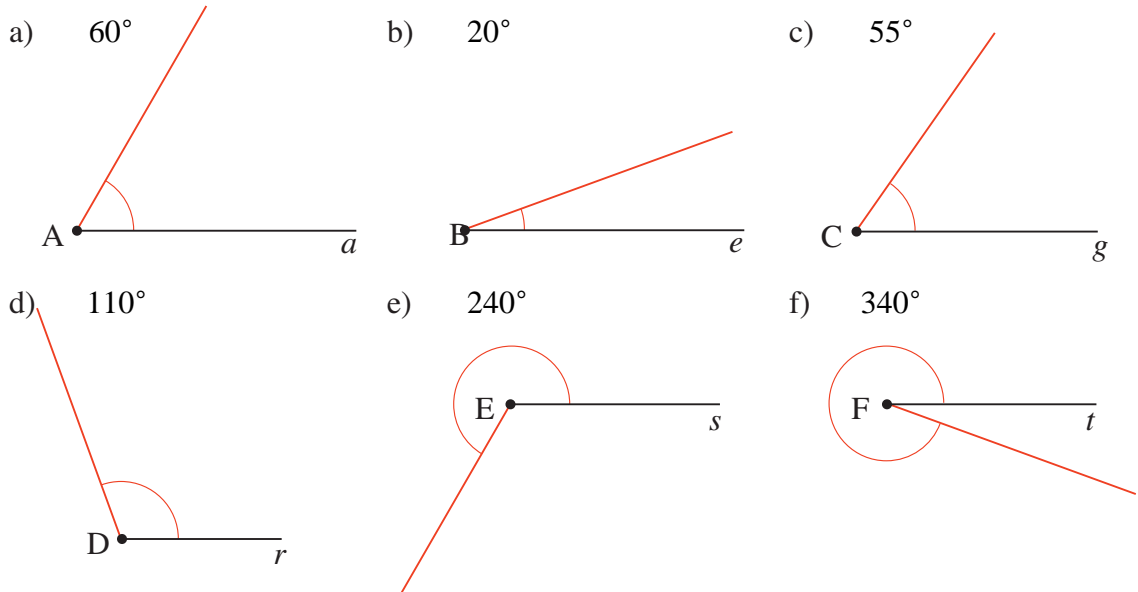
2

Measure these angles with a protractor and write their sizes in the boxes.



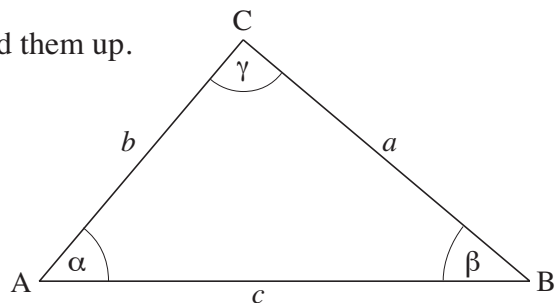
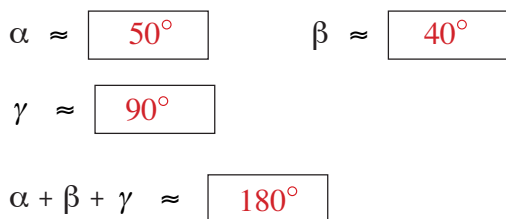
3

Use a ruler and protractor to draw the given angles.




4

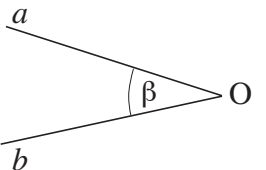
Measure the angles of the triangle and add them up.

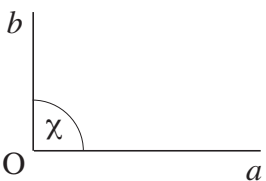


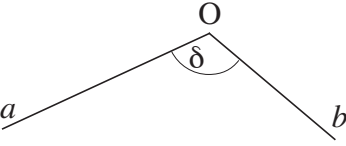
1

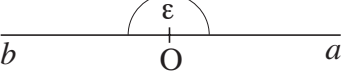
Write the name of the type of angle in the box, then measure the angle.

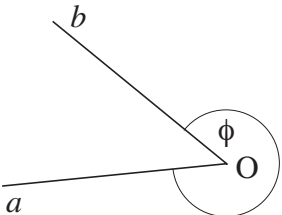
a)  angle $\alpha =$ °

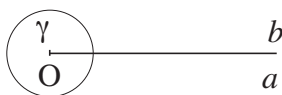
b)  angle $\beta =$ °

c)  angle $\chi =$ °

d)  angle $\delta =$ °

e)  angle $\varepsilon =$ °

f)  angle $\phi =$ °

g)  angle $\gamma =$ °

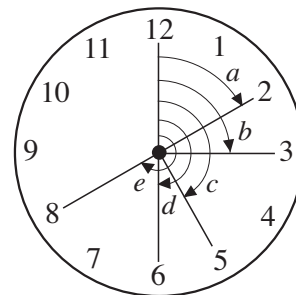
2

Measure or calculate the angles marked on the clock.

$\angle a =$ $\angle b =$

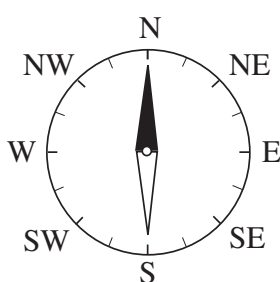
$\angle c =$ $\angle d =$

$\angle e =$



3

Measure or calculate the angles between the given compass directions.



a) N and NE b) N and E

(315°)

c) N and SE d) N and SW

(225°)

e) NE and SE f) E and NW

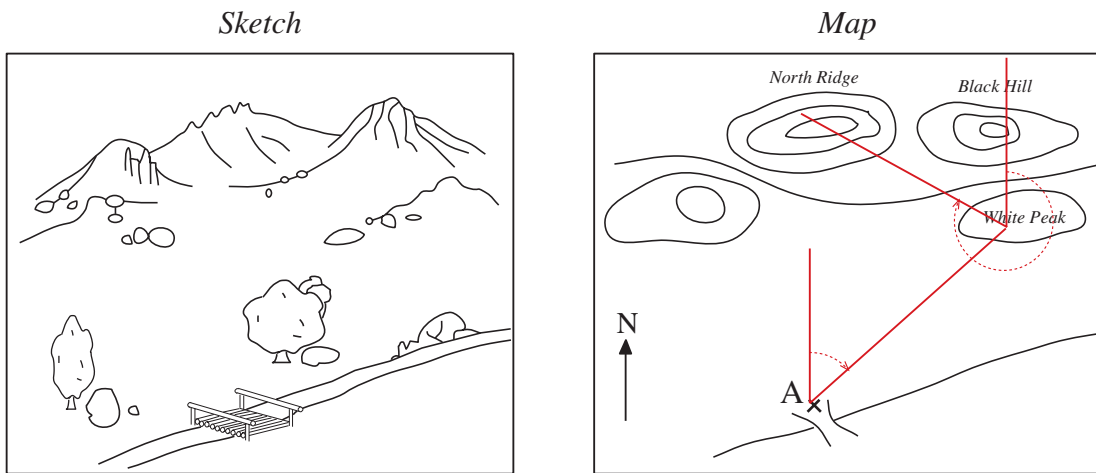
(270°)

g) W and SSW h) E and NNE

(292.5°)

1

Here is a sketch of some mountain peaks and the corresponding map.

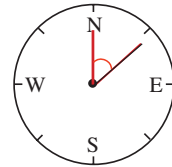


a) You are at the bridge (A) and want to walk to *White Peak*.

On the map, draw and measure the **angle** at point A between North and your planned direction of travel.

Write the angle and draw it on the compass diagram.

$\approx 48^\circ$

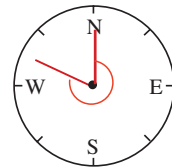


b) You have reached the top of *White Peak* and want to continue to *North Ridge*.

Measure the angle, in a **clockwise** direction, between North and your next planned direction of travel.

Write the angle and draw it on the compass diagram.

$\approx 295^\circ$



2

Draw turns from North by the given angles. Write the new compass directions below.

a) $+ 90^\circ$ **E**

b) $- 135^\circ$ **SW**

c) $- 45^\circ$ **NW**

d) $+ 225^\circ$ **SW**

e) $- 270^\circ$ **E**

??

3

a) How many degrees is the angle between:

i) N and NE 45°

ii) NNE and ENE? 45°

b) If a ship sails NNE and then turns to the right by 90° , in which compass direction is the ship travelling now?

ESE

c) If we are facing ESE and turn to the right by 45° , in which direction are we facing now?

SSE

4

In your exercise book, write the angle made by the minute hand of a clock as it moves:

- a) 5 minutes 30° b) 10 minutes 60° c) 20 minutes 120° d) 45 minutes 270° e) 1 minute. 6°

1

Measure the angles of this quadrilateral and add them up.

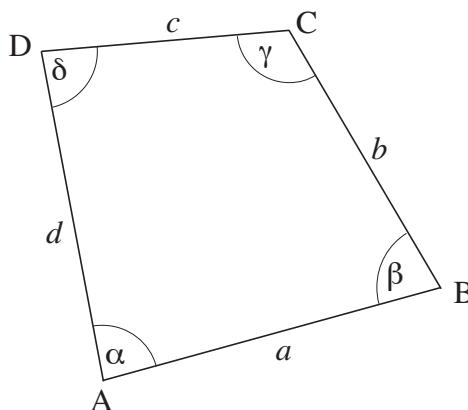
$$\alpha \approx 85^\circ$$

$$\beta \approx 75^\circ$$

$$\gamma \approx 115^\circ$$

$$\delta \approx 85^\circ$$

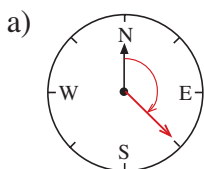
$$\alpha + \beta + \gamma + \delta \approx 360^\circ$$



2

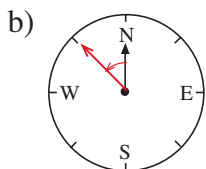
Start at the compass direction North and draw the rotations asked for.

Write the new compass directions below the diagrams.



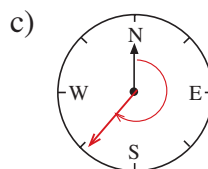
1 and a half right angles clockwise

South East



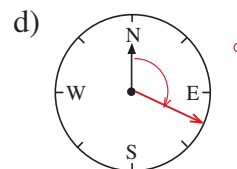
half a right angle anti-clockwise

North West



2 and a half right angles clockwise

South West

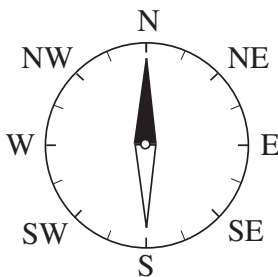


1 and a quarter right angles clockwise

East South-East

3

Measure or calculate the angles between the given compass directions.



a) S and W

$$90^\circ$$

b) S and NE

$$135^\circ$$

c) E and SW

$$135^\circ$$

d) N and SE

$$135^\circ$$

e) NW and SW

$$90^\circ$$

f) NW and E

$$135^\circ$$

g) SSW and SE

$$67.5^\circ$$

h) SSW and NNE

$$180^\circ$$

4

a) You are facing North and turn clockwise to face South-East.

Through what angle do you turn?

$$-135^\circ$$

b) You are facing North-West and turn anti-clockwise through 90° .

In which direction are you now facing?

SW

c) After turning anti-clockwise through 225° , you are facing East.

In which direction were you facing at the start?

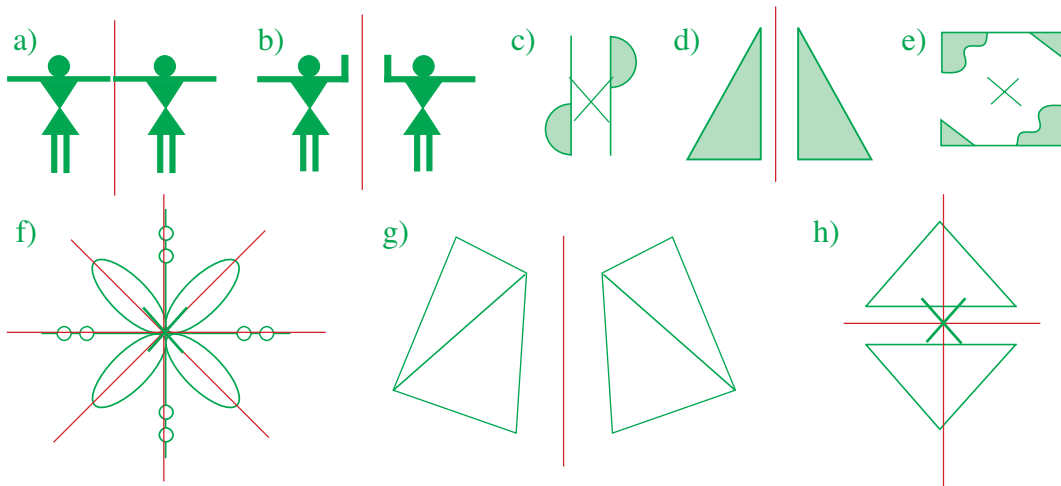
NW

d) You make 4 equal turns from NE to SE. What angle is each turn?

$$22.5^\circ$$

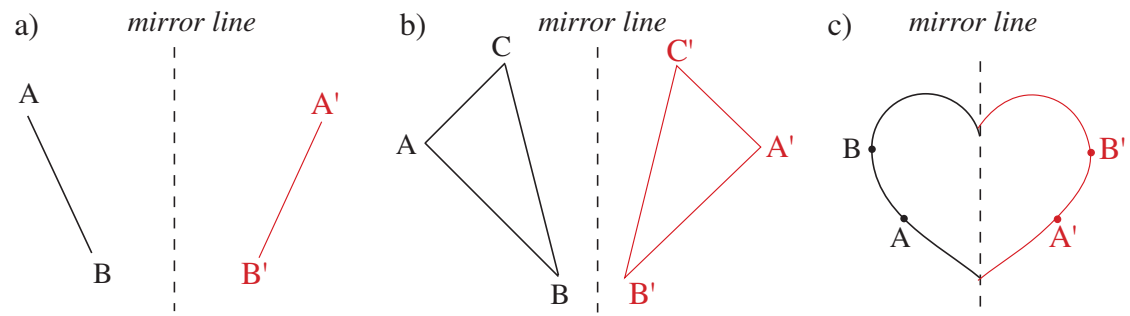
1

If the diagram has **line symmetry**, draw the lines of symmetry in *red*. If the diagram has **rotational symmetry**, mark the centre of rotation in *green*.



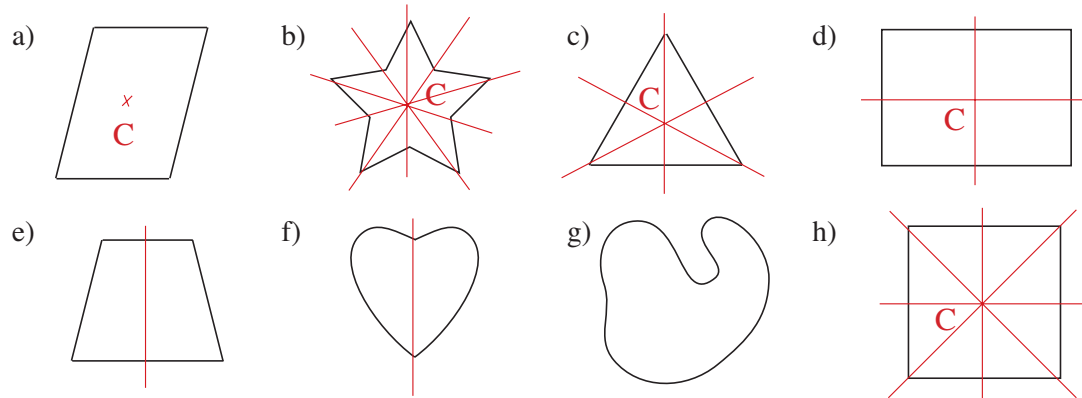
2

Reflect the shape in the mirror line. Label the corresponding points A', B', etc.



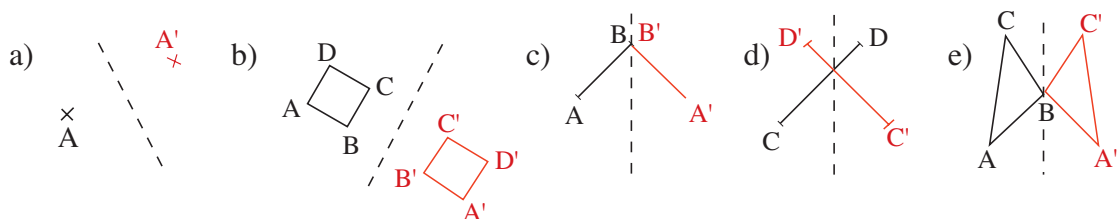
3

If the shape has line symmetry, draw the lines of symmetry. If the shape has rotational symmetry, mark the centre of rotation and label it C.



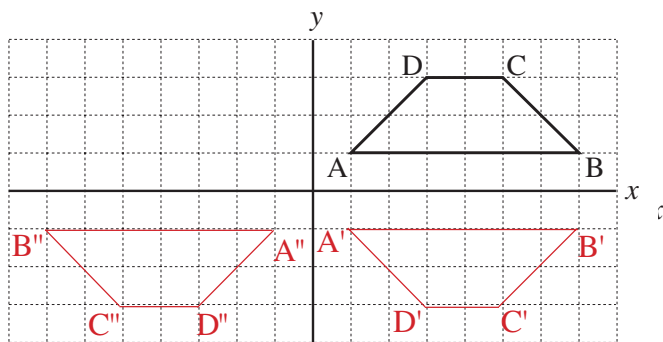
4

Draw the **mirror image** of each shape and label the corresponding points.



1

Reflect quadrilateral ABCD in the x -axis, then reflect its image in the y -axis.

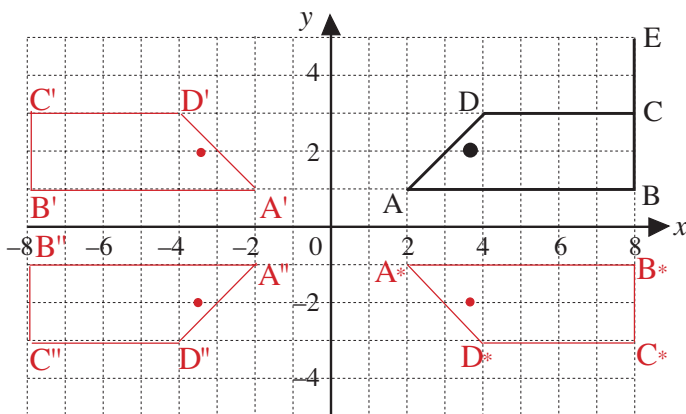


Fill in the missing signs.

| | | | | |
|----|---|------|---|--------|
| AB | <input type="checkbox"/> =, <input type="checkbox"/> // | A'B' | <input type="checkbox"/> =, <input type="checkbox"/> // | A''B'' |
| CD | <input type="checkbox"/> =, <input type="checkbox"/> // | C'D' | <input type="checkbox"/> =, <input type="checkbox"/> // | C''D'' |
| BC | <input type="checkbox"/> = | B'C' | <input type="checkbox"/> = | B''C'' |
| DA | <input type="checkbox"/> = | D'A' | <input type="checkbox"/> = | D''A'' |

2

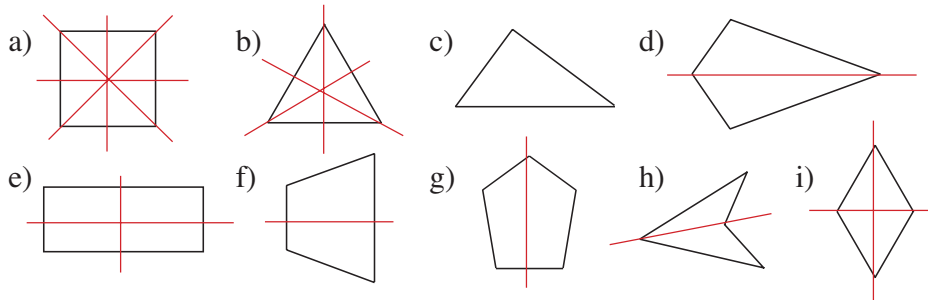
- Reflect the mouse in the y -axis. Label the image of point A with A', etc.
- Reflect the original mouse in the x -axis. Label the image of A with A*, etc.
- Reflect the image in a) in the x -axis. Label the image of A' with A'', etc.



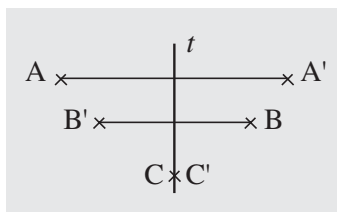
| | | |
|-------------|-------------|-------------|
| A (2,1) | B (8,1) | C (8,3) |
| D (4,3) | E (8,5) | |
| A' (-2,1) | B' (-8,1) | C' (-8,3) |
| D' (-4,3) | E' (-8,5) | |
| A* (2,-1) | B* (8,-1) | C* (8,-3) |
| D* (4,-3) | E* (8,-5) | |
| A'' (-2,-1) | B'' (-8,-1) | C'' (-8,-3) |
| D'' (-4,-3) | E'' (-8,-5) | |

3

Draw lines of symmetry on the polygons.



4

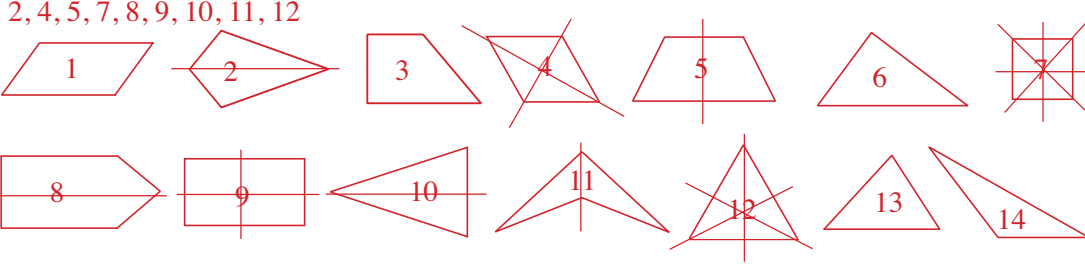


Imagine that the whole plane is reflected in *mirror line t*. Are these statements true or false? Write T or F.

- Each half plane determined by t is a reflection of the other. T
- Every point in the plane has just 1 image point. T
- The image of any line is also a line. T
- The image of a point on the *mirror line* is the point itself. T
- The image of a line perpendicular to the *mirror line* is the line itself. T
- The length of a line segment is greater than the length of its image. F
- The size of any angle is equal to the size of its image. T
- The midpoint between any point A and its image A' lies on the *mirror line*. T

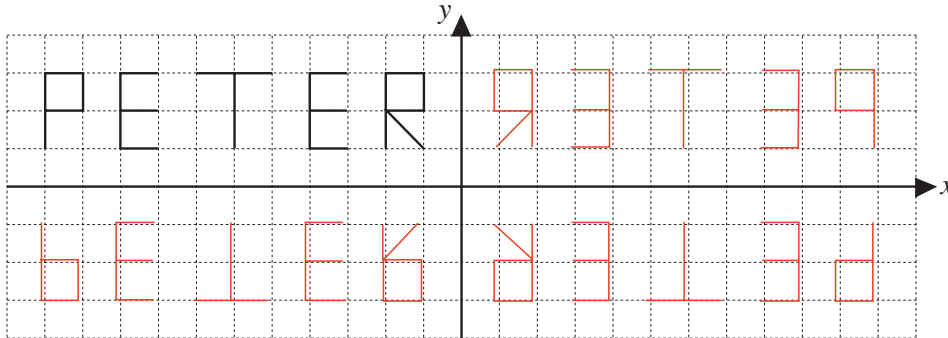
1

Which of these shapes is symmetrical? Draw the lines of symmetry.



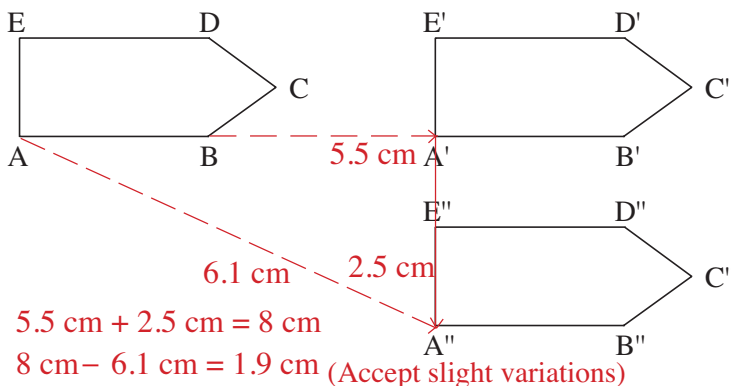
2

Reflect the word PETER: a) in the x-axis b) in the y-axis.



3

Two translations were done one after the other. Replace them with just one translation. Draw arrows between the corresponding points on the diagram (e.g. $A \rightarrow A''$)



Measure the distance of each translation and write it below the arrow.

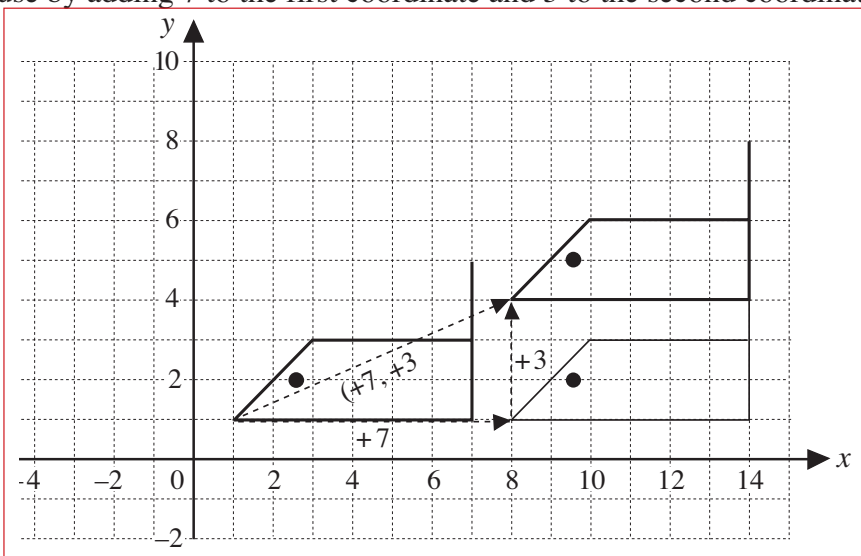
How much shorter is your translation than the sum of the two given?

1.9 cm

4

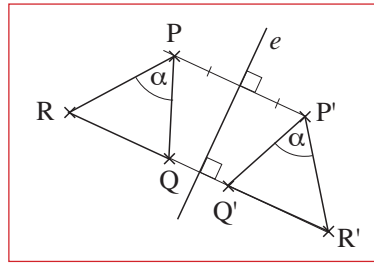
Translate the mouse by adding 7 to the first coordinate and 3 to the second coordinate of each vertex.

Diagram showing translation.



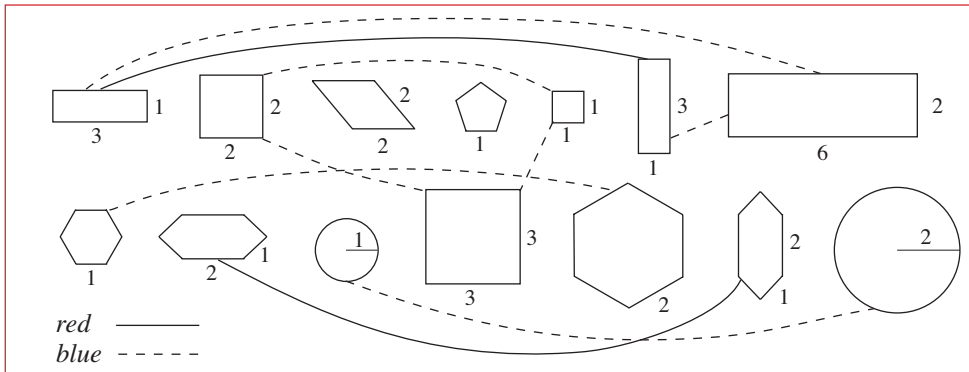
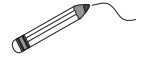
1

- Reflect the points P, Q and R in line e .
- Draw the triangles PQR and P'Q'R'.
- Measure the angles in each triangle and add them up.



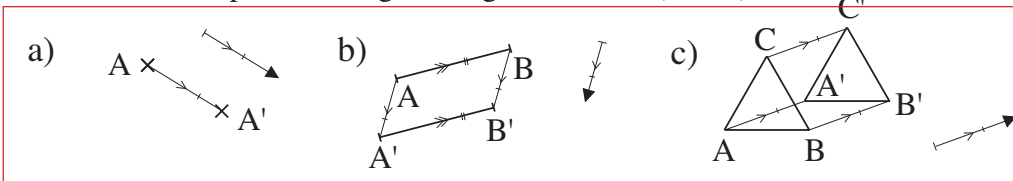
2

Join up **congruent** shapes in **red** and **similar** but not congruent shapes in **blue**.



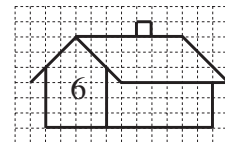
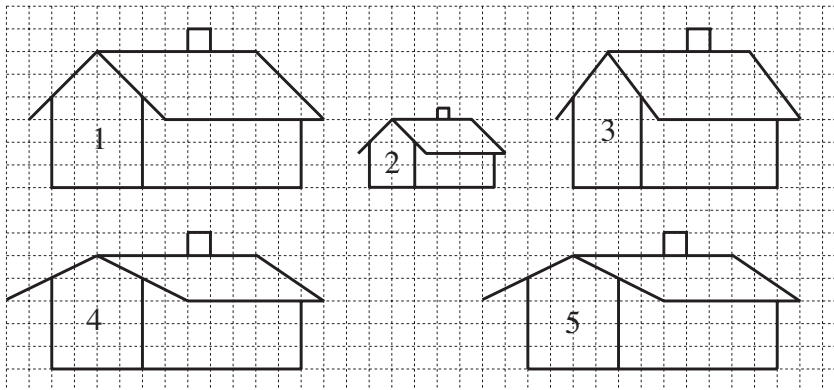
3

Translate the shape according to the given **vector** (arrow).



4

List the houses which are **similar** to one another.



Houses 1, 2 and 6 are similar.

Houses 4 and 5 are similar.

Houses 4 and 5 are similar and equal.

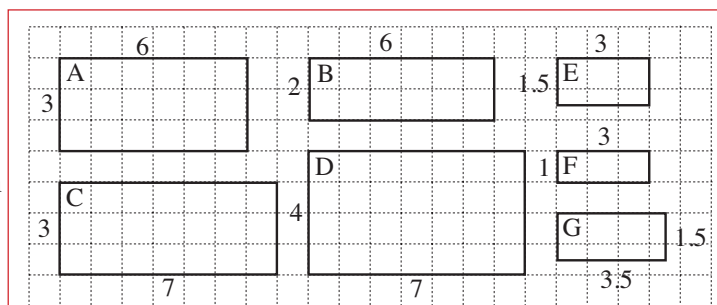
The symbol \sim can be used to indicate similarity, e.g. house 4 \sim house 5.

5

In your exercise book, list **similar** pairs of shapes.

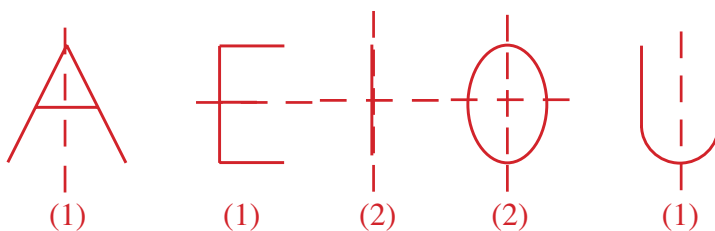
Write the ratio of enlargement or reduction beside each pair.

Similar shapes and ratios shown on diagram.



1

How many lines of symmetry do each of these letters have? Draw them all.

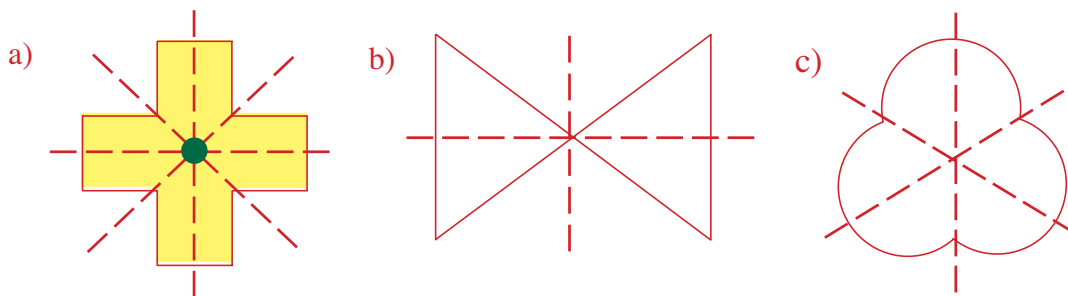


2

If the shape has **line symmetry**, draw the lines of symmetry in *red*.

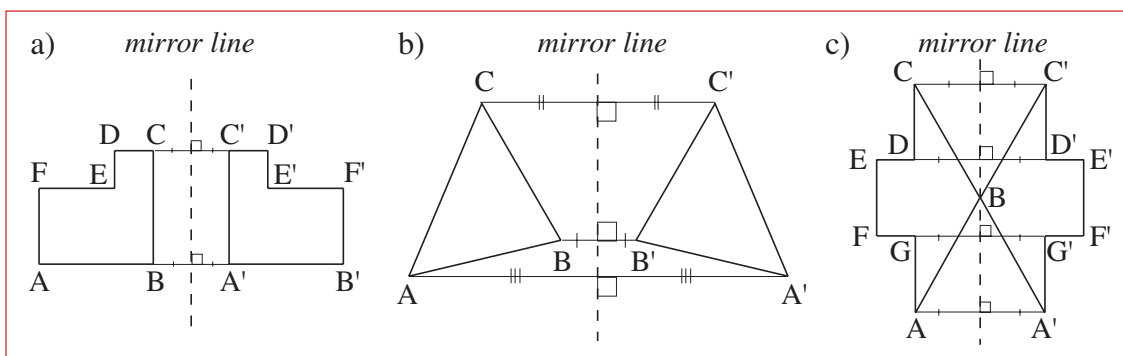
If the shape has **rotational symmetry**, mark the centre of rotation in *green*.

If the shape is a **polygon**, colour it *yellow*.



3

Reflect each shape in the *mirror line*. Label the corresponding points A', B', etc.



4

Reflect the quadrilateral in the *x*-axis, then **reflect** its image in the *y*-axis.

a) $BC = B'C'$ T

b) $BC = B''C''$ T

c) $BC \parallel B'C'$ F

d) $BC \parallel B''C''$ T

e) $BC \perp B'C'$ F

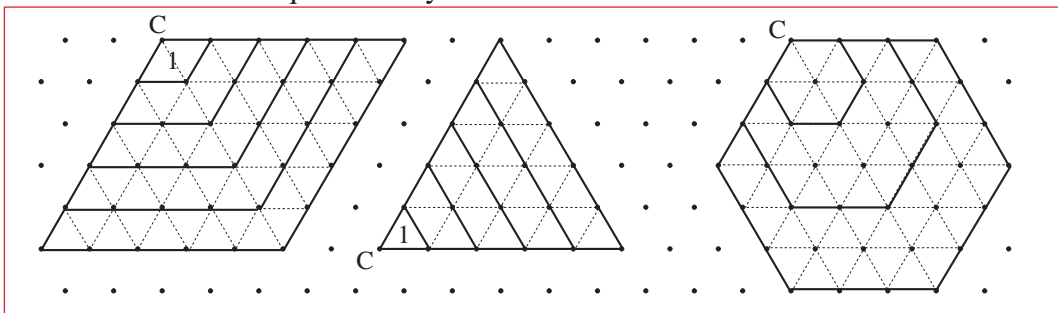
1

- a) **Enlarge** the square in the ratio of:
 i) 2:1 ii) 3:1.
 Write the area inside each square.
- b) **Reduce** the triangle in the ratio of
 i) 2:3 ii) 1:3.
- c) **Enlarge** the semicircle in the ratio of:
 i) 2:1 ii) 3:1.

$\frac{1}{2} < A < 1$ $2 < A < 4$ $4\frac{1}{2} < A < 7\frac{1}{2}$

2

Continue enlarging the rhombus, the triangle and the regular hexagon.
 Write their areas as sequences in your exercise book.



Areas of parallelograms: 2, 8, 18, 32, 50 Areas of triangles: 1, 4, 8, 16, 25
 Areas of hexagons: 6, 24, 54

3

Continue dividing the large shape into **congruent** (equal) parts.

a) (9)

b) (8)

4

Colour **similar** triangles in the same colour. Calculate their areas in your exercise book.

$A = 12 \square$ $A = 6 \square$ $A = 4 \square$ $A = 24 \square$
 $A = 12 \square$ $A = 16 \square$ $A = 3 \square$
 e.g. $2 \times 3 \div 2 = 3$

1

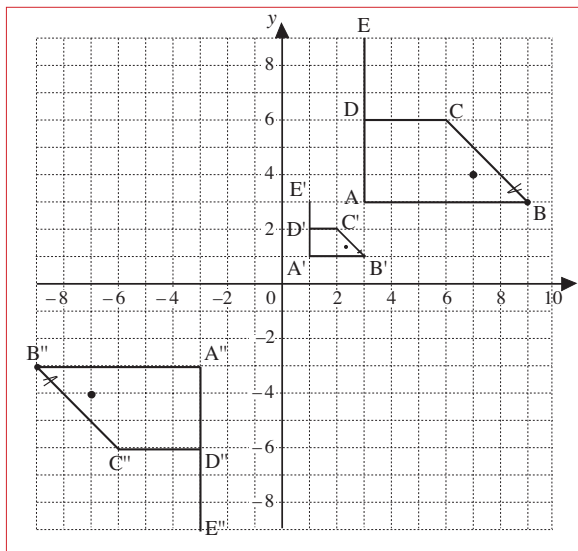
In your exercise book, calculate the **real** area of the gardens shown in these plans.

Areas

- a) **Area of diagram:** $4 \text{ cm} \times 2 \text{ cm} = 8 \text{ cm}^2$
Area of garden: $40 \text{ m} \times 20 \text{ m} = 800 \text{ m}^2$
- b) **Area of diagram:** $(3 \times 5) \text{ cm}^2 - (1 \times 1) \text{ cm}^2$
 $= 15 \text{ cm}^2 - 1 \text{ cm}^2 = 14 \text{ cm}^2$
Area of garden: $(60 \times 100) \text{ m}^2 - (20 \times 20) \text{ m}^2$
 $= 6000 \text{ m}^2 - 400 \text{ m}^2 = 5600 \text{ m}^2$

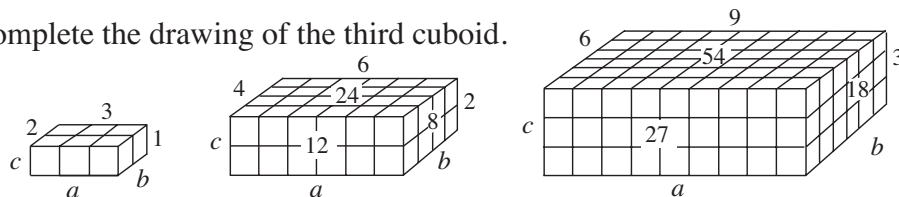
2

- a) Fill in the coordinates of the points.
A (3, 3), B (9, 3), C (6, 6), D (3, 6), E (3, 9)
- b) Divide the coordinates of each point by 3.
A' (1, 1), B' (3, 1), C' (2, 2), D' (1, 2), E' (1, 3)
- c) Change each of the original coordinates to its **opposite** number.
A'' (-3, -3), B'' (-9, -3), C'' (-6, -6), D'' (-3, -6), E'' (-3, -9)



3

- a) Complete the drawing of the third cuboid.



Continue the sequences for sides a , b and c and for area (A) and volume (V).

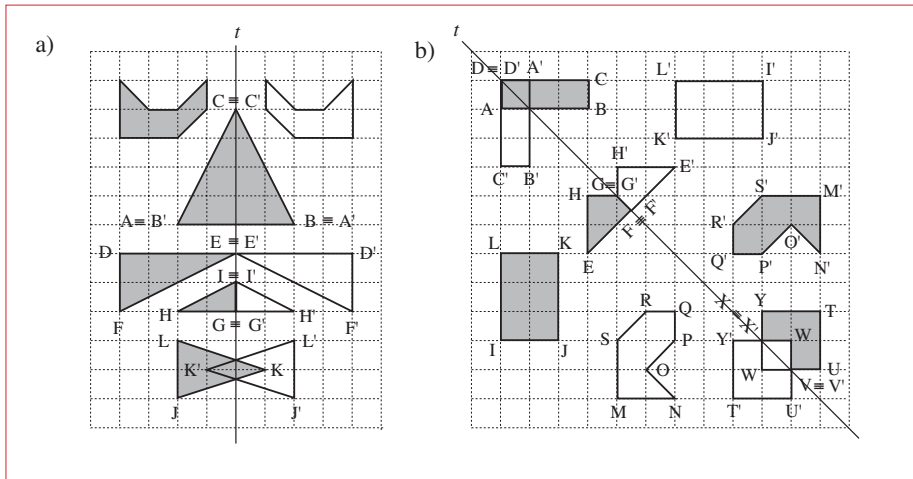
- a : 3, 6, 9, 12, 15, 18, ... (+3) [$3 \times n$, $n = 1, 2, 3, \dots$]
 b : 2, 4, 6, 8, 10, 12, ... (+2) [$2 \times n$, $n = 1, 2, 3, \dots$]
 c : 1, 2, 3, 4, 5, ... (+1) [n , $n = 1, 2, 3, \dots$]
 A: 22, 88, 198, 352, ... [$22 \times n \times n$, $n = 1, 2, 3, \dots$]
 V: 6, 48, 162, 384, ... [$6 \times n \times n \times n$, $n = 1, 2, 3, \dots$]

- b) Continue the sequences for a , A and V.

- a : 1, 2, 3, 4, 5, ... [n , $n = 1, 2, 3, \dots$]
 A: 6, 24, 54, 96, 150, ... [$6 \times n \times n$, $n = 1, 2, 3, \dots$]
 V: 1, 8, 27, 64, 125, ... [$n \times n \times n$, $n = 1, 2, 3, \dots$]

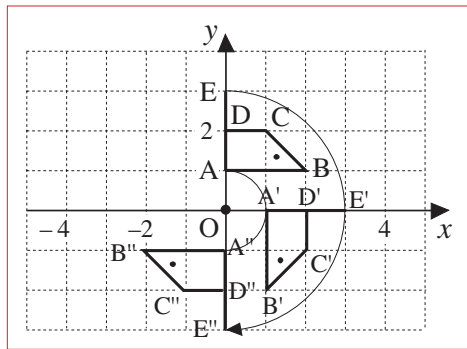
1

Reflect the shapes in axis t .



2

- a) Write the coordinates of the shape.
 $A(0, 1)$, $B(2, 1)$, $C(1, 2)$,
 $D(0, 2)$, $E(0, 3)$
- b) Rotate the shape by -90° around point O.
 Write the new coordinates.



- $A'(1, 0)$, $B'(1, -2)$, $C'(2, -1)$,
 $D'(2, 0)$, $E'(3, 0)$
- c) Repeat the rotation with the image. Write the new coordinates.
 $A''(0, -1)$, $B''(-2, -1)$, $C''(-1, -2)$, $D''(0, -2)$, $E''(0, -3)$

3

Write the coordinates of the points in the original diagram and in its images in your exercise book. What kind of transformations have been done?

- a) $A(3, 6)$, $A'(9, 6)$, $A''(7, 10)$ $B(1, 3)$, $B'(7, 3)$, $B''(5, 7)$
 $C(3, 1)$, $C'(9, 1)$, $C''(7, 5)$ $D(4, 3)$, $D'(10, 3)$, $D''(8, 7)$
 $E(3, 4)$, $E'(9, 4)$, $E''(7, 8)$

All movements are translations.

A to A': 6 units horizontally to the right

A' to A'': 4 units vertically up and 2 units horizontally to the left

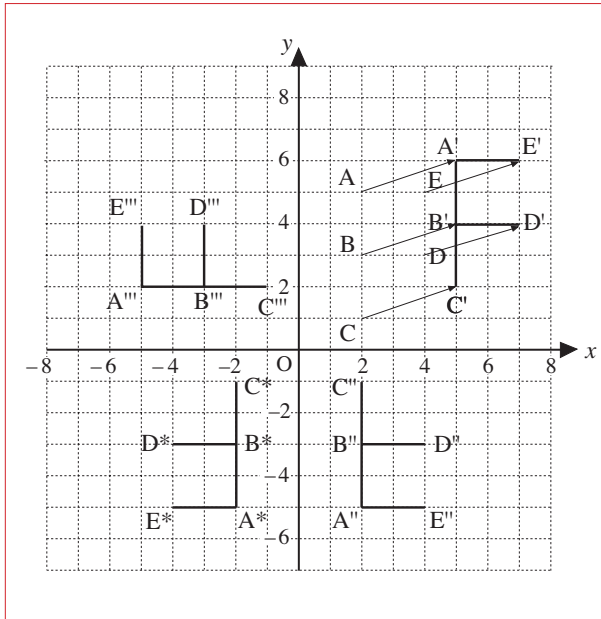
- b) $A(3, 6)$, $A'(-3, 6)$, $A''(-3, -6)$, $A^*(6, -3)$
 $B(1, 3)$, $B'(-1, 3)$, $B''(-1, -3)$, $B^*(3, -1)$
 $C(3, 1)$, $C'(-3, 1)$, $C''(-3, -1)$, $C^*(1, -3)$
 $D(4, 3)$, $D'(-4, 3)$, $D''(-4, -3)$, $D^*(3, -4)$
 $E(3, 4)$, $E'(-3, 4)$, $E''(-3, -4)$, $E^*(4, -3)$

A to A': Reflection in the y -axis

A' to A'': Reflection in the x -axis

A'' to A*: Rotation by -90° around point O

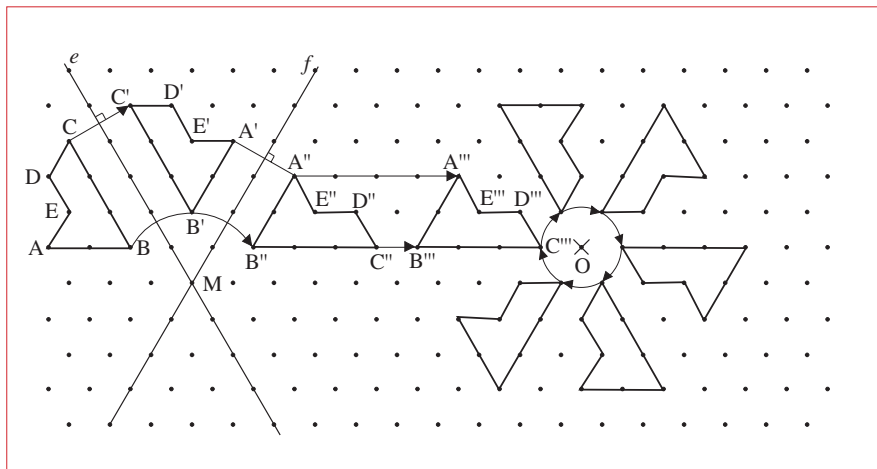
1



- a) **Translate** shape F so that the coordinates of point C' are (5, 2).
- b) **Reflect** the original shape F in the x -axis.
- c) **Rotate** the original shape F by 90° around point O.
- d) **Rotate** the original shape F by 180° around point O.

2

- a) **Reflect** shape ABCDE in line e .
- b) **Reflect** its image in line f .
- c) **Translate** the image 4 units to the right.
- d) **Rotate** the last shape by -60° around point O. Repeat the rotation several times.



3

- a) Write beside each solid how many planes of symmetry it has.

| | | | |
|---------------------------|-----------------------------|----------------|-----------------|
| i) square-based cuboid | ii) square-based pyramid | iii) cuboid | iv) cylinder |
|---------------------------|-----------------------------|----------------|-----------------|

- b) Which type of solid is formed by rotating each of the shaded shapes around the given axis?
 Write the names in your exercise book.

| | | | |
|------------|-----------------|----------------|-----------------|
| i) cone | ii) cylinder | iii) sphere | iv) cylinder |
|------------|-----------------|----------------|-----------------|

1

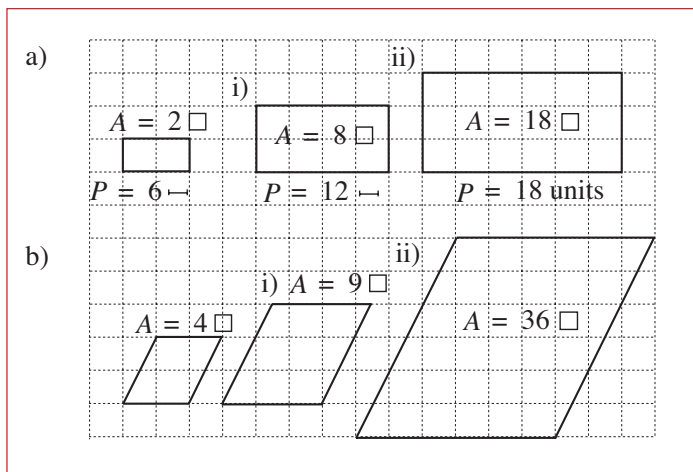
a) **Enlarge** the rectangle in the ratio of:

i) 2:1 ii) 3:1.

Write the area and perimeter of each shape.

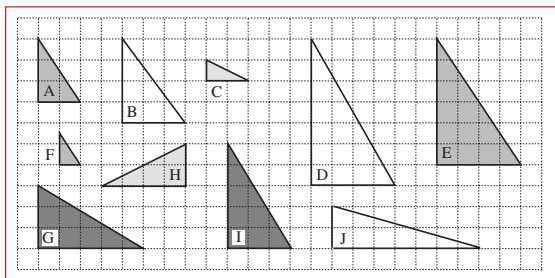
b) **Enlarge** the parallelogram in the ratio of:

i) 3:2 ii) 3:1



2

Colour **similar** triangles in the same colour. Calculate their areas in your exercise book.



$A \sim F \sim E, C \sim H, G \approx I$

Areas: A: $A = 3$ square units B: $A = 6$ square units
 C: $A = 1$ square unit D: $A = 14$ square units
 E: $A = 12$ square units F: $A = \frac{3}{4}$ of a square unit
 G: $A = 7\frac{1}{2}$ square units H: $A = 4$ square units
 I: $A = 7\frac{1}{2}$ square units J: $A = 7$ square units

3

a) Write the coordinates of these points.

A (1, 6), B (1, 2), C (2, 1), D (4, 1)
 E (5, 2), F (5, 6). G (4, 5), H (2, 5),
 I (2, 4), J (4, 4), K (3, 3) L (2, 2),
 M (4, 2)

b) Reflect the shape in the x -axis.

Write the coordinates of:

$A' (1, -6), E' (5, -2), J' (4, -4)$

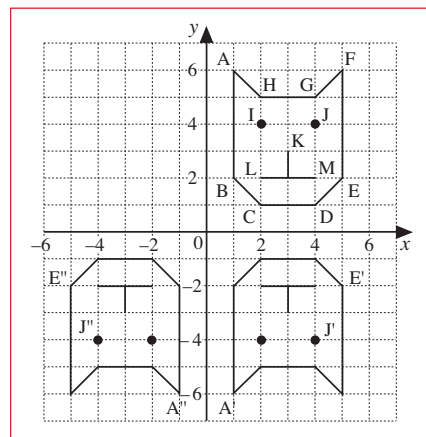
c) Reflect the new shape in the y -axis.

Write the coordinates of:

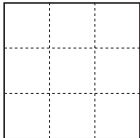
$A'' (-1, -6), E'' (-5, -2), J'' (-4, -4)$

d) How have the coordinates of the original points changed to make the third shape?

The original coordinates have changed to their opposite values in the 3rd shape.



1

- 1 unit
- a)  If this square is 1 unit, what part of the unit is each grid square? $\frac{1}{9}$
- b) Compare the fractions. Fill in the missing signs. (<, >, =)
- i) $\frac{1}{9} < \frac{2}{9}$ ii) $\frac{3}{9} < \frac{5}{9}$ iii) $\frac{6}{9} > \frac{3}{9}$ iv) $\frac{4}{9} > \frac{2}{9}$
- v) $\frac{9}{9} > \frac{7}{9}$ vi) $\frac{4}{9} < \frac{7}{9}$ vii) $\frac{8}{9} < \frac{9}{9}$ viii) $\frac{11}{9} < \frac{15}{9}$

2

- Each rectangle is 1 unit.
- a) Colour *red* one part of each of the rectangles. Write below it what fraction the *red* part is of the whole unit.
- b) List the fractions in decreasing order.
- $\frac{2}{3} > \frac{2}{4} > \frac{2}{6} > \frac{2}{12}$

3

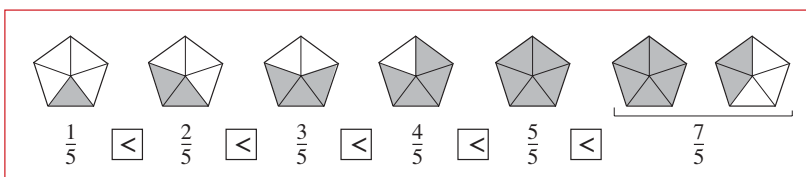
- a) Write beside each fraction its **opposite** value.
- $\frac{3}{4}, -\frac{3}{4}; -\frac{1}{2}, \frac{1}{2}; \frac{4}{4}, -\frac{4}{4}; -\frac{5}{4}, \frac{5}{4}$
- b) Use your ruler to measure and draw appropriate ticks on the number line, then mark on it and label all the eight fractions.
- $-\frac{5}{4}, -1, -\frac{3}{4}, -\frac{1}{2}, -\frac{1}{4}, 0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1, \frac{5}{4}$
- c) Write the fractions in increasing order.
- $-\frac{5}{4} < -\frac{4}{4} < -\frac{3}{4} < -\frac{1}{2} < \frac{1}{2} < \frac{3}{4} < \frac{4}{4} < \frac{5}{4}$

4

- Write these fractions in increasing order.
- a) $\frac{8}{12}, -\frac{1}{12}, -\frac{12}{12}, \frac{5}{12}, -\frac{13}{12}, \frac{14}{12}, -\frac{18}{12}$
- $-\frac{18}{12} < -\frac{13}{12} < -\frac{12}{12} < -\frac{1}{12} < \frac{5}{12} < \frac{8}{12} < \frac{14}{12}$
- b) $-\frac{3}{2}, \frac{3}{8}, \frac{3}{5}, \frac{3}{2}, -\frac{3}{4}, -\frac{3}{12}, \frac{3}{7}, -\frac{3}{6}$
- $-\frac{3}{2} < -\frac{3}{4} < -\frac{3}{6} < -\frac{3}{12} < \frac{3}{8} < \frac{3}{7} < \frac{3}{5} < \frac{3}{2}$

1

Each pentagon is 1 unit. Colour the given fractions and compare them. (<, > or =)

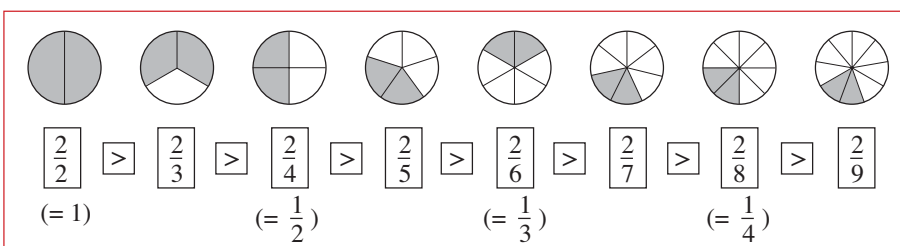


(Equal denominators, so greater fraction has greater numerator)

2

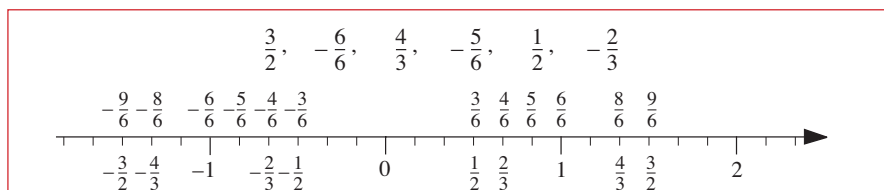
Each circle is 1 unit. Colour **two** parts in each circle.

Write the fractions coloured below the circles and compare them. (<, > or =)



3

a) Mark these fractions and their **opposite** values on the number line.



b) $-\frac{3}{2} < -\frac{4}{3} < -\frac{6}{6} < -\frac{5}{6} < -\frac{2}{3} < -\frac{1}{2} < \frac{1}{2} < \frac{2}{3} < \frac{5}{6} < \frac{6}{6} < \frac{4}{3} < \frac{3}{2}$
 ($-1\frac{1}{2}$) ($-1\frac{1}{3}$) (-1) (1) ($1\frac{1}{3}$) ($1\frac{1}{2}$)

4

Fill in the missing numbers.

a) $\frac{1}{2} + \boxed{\frac{1}{2}} = 1$ $\frac{1}{3} + \boxed{\frac{2}{3}} = 1$ $\frac{2}{3} + \boxed{\frac{1}{3}} = 1$ $\frac{3}{3} + \boxed{0} = 1$
 $\frac{3}{7} + \boxed{\frac{4}{7}} = 1$ $\boxed{\frac{7}{9}} + \frac{2}{9} = 1$ $\frac{4}{5} + \boxed{\frac{1}{5}} = 1$ $\frac{4}{5} + \boxed{1\frac{1}{5}} = 2$

b) $1 - \frac{2}{2} = \boxed{0}$ $1 - \frac{1}{2} = \boxed{\frac{1}{2}}$ $1 - \frac{0}{2} = \boxed{1}$ $1 - \frac{3}{4} = \boxed{\frac{1}{4}}$
 $2 - \frac{4}{5} = \boxed{1\frac{1}{5}}$ $1 - \frac{3}{7} = \boxed{\frac{4}{7}}$ $2 - \frac{6}{6} = \boxed{1}$ $3 - \frac{2}{5} = \boxed{2\frac{3}{5}}$

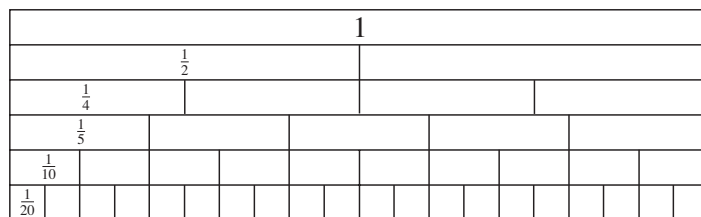
5

Compare the fractions. Fill in the missing signs. (<, > or =)

a) a) $\frac{2}{15} < \frac{7}{15}$ b) $\frac{6}{7} > \frac{1}{7}$ c) $-\frac{2}{8} > -\frac{3}{8}$
 d) $\frac{51}{10} < \frac{52}{10}$ e) $\frac{4}{8} > \frac{4}{10}$ f) $\frac{3}{2} > \frac{3}{4}$
 g) $-\frac{1}{3} > -\frac{1}{2}$ h) $\frac{40}{50} = \frac{80}{100} > \frac{40}{100}$

1

Write different forms of the same quantities from the diagram.



$$1 = \frac{2}{2} = \frac{4}{4} = \frac{5}{5} = \frac{10}{10} = \frac{20}{20} \quad \frac{1}{2} = \frac{2}{4} = \frac{5}{10} = \frac{10}{20} \quad \frac{1}{4} = \frac{5}{20}$$

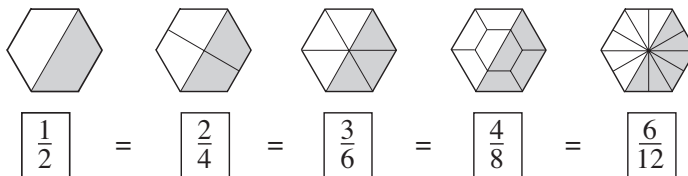
$$\frac{3}{4} = \frac{15}{20} \quad \frac{1}{5} = \frac{2}{10} = \frac{4}{20} \quad \frac{2}{5} = \frac{4}{10} = \frac{8}{20} \quad \frac{3}{5} = \frac{6}{10} = \frac{12}{20}$$

$$\frac{4}{5} = \frac{8}{10} = \frac{16}{20} \quad \frac{1}{10} = \frac{2}{20} \quad \frac{3}{10} = \frac{6}{20} \quad \frac{7}{10} = \frac{14}{20} \quad \frac{9}{10} = \frac{18}{20}$$

2

Each hexagon is 1 unit.

Which form of the fraction shaded do they each show?



3

Write each of these fractions in at least 5 different forms.

e.g.

a) $\frac{2}{3} = \frac{4}{6} = \frac{6}{9} = \frac{8}{12} = \frac{10}{15} = \frac{12}{18} (= \frac{20}{30} = \frac{44}{66}, \text{etc.})$

b) $\frac{4}{7} = \frac{8}{14} = \frac{12}{21} = \frac{16}{28} = \frac{20}{35} = \frac{24}{42} (= \frac{36}{63} = \frac{400}{700}, \text{etc.})$

c) $\frac{0}{6} = \frac{0}{12} = \frac{0}{18} = \frac{0}{24} = \frac{0}{30} = \frac{0}{36} (= \frac{0}{2} = \frac{0}{1} = 0, \text{etc.})$

d) $\frac{11}{11} = \frac{22}{22} = \frac{33}{33} = \frac{44}{44} = \frac{55}{55} = \frac{66}{66} (= \frac{2}{2} = \frac{1}{1} = 1, \text{etc.})$

4

e.g.

a) i) $\frac{6}{10} = \frac{3}{5}$ ii) $\frac{24}{72} = \frac{12}{36} = \frac{6}{18} = \frac{3}{9} = \frac{1}{3}$

iii) $\frac{4}{8} = \frac{2}{4} = \frac{1}{2}$ iv) $\frac{15}{45} = \frac{3}{9} = \frac{1}{3}$

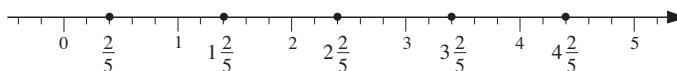
v) $\frac{8}{5}$ (cannot be simplified further, but $= 1\frac{3}{5}$) vi) $\frac{8}{4} = \frac{4}{2} = \frac{2}{1} = 2$

b) Compare the fractions and write them in increasing order.

$$\frac{1}{3} < \frac{1}{2} < \frac{3}{5} < 1\frac{3}{5} < 2 \quad (\text{e.g. } \frac{1}{3} = \frac{2}{6} < \frac{1}{2} = \frac{3}{6})$$

1

List the numbers marked on the number line in increasing order and continue the sequence.



$$\frac{2}{5}, 1\frac{2}{5}, 2\frac{2}{5}, 3\frac{2}{5}, 4\frac{2}{5}, 5\frac{2}{5}, 6\frac{2}{5}, 7\frac{2}{5}, \dots (+1)$$

or $\frac{2}{5}, \frac{7}{5}, \frac{12}{5}, \frac{17}{5}, \frac{22}{5}, \frac{27}{5}, \frac{32}{5}, \frac{37}{5}, \dots (+\frac{5}{5} = 1)$

2

Fill in the missing numerators and denominators. Write other forms of the numbers.

a) $\frac{3}{4} = \frac{6}{8} = \frac{\boxed{9}}{12} = \frac{\boxed{12}}{16} = \frac{15}{\boxed{20}} = \frac{\boxed{18}}{\boxed{24}} = \frac{30}{40} = \frac{36}{48}$ etc. e.g.

b) $\frac{6}{5} = \frac{12}{\boxed{10}} = \frac{\boxed{24}}{20} = \frac{18}{\boxed{15}} = 1 + \frac{\boxed{1}}{5} = 1\frac{\boxed{1}}{5}$

c) $\frac{12}{3} = \frac{24}{\boxed{6}} = \frac{\boxed{36}}{9} = \frac{\boxed{4}}{1} = \frac{4}{\boxed{1}} = \frac{\boxed{48}}{12} = \frac{\boxed{40}}{10} = \frac{8}{2}$ etc. e.g.

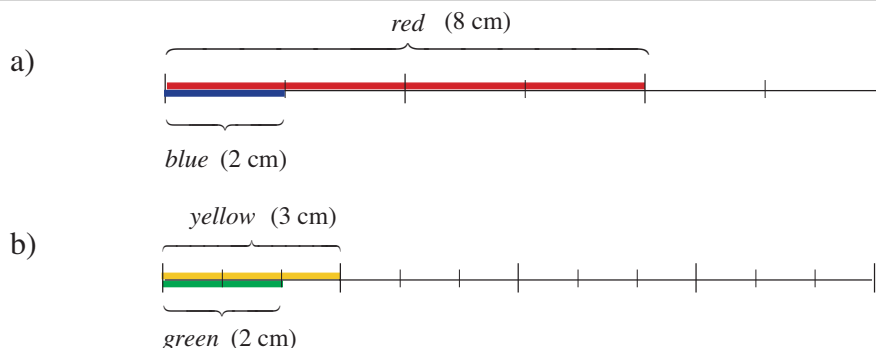
3

Compare the fractions in each pair. Fill in the missing signs. (<, > or =)

a) $\frac{3}{4} \boxed{>} \frac{5}{8}$ b) $\frac{4}{5} \boxed{=} \frac{8}{10}$ c) $\frac{7}{9} \boxed{>} \frac{2}{3}$ d) $\frac{23}{50} \boxed{>} \frac{4}{10}$
 as $\frac{6}{8} > \frac{5}{8}$ as $\frac{8}{10} = \frac{8}{10}$ as $\frac{7}{9} > \frac{6}{9}$ as $\frac{23}{50} > \frac{20}{50}$

e) $\frac{2}{3} \boxed{>} \frac{5}{8}$ f) $\frac{1}{4} \boxed{>} \frac{1}{5}$ g) $\frac{5}{6} \boxed{>} \frac{7}{9}$ h) $\frac{40}{30} \boxed{>} \frac{25}{20}$
 as $\frac{16}{24} > \frac{15}{24}$ as $\frac{5}{20} > \frac{4}{20}$ as $\frac{15}{18} > \frac{14}{18}$ as $\frac{80}{60} > \frac{75}{60}$

4



5

How many centimetres are in:

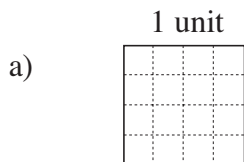
a) 2 fifths of 10 metres

400 cm

b) 2 fifths of 1 metre?

40 cm

1



If this square is 1 unit,
 what part of the unit is 1 grid square?

$\frac{1}{16}$

b) Compare the fractions. Fill in the missing signs. (<, >, =)

- i) $\frac{1}{16} < \frac{3}{16}$ ii) $\frac{5}{16} > \frac{1}{4}$ iii) $\frac{12}{16} = \frac{6}{8}$ iv) $\frac{8}{16} > \frac{7}{16}$
 v) $\frac{5}{16} < \frac{1}{2}$ vi) $\frac{1}{4} = \frac{4}{16}$ vii) $\frac{17}{16} < \frac{19}{16}$ viii) $\frac{16}{16} > \frac{7}{8}$

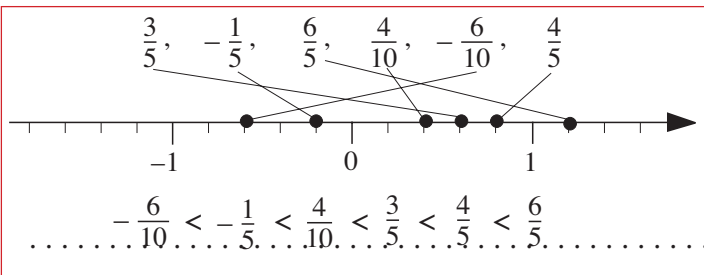
2

Fill in the missing numerators and denominators.

- a) $\frac{4}{12} = \frac{1}{3}$ b) $\frac{3}{6} = \frac{1}{2}$ c) $\frac{15}{20} = \frac{3}{4}$ d) $\frac{5}{10} = \frac{1}{2}$
 e) $\frac{5}{15} = \frac{1}{3}$ f) $\frac{4}{8} = \frac{16}{32}$ g) $\frac{3}{7} = \frac{9}{21}$ h) $\frac{36}{48} = \frac{3}{4}$

3

a) Mark these fractions
 on the number line.



b) List all the fractions
 in decreasing order.

4

Compare the quantities. Fill in the missing signs. (>, <, =)

- a) $1\frac{1}{2}$ litres = 1500 ml b) $1\frac{1}{4}$ litres < 1500 ml
 c) $1\frac{2}{3}$ hours = 100 minutes d) $1\frac{1}{3}$ days > 30 hours
 e) $2\frac{1}{4}$ km < 2500 m f) $1\frac{2}{3}$ years = 20 months
 g) $1\frac{1}{20}$ m = 105 cm h) $1\frac{4}{5}$ kg > 1400 g

5

Compare the fractions. Fill in the missing signs. (<, >, =)

- a) $\frac{3}{4} < \frac{7}{8}$ b) $\frac{1}{7} < \frac{1}{6}$ c) $-\frac{2}{9} > -\frac{1}{3}$ d) $\frac{4}{10} = \frac{20}{50}$
 e) $\frac{2}{3} < \frac{3}{4}$ f) $\frac{1}{7} = \frac{4}{28}$ g) $\frac{30}{25} < \frac{25}{20}$ h) $\frac{15}{45} = \frac{2}{6}$

1

Put these numbers into three groups.

$$\frac{1}{8} \quad \frac{2}{4} \quad \frac{3}{2} \quad \frac{5}{8} \quad \frac{7}{2} \quad \frac{1}{2} \quad \frac{4}{4} \quad \frac{6}{6} \quad \frac{3}{8} \quad \frac{7}{9} \quad \frac{8}{8} \quad \frac{7}{6}$$

Less than 1:

$$\frac{1}{8}, \frac{2}{4} (= \frac{1}{2}), \frac{5}{8}, \frac{1}{2}, \frac{3}{8}, \frac{7}{9}$$

Equal to 1:

$$\frac{4}{4}, \frac{6}{6}, \frac{8}{8}$$

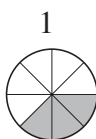
Greater than 1:

$$\frac{3}{2} (= 1\frac{1}{2}), \frac{7}{2} (= 3\frac{1}{2}), \frac{7}{6} (= 1\frac{1}{6})$$

2

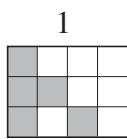
What part of each diagram is shaded? Write the fraction and show it as an addition.

a)



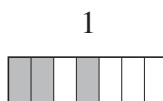
$$\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$$

b)



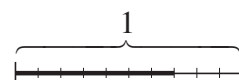
$$\frac{5}{12} = \frac{3}{12} + \frac{1}{12} + \frac{1}{12}$$

c)



$$\frac{3}{7} = \frac{2}{7} + \frac{1}{7}$$

d)

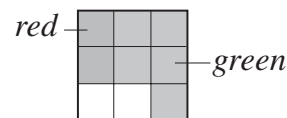


$$\frac{7}{10} = \frac{5}{10} + \frac{2}{10}$$

3

Andrew planted $\frac{2}{9}$ of his garden with strawberries and $\frac{5}{9}$ of his garden with gooseberries.

a) Shade the part used for strawberries in *red* and the part used for gooseberries in *green*.



b) What part of his garden did Andrew use to plant the fruit?

$$\frac{2}{9} + \frac{5}{9} = \frac{7}{9}$$

c) What part of his garden did he **not** use to plant the fruit?

$$1 - \frac{7}{9} = \frac{2}{9} \text{ (or } \frac{9}{9} - \frac{7}{9} = \frac{2}{9} \text{)}$$

4

a) i) $\frac{9}{7} = 1 + \frac{2}{7}$

ii) $\frac{16}{5} = 1 + \frac{11}{5} = 2 + \frac{6}{5} = 3 + \frac{1}{5}$

iii) $\frac{49}{22} = 1 + \frac{27}{22} = 2 + \frac{5}{22}$

iv) $\frac{13}{4} = 1 + \frac{9}{4} = 2 + \frac{5}{4} = 3 + \frac{1}{4}$

b) i) $1 + \frac{1}{2} = \frac{2}{2} + \frac{1}{2} = \frac{3}{2}$

ii) $1 + \frac{2}{3} = \frac{3}{3} + \frac{2}{3} = \frac{5}{3}$

iii) $3 + \frac{1}{5} = \frac{15}{5} + \frac{1}{5} = \frac{16}{5}$

iv) $5 + \frac{2}{7} = \frac{35}{7} + \frac{2}{7} = \frac{37}{7}$

v) $3 + \frac{7}{4} = \frac{12}{4} + \frac{7}{4} = \frac{19}{4}$

vi) $6 + \frac{2}{9} = \frac{54}{9} + \frac{2}{9} = \frac{56}{9}$

5

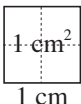
a) $\frac{1}{4} + \frac{3}{4} + \frac{7}{4} + \frac{2}{4} = \frac{13}{4} (= 3\frac{1}{4})$

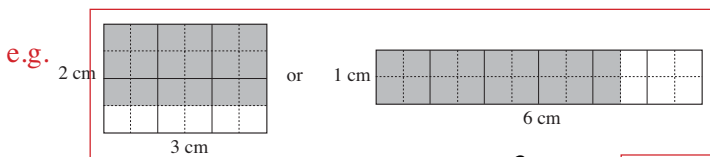
b) $\frac{7}{3} - \frac{2}{3} = \frac{5}{3} (= 1\frac{2}{3})$

c) $\frac{9}{11} + \frac{3}{11} - \frac{1}{11} - \frac{5}{11} = \frac{12}{11} - \frac{6}{11} = \frac{6}{11}$

d) $\frac{110}{50} - \frac{41}{50} + \frac{12}{50} = \frac{69}{50} + \frac{12}{50} = \frac{81}{50} (= 1\frac{31}{50})$

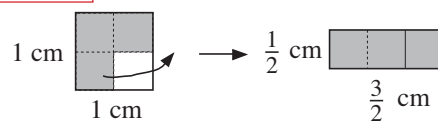
1

- a) Draw a rectangle which has an area of 6 cm^2 .  1 cm Colour $\frac{3}{4}$ of its area.



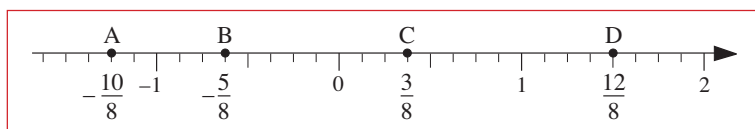
- b) Draw a rectangle which has an area of $\frac{3}{4} \text{ cm}^2$.

e.g.



2

- a) Write the numbers below the dots marked on the number line.



- b) Calculate:

i) $A + B = -\frac{15}{8} (= -1\frac{7}{8})$ ii) $B + C = -\frac{2}{8} (= -\frac{1}{4})$ iii) $A + C = -\frac{7}{8}$

iv) $B + D = \frac{7}{8}$ v) $A + D = \frac{2}{8} (= \frac{1}{4})$ vi) $C + D = \frac{15}{8} (= 1\frac{7}{8})$

- c) i) A from B: $\frac{5}{8}$ ii) B from C: $\frac{8}{8} (= 1)$ iii) A from C: $\frac{13}{8} (= 1\frac{5}{8})$

iv) B from D: $\frac{17}{8} (= 2\frac{1}{8})$ v) A from D: $\frac{22}{8} (= 2\frac{6}{8} = 2\frac{3}{4})$ vi) C from D: $\frac{9}{8} (= 1\frac{1}{8})$

3

Answer each question by writing an operation.

- a) How much should we add to $\frac{3}{10}$ to get $\frac{8}{10}$?

Add $\frac{5}{10}$

- b) How much more is $\frac{4}{11}$ than $\frac{1}{11}$?

$\frac{3}{11}$ more

- c) How much should be added to 1 to get $\frac{7}{5}$?

Add $\frac{2}{5}$

- d) How much more is $\frac{8}{5}$ than 1?

$\frac{3}{5}$ more

- e) How much should be added to $\frac{6}{9}$ to get $\frac{11}{9}$?

Add $\frac{5}{9}$

4

a) $\frac{3}{6} + \frac{1}{6} + \frac{5}{6} + \frac{2}{6} = \frac{11}{6} (= 1\frac{5}{6})$ b) $1 + \frac{3}{8} = 1\frac{3}{8}$ c) $6 + \frac{5}{9} = 6\frac{5}{9}$

d) $\frac{4}{7} - \frac{3}{7} = \frac{1}{7}$ e) $1 - \frac{3}{8} = \frac{5}{8}$ f) $6 - \frac{5}{9} = 5\frac{4}{9}$ g) $\frac{13}{9} - 1 = \frac{4}{9}$

h) $\frac{3}{8} - 1 = -\frac{5}{8}$ i) $\frac{3}{10} + \frac{4}{10} - \frac{7}{10} - \frac{2}{10} = -\frac{2}{10}$ j) $\frac{2}{3} - (-\frac{2}{3}) = \frac{4}{3}$

1

Do the calculations.

a) $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6} (= \frac{1}{2})$ b) $\frac{2}{5} + \frac{1}{5} = \frac{3}{5}$ c) $\frac{5}{8} - \frac{2}{8} = \frac{3}{8}$
 d) $\frac{3}{7} + \frac{1}{7} + \frac{2}{7} = \frac{6}{7}$ e) $\frac{8}{10} + \frac{3}{10} - \frac{5}{10} + \frac{2}{10} = \frac{8}{10} (= \frac{4}{5})$ f) $\frac{3}{9} - \frac{7}{9} = -\frac{4}{9}$
 g) $1\frac{2}{3} + \frac{1}{3} = 2$ h) $2\frac{8}{9} - \frac{5}{9} = 2\frac{3}{9}$ i) $4\frac{2}{3} - 3\frac{1}{3} = 1\frac{1}{3}$

2

Calculate the sums and differences. Use the diagrams to help you.

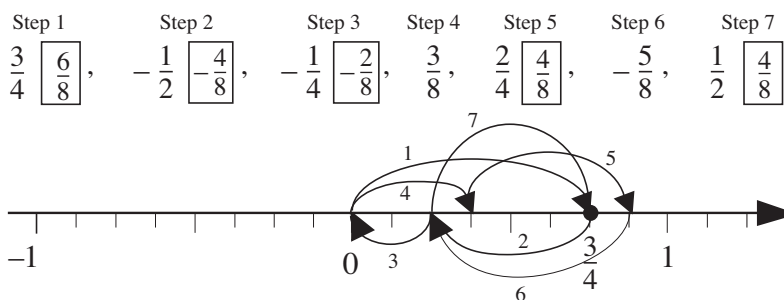
a) i) $= \frac{8}{10} (= \frac{4}{5})$ ii) $= \frac{4}{10} (= \frac{2}{5})$ iii) $= \frac{3}{10}$
 b) i) $= \frac{5}{8}$ ii) $= \frac{1}{8}$ iii) $= \frac{5}{8}$
 c) i) $= \frac{8}{9}$ ii) $= \frac{2}{9}$ iii) $= \frac{3}{9} (= \frac{1}{3})$

3

Calculate the sums and differences. Write details in your exercise book if necessary.

a) $\frac{2}{5} + \frac{3}{10} = \frac{4+3}{10} = \frac{7}{10}$ b) $\frac{5}{12} + \frac{3}{4} = \frac{5+9}{12} = \frac{14}{12} (= 1\frac{2}{12} = 1\frac{1}{6})$
 c) $\frac{1}{3} + \frac{2}{9} - \frac{3}{18} = \frac{6+4-3}{18} = \frac{7}{18}$ d) $\frac{6}{2} + \frac{4}{10} + \frac{3}{5} = \frac{30+4+6}{10} = \frac{40}{10} (= 4)$
 e) $\frac{3}{5} - \frac{4}{10} = \frac{6-4}{10} = \frac{2}{10} (= \frac{1}{5})$ or $\frac{3}{5} - \frac{2}{5} = \frac{1}{5}$ f) $\frac{11}{12} - \frac{3}{4} = \frac{11-9}{12} = \frac{2}{12} (= \frac{1}{6})$
 g) $\frac{3}{7} - \frac{2}{21} = \frac{9-2}{21} = \frac{7}{21} (= \frac{1}{3})$ h) $\frac{21}{12} - \frac{4}{3} = \frac{21-16}{12} = \frac{5}{12}$
 i) $1\frac{2}{3} - \frac{7}{6} = \frac{5}{3} - \frac{7}{6} = \frac{10-7}{6} = \frac{3}{6} = \frac{1}{2}$ or $1\frac{2}{3} - \frac{7}{6} = 1\frac{2}{3} - 1\frac{1}{6} = \frac{2}{3} - \frac{1}{6} = \frac{4-1}{6} = \frac{3}{6} = \frac{1}{2}$

4



5

Solve the equations. Draw suitable number lines in your exercise book if necessary.

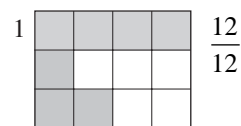
a) $a = \frac{3}{3} - \frac{1}{3} = \frac{2}{3}$ b) $b = \frac{3}{8} - \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$ c) $c = \frac{11}{4} - \frac{7}{4} = \frac{4}{4} = 1$
 d) $d = \frac{2}{7} + \frac{3}{7} = \frac{5}{7}$ e) $e = 1 - \frac{7}{9} = \frac{2}{9}$ f) $f = \frac{6}{5} - 1 = \frac{6}{5} - \frac{5}{5} = \frac{1}{5}$

1

Use the diagram to help you do the calculations.

a) $\frac{1}{3} + \frac{1}{4} = \frac{4}{12} + \frac{3}{12} = \frac{7}{12}$

b) $\frac{2}{3} + \frac{1}{12} - \frac{1}{4} = \frac{8+1-3}{12} = \frac{6}{12} = \frac{1}{2}$



2

Use the diagram to help you do the calculations.

a) $\frac{1}{3} + \frac{2}{5} = \frac{5}{15} + \frac{6}{15} = \frac{11}{15}$

b) $\frac{2}{3} - \frac{2}{5} = \frac{10}{15} - \frac{6}{15} = \frac{4}{15}$

c) $\frac{1}{5} + \frac{2}{3} - \frac{3}{5} = \frac{3+10-9}{15} = \frac{4}{15}$ or $\frac{1}{5} + \frac{2}{3} - \frac{3}{5} = \frac{2}{3} - \frac{2}{5} = \frac{4}{15}$



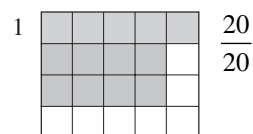
3

Use the diagram to help you do the calculations.

a) $\frac{1}{4} + \frac{2}{5} = \frac{5}{20} + \frac{8}{20} = \frac{13}{20}$

b) $\frac{4}{5} - \frac{1}{4} = \frac{16}{20} - \frac{5}{20} = \frac{11}{20}$

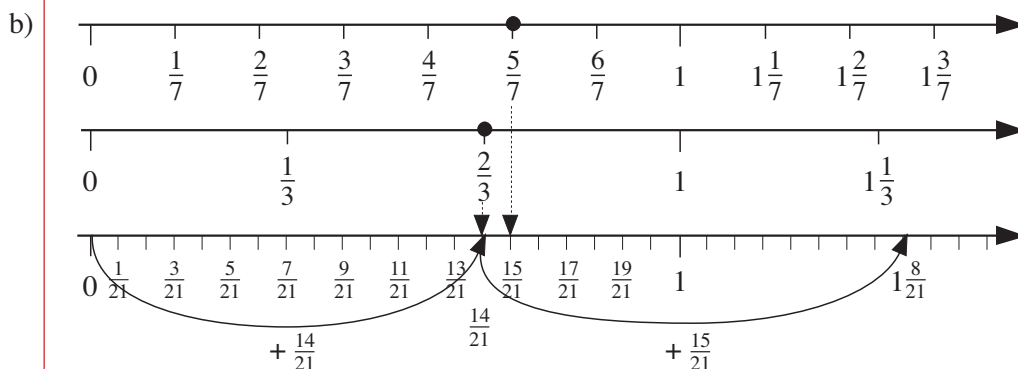
c) $\frac{1}{2} + \frac{3}{5} - \frac{3}{10} - \frac{3}{20} = \frac{10+12-6-3}{20} = \frac{13}{20}$



4

Add $\frac{2}{3}$ and $\frac{5}{7}$ in different ways. Complete the diagrams and equations.

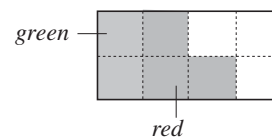
a) $\frac{2}{3} + \frac{5}{7} = \frac{14}{21} + \frac{15}{21} = \frac{29}{21} = 1\frac{8}{21}$



c) $\frac{2}{3} = \frac{4}{6} = \frac{6}{9} = \frac{8}{12} = \frac{10}{15} = \frac{12}{18} = \frac{14}{21} = \frac{16}{24}$
 $\frac{5}{7} = \frac{10}{14} = \frac{15}{21} = \frac{20}{28} = \frac{25}{35}$
 $\frac{2}{3} + \frac{5}{7} = \frac{14+15}{21} = \frac{29}{21} = 1\frac{8}{21}$

1

Jim planted $\frac{3}{8}$ of his vegetable garden with beetroot and one quarter of it with leeks.



- a) Shade the part used for beetroot in *red* and the part used for leeks in *green*.
- b) What part of the vegetable garden has not yet been used?

$$\frac{3}{8}$$

2

- a) $a = \frac{3}{4} - \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$ b) $b = \frac{5}{7} - \frac{1}{7} = \frac{4}{7}$ c) $c = \frac{9}{5} - \frac{7}{5} = \frac{2}{5}$
- d) $d = \frac{4}{9} + \frac{5}{9} = \frac{9}{9} = 1$ e) $e = 2 - \frac{3}{8} = 1\frac{5}{8}$ f) $f = \frac{7}{6} - 1 = \frac{7}{6} - \frac{6}{6} = \frac{1}{6}$

3

Solve the problems in your exercise book.

- a) **John has £7 left.**
- b) i) **Sally gave 60 stamps to her brother.**
 ii) **Sally still has 120 stamps left.**

4

Calculate the sums and differences.

- a) $\frac{3}{5} + \frac{3}{10} = \frac{6+3}{10} = \frac{9}{10}$ b) $\frac{7}{8} + \frac{1}{4} = \frac{7+2}{8} = \frac{9}{8}$
- c) $\frac{1}{2} + \frac{1}{10} - \frac{2}{5} = \frac{5+1-4}{10} = \frac{2}{10} = \frac{1}{5}$ d) $\frac{4}{11} + \frac{5}{11} - \frac{2}{11} = \frac{4+5-2}{11} = \frac{7}{11}$
- e) $\frac{7}{12} - \frac{1}{3} = \frac{7-4}{12} = \frac{3}{12} = \frac{1}{4}$ f) $\frac{5}{7} - \frac{5}{21} = \frac{15-5}{21} = \frac{10}{21}$
- g) $\frac{2}{3} + \frac{2}{9} - \frac{3}{18} = \frac{12+4-3}{18} = \frac{13}{18}$ h) $\frac{1}{4} + \frac{3}{8} - \frac{5}{16} = \frac{4+6-5}{16} = \frac{5}{16}$
- i) $1\frac{1}{5} - \frac{3}{10} = \frac{6}{5} - \frac{3}{10} = \frac{12-3}{10} = \frac{9}{10}$

5

- a) What has been done to $\frac{7}{8}$ to get $1\frac{1}{2}$? $1\frac{1}{2} - \frac{7}{8} = \frac{3}{2} - \frac{7}{8} = \frac{12-7}{8} = \frac{5}{8}$
- b) What has been done to $\frac{10}{17}$ to get 2? $2 - \frac{10}{17} = \frac{34}{17} - \frac{10}{17} = \frac{24}{17} = 1\frac{7}{17}$
- c) What has been done to $\frac{3}{10}$ to get $\frac{3}{5}$? $\frac{3}{5} - \frac{3}{10} = \frac{6-3}{10} = \frac{3}{10}$
- d) What has been done to 3 to get $\frac{3}{4}$? $3 - \frac{3}{4} = \frac{12}{4} - \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4}$

1

Calculate the sums and differences. Write details in your exercise book.

a) i) $\frac{3}{7} + \frac{2}{7} = \frac{5}{7}$ ii) $\frac{13}{20} - \frac{6}{20} = \frac{7}{20}$ iii) $1 - \frac{5}{9} = \frac{4}{9}$
 iv) $1 + \frac{3}{8} = 1\frac{3}{8}$ ($= \frac{8+3}{8} = \frac{11}{8}$)
 b) i) $\frac{4}{10} + \frac{2}{5} = \frac{4+4}{10} = \frac{8}{10} = \frac{4}{5}$ ii) $\frac{3}{4} - \frac{5}{8} = \frac{6-5}{8} = \frac{1}{8}$
 iii) $\frac{5}{6} + \frac{1}{3} - \frac{1}{2} = \frac{5+2-3}{6} = \frac{4}{6} = \frac{2}{3}$

2

a) i) $\frac{3}{8} + \frac{4}{8} = \frac{7}{8}$ ii) $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{4+2+1}{8} = \frac{7}{8}$ iii) $\frac{7}{8} - \frac{3}{4} = \frac{7-6}{8} = \frac{1}{8}$
 b) i) $\frac{2}{3} + \frac{1}{8} = \frac{16+3}{24} = \frac{19}{24}$ ii) $\frac{1}{3} + \frac{3}{8} = \frac{8+9}{24} = \frac{17}{24}$
 iii) $\frac{7}{8} - \frac{2}{3} = \frac{21-16}{24} = \frac{5}{24}$
 c) i) $\frac{1}{6} + \frac{5}{24} = \frac{4+5}{24} = \frac{9}{24}$ ($= \frac{3}{8}$) ii) $\frac{5}{8} - \frac{1}{6} = \frac{15-4}{24} = \frac{11}{24}$
 iii) $\frac{5}{12} + \frac{7}{24} - \frac{1}{8} = \frac{10+7-3}{24} = \frac{14}{24} = \frac{7}{12}$

3

People in Britain need to heat their houses for 7 months of the year.

a) For what part of the year do British people *not* need to heat their houses? *Plan:* $\frac{12}{12} - \frac{7}{12} = \frac{5}{12}$ (yr)

not need to heat their houses?

Answer: British people do not need to heat their houses for 5 twelfths of the year.

b) For how many months will British people heat their houses over the next 5 years? *Plan:* $\frac{7}{12} \times 5 = \frac{35}{12}$ (yr) = 35 months

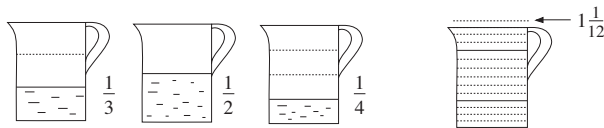
heat their houses over the next 5 years?

Answer: British people will heat their houses for 35 months over the next 5 years.

4

The 3 jugs each have a capacity of 5 litres.

The first jug is a third full, the second jug is half full and the third jug is a quarter full of water.

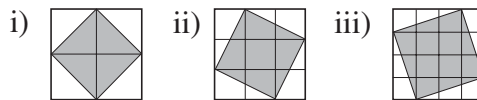


If all the water is poured into one of the jugs what part of the jug will be filled? *Plan:* $\frac{1}{3} + \frac{1}{2} + \frac{1}{4} = \frac{4+6+3}{12} = \frac{13}{12} = 1\frac{1}{12}$ (jugs)

Answer: The whole jug will be filled and 1 twelfth of 5 litres of water will overflow.

5

a) What part of each square is shaded?



b) Subtract the smallest from the greatest fraction.

Shaded: $\frac{2}{4} = \frac{1}{2}$ $\frac{5}{9}$ $\frac{10}{16} = \frac{5}{8}$

Difference between smallest and greatest is:

$\frac{5}{8} - \frac{1}{2} = \frac{5-4}{8} = \frac{1}{8}$

1

Solve the equations.

a) $a = \frac{3}{2} - \frac{1}{2} = \frac{2}{2} = \underline{1}$ b) $b = \frac{3}{4} - \frac{1}{4} = \frac{2}{4} = \underline{\frac{1}{2}}$ c) $c = \frac{11}{8} - \frac{7}{8} = \frac{4}{8} = \underline{\frac{1}{2}}$ d) $d = \frac{2}{7} + \frac{3}{7} = \underline{\frac{5}{7}}$

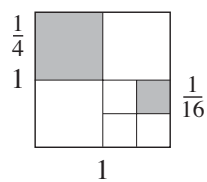
e) $e = 1 - \frac{7}{9} = \underline{\frac{2}{9}}$ f) $f = \frac{6}{5} - 1 = \underline{\frac{1}{5}}$ g) $g = 2 - \frac{7}{5} = \frac{10-7}{5} = \underline{\frac{3}{5}}$ h) $h = 1 + \frac{5}{6} = \underline{1\frac{5}{6}}$

2

a) What part of the unit square is shaded? $\frac{1}{4} + \frac{1}{16} = \frac{4+1}{16} = \underline{\frac{5}{16}}$

b) What part is **not** shaded? $1 - \frac{5}{16} = \underline{\frac{11}{16}}$ (or $\frac{1}{4} + \frac{1}{4} + \frac{3}{16} = \underline{\frac{11}{16}}$)

c) What area is shaded if the area of the unit square is 64 m²? $\frac{5}{16}$ of 64 m² = $64 \div 16 \times 5 = 4 \times 5 = \underline{20 \text{ (m}^2\text{)}}$



3

The first number in a sequence is $\frac{2}{3}$. We know that each of the other terms is $\frac{1}{2}$ more than the previous term. Write down the first five terms and add them up.

e.g: $\frac{2}{3} + \frac{1}{2} = \frac{4+3}{6} = \frac{7}{6}$, then add $\frac{3}{6}$ each time,
 so first 5 terms are: $\frac{2}{3}, \frac{7}{6}, \frac{10}{6}, \frac{13}{6}, \frac{16}{6}$
 (or $\frac{2}{3}, 1\frac{1}{6}, 1\frac{2}{3}, 2\frac{1}{6}, 2\frac{2}{3}$)
 Sum: $\frac{4}{6} + \frac{7}{6} + \frac{10}{6} + \frac{13}{6} + \frac{16}{6} = \frac{50}{6} = \frac{25}{3} = 8\frac{1}{3}$

4

Mum made 18 butterfly cakes for Saturday tea.

- a) If Andrew ate $\frac{1}{3}$ of them, how many cakes did he eat? **6**
- b) If Bella ate $\frac{2}{9}$ of them, how many cakes did she eat? **4**
- c) If Christine ate $\frac{2}{6}$ of them, how many cakes did she eat? **6**
- d) If Mum ate what was left, how many cakes did she eat? **2**

5

Three eighths of a 4 m 24 cm long pipe was cut off.

- a) What part of the pipe was left? $1 - \frac{3}{8} = \underline{\frac{5}{8}}$
- b) How many cm were cut off? $\underline{424 \text{ cm} \div 8 \times 3 = 53 \text{ cm} \times 3 = 159 \text{ cm}}$

1

Do the calculations. Write details in your exercise book where needed.

- a) i) $\frac{4}{15} + \frac{9}{15} = \frac{13}{15}$ ii) $\frac{14}{20} - \frac{9}{20} = \frac{5}{20} = \frac{1}{4}$
 iii) $\frac{1}{2} + \frac{5}{3} + \frac{1}{3} - 1 = \frac{1}{2} + 2 - 1 = 1\frac{1}{2}$ (as $\frac{5}{3} + \frac{1}{3} = 2$)
- b) i) $\frac{3}{2} + \frac{3}{10} = \frac{15+3}{10} = \frac{18}{10} = \frac{9}{5} = 1\frac{4}{5}$ ii) $\frac{17}{18} - \frac{2}{3} = \frac{17-12}{18} = \frac{5}{18}$
 iii) $\frac{5}{15} + \frac{1}{5} - \frac{1}{3} = \frac{1}{3} + \frac{1}{5} - \frac{1}{3} = \frac{1}{5}$
- c) i) $\frac{4}{7} + \frac{1}{6} = \frac{24+7}{42} = \frac{31}{42}$ ii) $\frac{4}{5} - \frac{3}{11} = \frac{44-15}{55} = \frac{29}{55}$
 iii) $\frac{1}{2} + \frac{1}{3} - \frac{2}{5} = \frac{15+10-12}{30} = \frac{13}{30}$
- d) i) $\frac{3}{10} + \frac{6}{15} = \frac{3}{10} + \frac{2}{5} = \frac{3+4}{10} = \frac{7}{10}$ ii) $\frac{7}{9} - \frac{1}{6} = \frac{14-3}{18} = \frac{11}{18}$
 iii) $\frac{7}{12} + \frac{3}{4} - \frac{9}{20} = \frac{35+45-27}{60} = \frac{53}{60}$

2

Calculate:

- a) $\frac{2}{3}$ of 60 metres = $60 \text{ m} \div 3 \times 2 = 20 \text{ m} \times 2 = 40 \text{ m}$
- b) $\frac{1}{4}$ of 3 hours = $\frac{3}{4}$ of 1 hour = 45 min
- c) $\frac{7}{5}$ of 40 litres = $40 \div 5 \times 7 = 8 \times 7 = 56$ (litres)
- d) $2\frac{1}{4}$ times 80 kg = $2 \times 80 \text{ kg} + 80 \text{ kg} \div 4 = 160 \text{ kg} + 20 \text{ kg} = 180 \text{ kg}$
 or = $\frac{9}{4}$ of 80 kg = $80 \div 4 \times 9 = 20 \times 9 = 180 \text{ kg}$

3

Calculate the whole quantity if:

- a) $\frac{2}{3}$ of it is 60 metres 90 metres b) $\frac{1}{4}$ of it is 3 hours 12 hours
 c) $\frac{7}{5}$ of it is 35 litres 25 litres d) $2\frac{1}{4}$ times it is 90 kg 40 kg

4

Jim was putting up a 120 m fence around his garden. On the first day he put up $\frac{3}{5}$ of the fence. How many metres of fence did he still have to put up? 48 m

5

I had 24 marbles. I lost 1 third of them, then I lost another 12 marbles.

- a) How many marbles did I have left? 4 marbles left
 b) What part of the 24 marbles did I have left? $\frac{1}{6}$

1

Exchange the quantities.

- a) 1 week = $\boxed{7}$ days, 1 day = $\boxed{\frac{1}{7}}$ week, 4 days = $\boxed{\frac{4}{7}}$ week
 b) 4 m = $\boxed{400}$ cm, 1 cm = $\boxed{\frac{1}{100}}$ m, 27 cm = $\boxed{\frac{27}{100}}$ m
 c) 2 h = $\boxed{120}$ min, 1 min = $\boxed{\frac{1}{60}}$ hour, 40 min = $\boxed{\frac{2}{3}}$ hour
 d) 17 litres = $\boxed{1700}$ cl, 17 cl = $\boxed{\frac{17}{100}}$ litre, 320 ml = $\boxed{\frac{8}{25}}$ litre

2

Exchange the quantities. Do the calculations in your exercise book.

- a) 20 min = $\boxed{\frac{1}{3}}$ hour, 45 min = $\boxed{\frac{3}{4}}$ hour, 90 min = $\boxed{1\frac{1}{2}}$ hours
 b) $\frac{1}{2}$ hour = $\boxed{30}$ min, $\frac{2}{5}$ hour = $\boxed{24}$ min, $\frac{61}{60}$ hour = $\boxed{61}$ min
 c) 70 cm = $\boxed{\frac{7}{10}}$ m, 110 cm = $\boxed{1\frac{1}{10}}$ m, 3 cm = $\boxed{\frac{3}{100}}$ m
 d) $\frac{1}{5}$ m = $\boxed{20}$ cm, $\frac{9}{4}$ m = $\boxed{225}$ cm, $\frac{3}{50}$ m = $\boxed{6}$ cm
 e) 43 cl = $\boxed{\frac{43}{100}}$ litre, 350 g = $\boxed{\frac{7}{20}}$ kg, 11 m = $\boxed{\frac{11}{1000}}$ km
 f) $\frac{5}{4}$ litres = $\boxed{125}$ cl, $\frac{42}{1000}$ kg = $\boxed{42}$ g, $\frac{32}{1000}$ km = $\boxed{32}$ m

3

Calculate the sums and differences.

- a) $\frac{3}{50} + \frac{41}{50} - \frac{10}{50} = \frac{44 - 10}{50} = \frac{34}{50} = \underline{\underline{\frac{17}{25}}}$ b) $\frac{6}{14} + \left(-\frac{9}{14}\right) = \frac{6 - 9}{14} = \underline{\underline{-\frac{3}{14}}}$
 c) $\frac{5}{21} - \left(-\frac{2}{21}\right) = \frac{5 + 2}{21} = \frac{7}{21} = \underline{\underline{\frac{1}{3}}}$ d) $-\frac{8}{15} + \left(-\frac{4}{15}\right) = -\frac{8}{15} - \frac{4}{15} = -\frac{12}{15} = \underline{\underline{-\frac{4}{5}}}$
 e) $-\frac{7}{10} - \left(-\frac{2}{5}\right) = \frac{-7 + 4}{10} = \underline{\underline{-\frac{3}{10}}}$ f) $-\frac{7}{10} - \left(+\frac{2}{5}\right) = \frac{-7 - 4}{10} = -\frac{11}{10} = \underline{\underline{-1\frac{1}{10}}}$

4

Fill in the missing numbers. Do the calculations in your exercise book.

- a) $\frac{4}{5} + \boxed{\frac{3}{5}} = \frac{7}{5}$ b) $\frac{11}{8} - \boxed{\frac{5}{8}} = \frac{3}{4}$ c) $\boxed{\left(-\frac{1}{9}\right)} + \frac{4}{9} = \frac{3}{9}$
 d) $\boxed{\frac{5}{6}} - \frac{2}{3} = \frac{1}{6}$ e) $\frac{8}{7} - \boxed{\frac{1}{7}} + 2 = 3$ f) $\frac{5}{6} - \boxed{\frac{1}{12}} = \frac{3}{4}$

5

Charlie spends a quarter of every week-day in school and 1 third of the day sleeping. How many hours does he have left for doing other things?

Answer: Charlie has 10 hours left for doing other things.

1

Calculate the quantities.


- a) $\frac{3}{4}$ of 12 hours = $12 \div 4 \times 3 = 3 \times 3 = 9$ (hours)
- b) $\frac{4}{5}$ of 200 m = $200 \div 5 \times 4 = 40 \times 4 = 160$ (m)
- c) $\frac{4}{3}$ of 60 kg = $60 \div 3 \times 4 = 20 \times 4 = 80$ (kg)
- d) $3\frac{1}{8}$ times 40 litres = $3 \times 40 + \frac{1}{8}$ of 40
 = $120 + 40 \div 8 = 120 + 5 = 125$ (litres)

2

Calculate the whole quantity if:

- a) $\frac{3}{4}$ of it is 12 hours $\frac{4}{4} \rightarrow 12 \div 3 \times 4 = 4 \times 4 = 16$ (hours)
- b) $\frac{4}{5}$ of it is 200 m $\frac{5}{5} \rightarrow 200 \div 4 \times 5 = 50 \times 5 = 250$ (m)
- c) $\frac{4}{3}$ of it is 60 kg $\frac{3}{3} \rightarrow 60 \div 4 \times 3 = 15 \times 3 = 45$ (kg)
- d) $3\frac{1}{8}$ times it is 50 litres $\frac{8}{8} \rightarrow 50 \div 25 \times 8 = 2 \times 8 = 16$ (litres)

3

The farmer had some chickens. He sold $\frac{5}{8}$ of them and had 180 chickens left. 

How many chickens did the farmer have at first?

480 (chickens)

4

Exchange the quantities.

- a) $\frac{1}{2}$ min = 30 sec b) $\frac{7}{10}$ kg = 700 g c) $\frac{2}{5}$ km = 400 m
- d) $\frac{3}{10}$ litre = 300 ml e) $\frac{1}{6}$ hour = 10 min f) $\frac{3}{4}$ yr = 9 month
- g) 40 cl = $\frac{2}{5}$ litre h) 75 cm = $\frac{3}{4}$ m i) 200 g = $\frac{1}{5}$ kg
- j) 40 min = $\frac{2}{3}$ hour k) 6 hours = $\frac{1}{4}$ day l) 3 days = $\frac{3}{7}$ week

5

Solve these problems in your exercise book.

- a) Ann bought some mini chocolate eggs. She gave half of them to her nephews and nieces and used a quarter of them to decorate her Easter cake. She had 9 eggs left. How many mini chocolate eggs did she buy? **36 eggs**
- b) Mary made 96 small cakes. She took 2 thirds of them to the school fair and gave an eighth of them to her neighbours. How many cakes did Mary have left? **20 cakes**