Dr Oliver Mathematics
GCSE Mathematics
2021 November Paper 1H: Non-Calculator
1 hour 30 minutes

The total number of marks available is 80.
You must write down all the stages in your working.

1. (a) Work out (3)

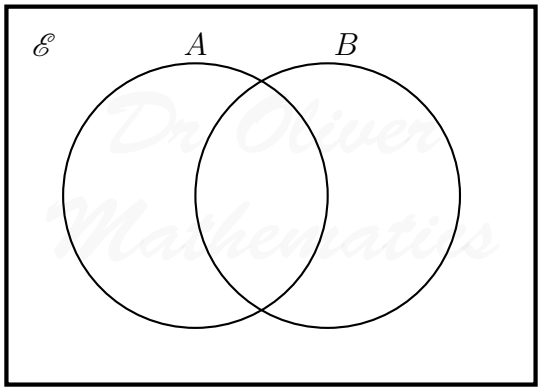
$$3.67 \times 4.2.$$

(b) Work out (3)

$$59.84 \div 1.6.$$

2. $\mathscr{E} = \{\text{even numbers less than } 19\}$. (3)
$A = \{6, 12, 18\}$.
$B = \{2, 6, 14, 18\}$.

Complete the Venn diagram for this information.



3. Work out (3)

$$4\tfrac{1}{5} - 2\tfrac{2}{3}.$$

Give your answer as a mixed number.

4. At the end of 2017, (4)

- the value of Tamara's house was £220 000 and
- the value of Rahim's house was £160 000.

At the end of 2019,

- the value of Tamara's house had decreased by 20% and
- at the value of Rahim's house had increased by 30%.

At the end of 2019, whose house had the greater value?
You must show how you get your answer.

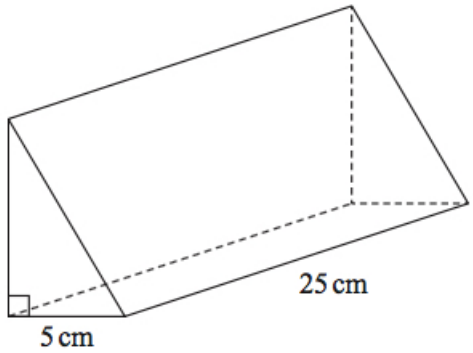
5. Rosie, Matilda and Ibrahim collect stickers: (3)

$$\text{Rosie} : \text{Matilda} : \text{Ibrahim} = 4 : 7 : 15.$$

Ibrahim has 24 more stickers than Matilda.

Ibrahim has more stickers than Rosie.
How many more?

6. The diagram shows a prism. (3)

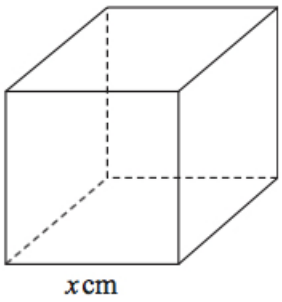


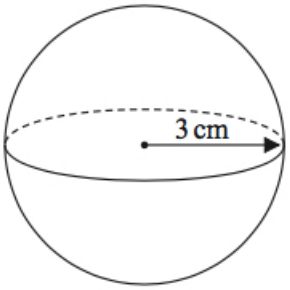
The cross section of the prism is a right-angled triangle.
The base of the triangle has length 5 cm.

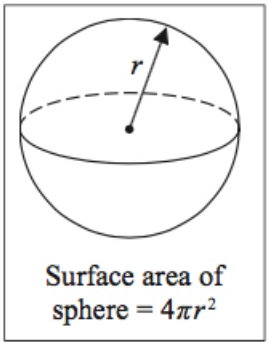
The prism has length 25 cm.
The prism has volume 750 cm^3.

Work out the height of the prism.

7. The diagram shows a cube with edges of length x cm and a sphere of radius 3 cm. (4)







The surface area of the cube is equal to the surface area of the sphere.

Show that

$$x = \sqrt{k\pi},$$

where k is an integer.

8. Solve (3)

$$x^2 = 5x + 24.$$

9. (a) Write down the value of (1)

$$7^0.$$

(b) Find the value of (1)

$$3 \times 3^6 \times 3^{-6}.$$

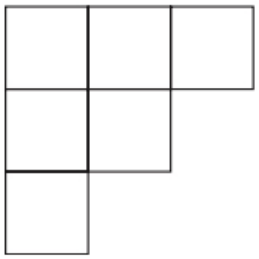
(c) Find the value of (1)

$$2^{-4}.$$

(d) Find the value of (1)

$$27^{\frac{1}{3}}.$$

10. The diagram shows a shape made from 6 identical squares.

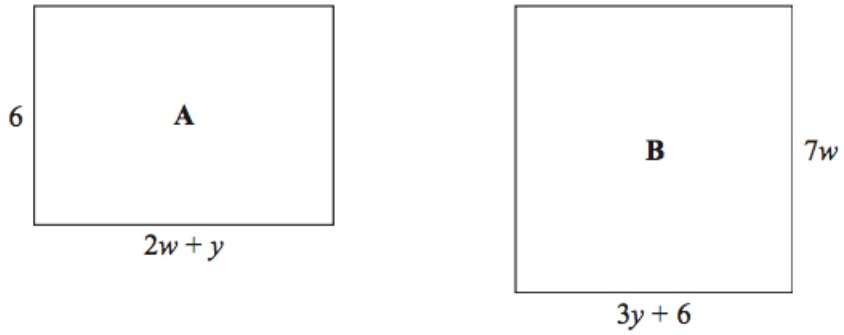


The total area of the shape is 5 406 cm^2.

(a) Find an estimate for the length of one side of each square. (3)
Give your answer correct to the nearest whole number.

(b) Is your answer to part (a) an underestimate or an overestimate? (1)
You must give a reason for your answer.

11. The diagram shows two rectangles, **A** and **B**. (4)



All measurements are in centimetres.

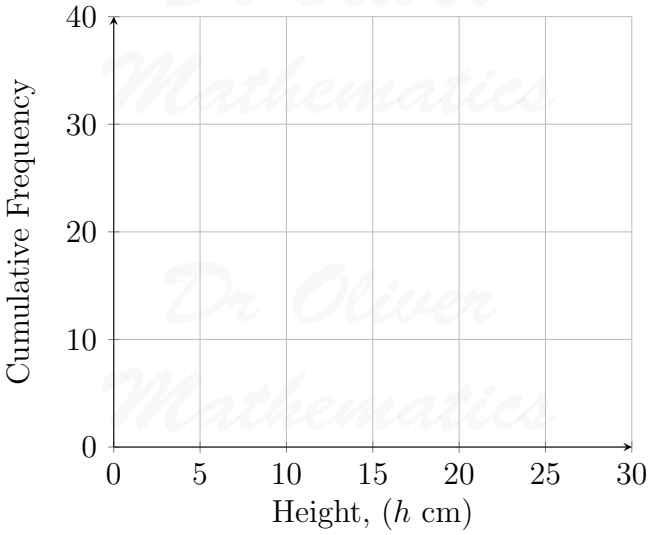
The area of rectangle **A** is equal to the area of rectangle **A**.

Find an expression for y in terms of w.

12. The cumulative frequency table gives information about the heights, in cm, of 40 plants.

Height, (h cm)	Cumulative Frequency
$0 < h \leqslant 5$	4
$0 < h \leqslant 10$	11
$0 < h \leqslant 15$	24
$0 < h \leqslant 20$	34
$0 < h \leqslant 25$	38
$0 < h \leqslant 30$	40

(a) On the grid, draw a cumulative frequency graph for this information. (2)



13. Ted is trying to change (1)

$$0.\dot{4}\dot{3}$$

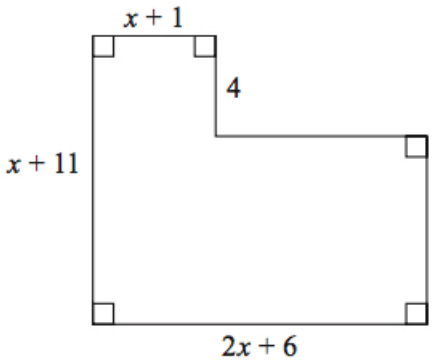
to a fraction.

Here is the start of his method.

$$x = 0.\dot{4}\dot{3}$$
$$10x = 4.\dot{3}\dot{4}$$
$$10x - x = 4.\dot{3}\dot{4} - 0.\dot{4}\dot{3}$$

Evaluate Ted's method so far.

14. Here is a shape with all its measurements in centimetres. (3)



The area of the shape is A cm^2.

Show that

$$A = 2x^2 + 24x + 46.$$

15. Show that (3)

$$\frac{4x+3}{2x} + \frac{3}{5}$$

can be written in the form

$$\frac{ax+b}{cx},$$

where a, b, and c are integers.

16. There are only 3 red counters and 5 yellow counters in a bag. (4)

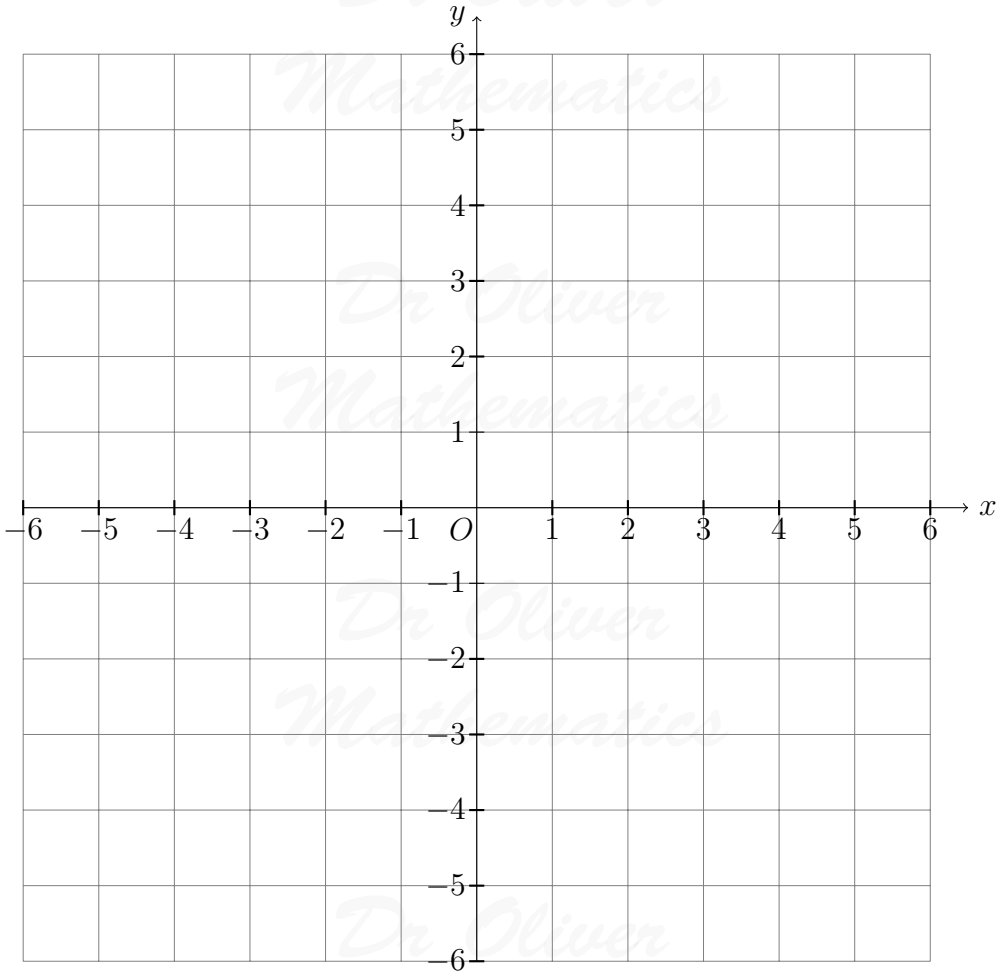
Jude takes at random 3 counters from the bag.

Work out the probability that he takes exactly one red counter.

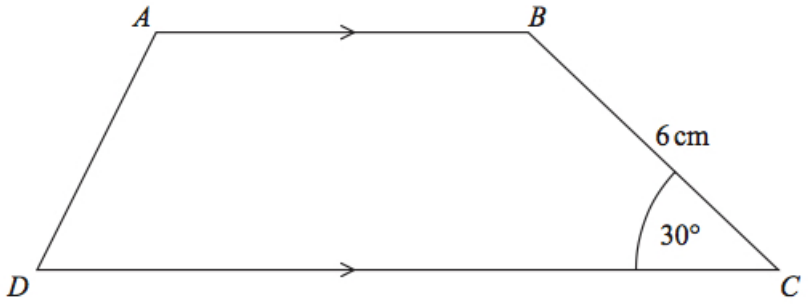
17. On the grid show, by shading, the region that satisfies all of these inequalities: (3)

$$2y + 4 < x \qquad x < 3 \qquad y < 6 - 3x.$$

Label the region **R**.



18. Here is trapezium $ABCD$. (5)



The area of the trapezium is 66 cm^2.

The length of AB : the length of $CD = 2 : 3$.

Find the length of AB.

19. Show that (4)

$$\frac{8+\sqrt{12}}{5+\sqrt{3}}$$

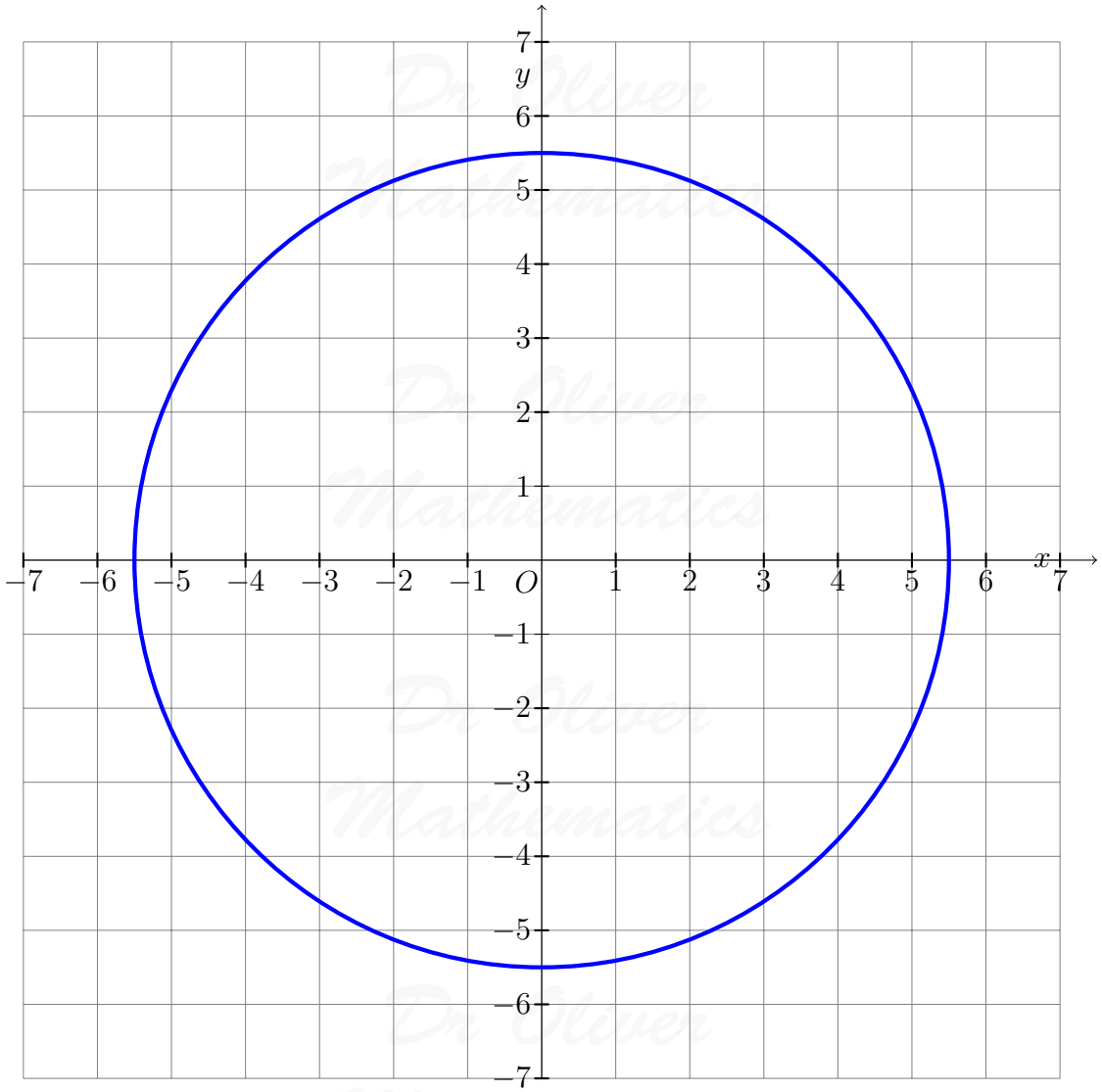
can be written in the form

$$\frac{a+\sqrt{3}}{b},$$

where a and b are integers.

20. The diagram shows the graph of (3)

$$x^2 + y^2 = 30.25.$$



Use the graph to find estimates for the solutions of the simultaneous equations

$$x^2 + y^2 = 30.25$$
$$y - 2x = 1.$$

21. The functions f and g are such that

$$\mathrm{f}(x) = 3x^2 + 1 \text{ for } x > 0$$

and

$$\mathrm{g}(x) = \frac{4}{x^2} \text{ for } x > 0.$$

(a) Work out $\mathrm{g\,f}(1)$. (2)

The function h is such that

$$h = (\mathrm{f\,g})^{-1}.$$

(b) Find $\mathrm{h}(x)$. (4)

22. Find the coordinates of the turning point on the curve with equation (4)

$$y = 9 + 18x - 3x^2.$$

You must show all your working.