1 (a) Simplify $a^7 \times a^4$

(b) Simplify $w^{15} \div w^3$

(c) Simplify $(8x^5y^3)^2$

(d) Make t the subject of $c = t^3 - 8v$

2 Danil, Gabriel and Hadley share some money in the ratios $3:5:9$
The difference between the amount of money that Gabriel receives and the amount of money that Hadley receives is 196 euros.

Work out the amount of money that Danil receives.

3 The diagram shows triangle ABC
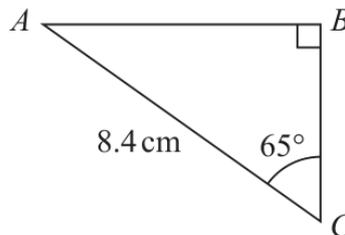

Diagram **NOT**
accurately drawn

Work out the length of the side AB
Give your answer correct to 3 significant figures.

4 Sarah makes and sells mugs.

One day she makes 150 mugs.
Her total cost for making these mugs is £1140

Of these mugs

$\frac{2}{5}$ are small mugs

32% are medium mugs
and the rest are large mugs

MUGS	
Small	£8.50
Medium	£11.20
Large	£14.20

Here is Sarah's price list for selling each mug.

Sarah sells all 150 mugs.

Work out her percentage profit.
Give your answer correct to the nearest whole number.

5 Jenny has six cards.

Each card has a whole number written on it so that

the smallest number is 5
the largest number is 24
the median of the six numbers is 14
the mode of the six numbers is 8

Jenny arranges her cards so that the numbers are in order of size.

| 5 | .... | .... | .... | .... | 24 |

(a) For the remaining four cards, write on each dotted line a number that could be on the card.

A basketball team plays 6 games.
After playing 5 games, the team has a mean score of 21 points per game.
After playing 6 games, the team has a mean score of 23 points per game.

(b) Work out the number of points the team scored in its 6th game.

6 (a) Solve the inequality $5x - 7 \leqslant 2$

(b) (i) Factorise $y^2 - 2y - 35$
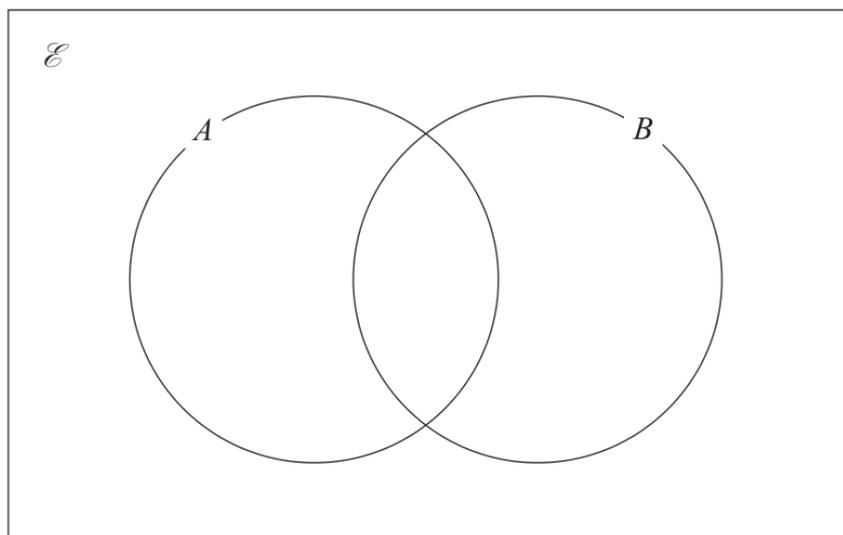
(ii) Hence, solve $y^2 - 2y - 35 = 0$

7 $\mathscr{E} = \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$

$A \cap B = \{5, 10, 15\}$

$B' = \{7, 8, 9, 11, 12, 13, 14\}$

$A' = \{4, 6, 7, 8, 14\}$

Complete the Venn diagram for this information.

8 $a = 4.2 \times 10^{-24}$ $b = 3 \times 10^{145}$

Work out the value of $a \times b$
Give your answer in standard form.

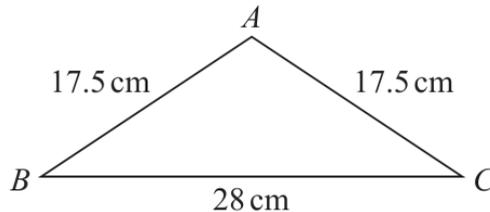
9   The diagram shows isosceles triangle ABC

Diagram **NOT** accurately drawn

$AB = AC = 17.5$ cm $BC = 28$ cm

Calculate the area of triangle ABC

10 The straight line **L** has equation $2y + 7x = 10$

(a) Find the gradient of **L**

(b) Find the coordinates of the point where **L** crosses the y-axis.

11 Himari invests 200 000 yen for 3 years in a savings account paying compound interest.

The rate of interest is 1.8% for the first year and x% for each of the second year and the third year.

The value of the investment at the end of the third year is 209 754 yen.

Work out the value of x
Give your answer correct to one decimal place.

12 The table gives information about the times, in minutes, taken by 80 customers to do their shopping in a supermarket.

Time taken (t minutes)	Frequency
$0 < t \leqslant 10$	7
$10 < t \leqslant 20$	26
$20 < t \leqslant 30$	24
$30 < t \leqslant 40$	14
$40 < t \leqslant 50$	7
$50 < t \leqslant 60$	2

(a) Complete the cumulative frequency table.

Time taken (*t* minutes)	Cumulative frequency
$0 < t \leqslant 10$	
$0 < t \leqslant 20$	
$0 < t \leqslant 30$	
$0 < t \leqslant 40$	
$0 < t \leqslant 50$	
$0 < t \leqslant 60$	

(b) On the grid opposite, draw a cumulative frequency graph for your table.

Cumulative frequency

Time taken (minutes)

(2)
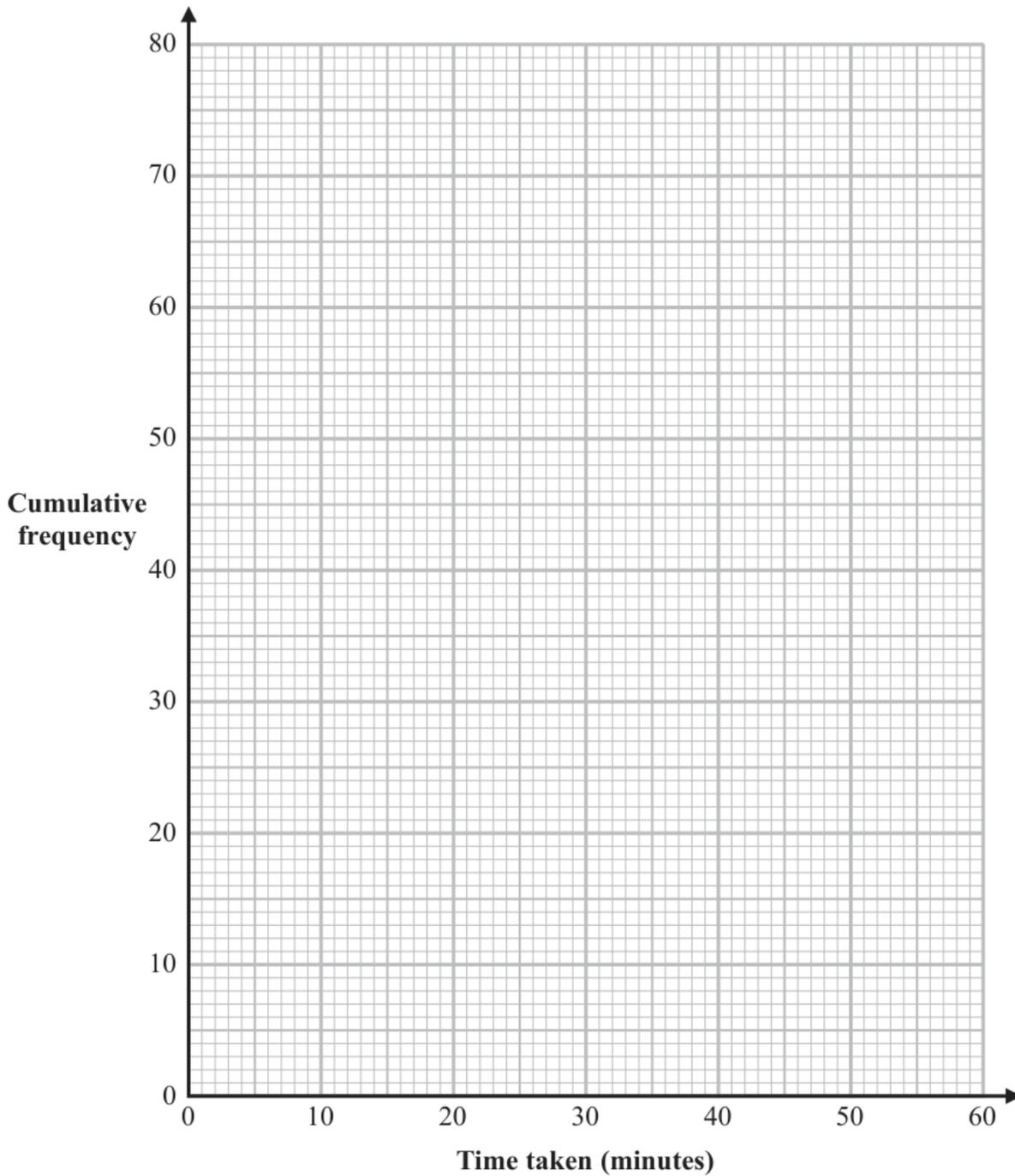
(c) Use your graph to find an estimate for the median time taken.

One of the 80 customers is chosen at random.

(d) Use your graph to find an estimate for the probability that the time taken by this customer was more than 42 minutes.
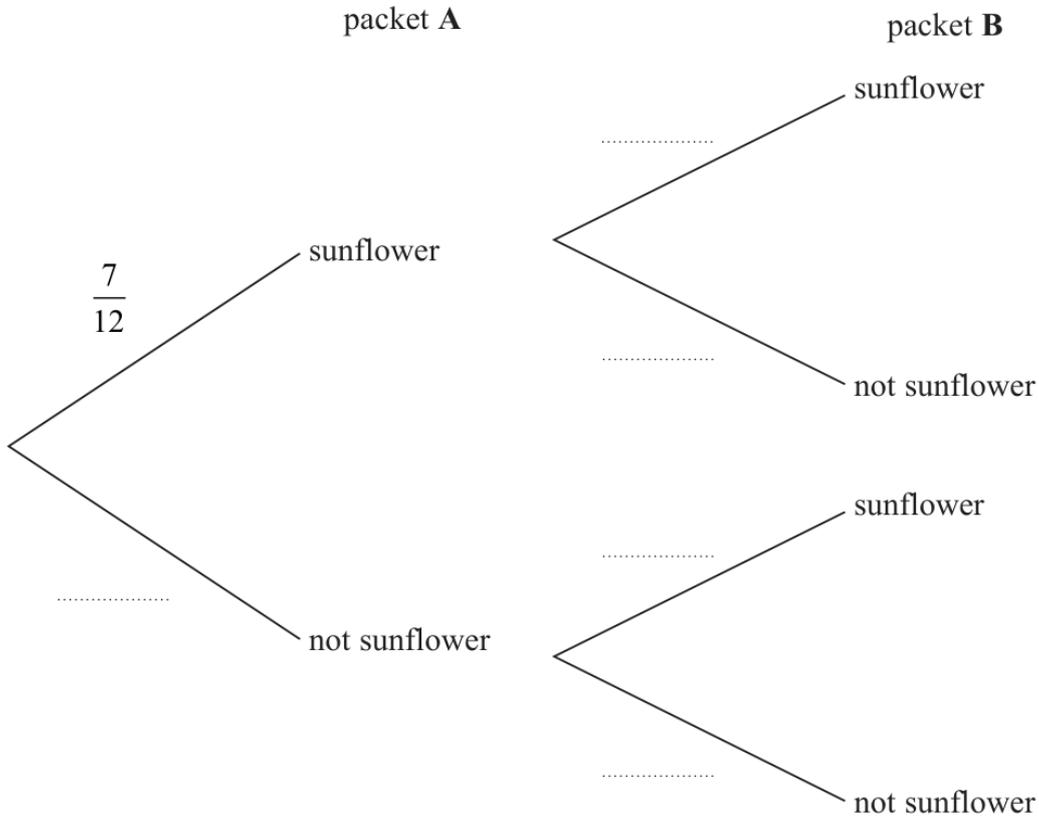
13 (a) Expand and simplify $5x(x + 2)(3x - 4)$

(b) Simplify completely $\left(\dfrac{16w^8}{y^{20}}\right)^{-\frac{3}{4}}$

14 Aika has 2 packets of seeds, packet **A** and packet **B**

There are 12 seeds in packet **A** and 7 of these are sunflower seeds.
There are 15 seeds in packet **B** and 8 of these are sunflower seeds.

Aika is going to take at random a seed from packet **A** and a seed from packet **B**

(a) Complete the probability tree diagram.

packet **A**   packet **B**

                                                    sunflower
                          ....
              sunflower
    $\dfrac{7}{12}$
                          ....
                                                    not sunflower

                                                    sunflower
                          ....
              not sunflower
    ....
                          ....
                                                    not sunflower

(b) Calculate the probability that Aika will take two sunflower seeds.

15 A is inversely proportional to C^2

$A = 40$ when $C = 1.5$

Calculate the value of C when $A = 1000$
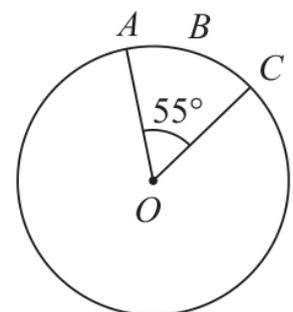

16 The diagram shows a circle with centre O

A, B and C are points on the circle so that the length of the arc ABC is 5 cm

Given that angle $AOC = 55°$

work out the area of the circle.
Give your answer correct to one decimal place.
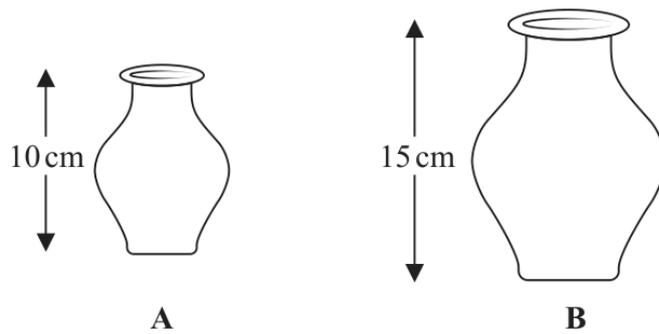
17 **A** and **B** are two similar vases.

Diagram **NOT** accurately drawn

10 cm   15 cm

A   **B**

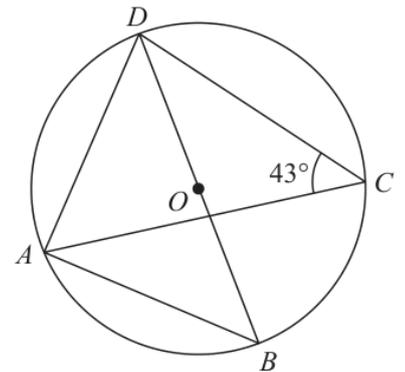Vase **A** has height 10 cm.
Vase **B** has height 15 cm.

The difference between the volume of vase **A** and the volume of vase **B** is 1197 cm^3

Calculate the volume of vase **A**

18   *A*, *B*, *C* and *D* are points on a circle, centre *O*.
DOB is a diameter of the circle.
Angle *ACD* = 43°

Work out the size of angle *ADB*.
Give a reason for each stage in your working.

19 Solve the simultaneous equations

$$3x^2 + y^2 - xy = 5$$
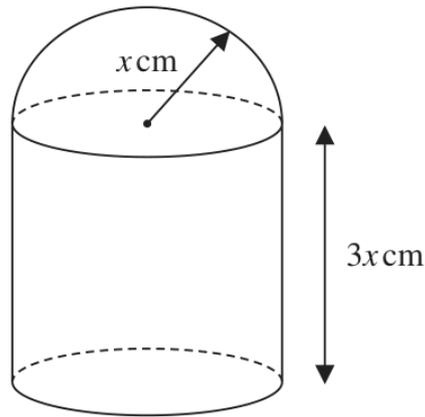$$y = 2x - 3$$

20 (a) Express $7 + 12x - 3x^2$ in the form $a + b(x + c)^2$ where *a*, *b* and *c* are integers.

C is the curve with equation $y = 7 + 12x - 3x^2$
The point *A* is the maximum point on **C**

(b) Use your answer to part (a) to write down the coordinates of *A*

21 The diagram shows a solid made from a cylinder and a hemisphere.
The cylinder and the hemisphere are both made from the same metal.

The plane face of the hemisphere coincides with the upper plane face of the cylinder.

The radius of the cylinder and the radius of the hemisphere are both x cm.
The height of the cylinder is $3x$ cm.

The total surface area of the solid is 81π cm^2
The mass of the solid is 840 grams.

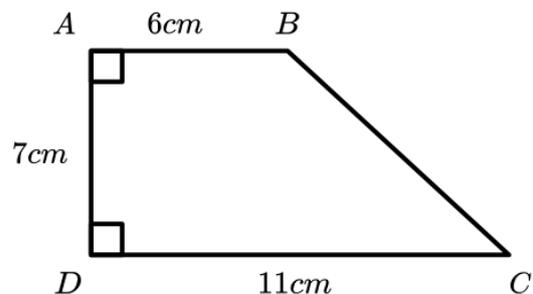The following table gives the density of each of four metals.

Metal	Density (g/cm^3)
Aluminium	2.7
Nickel	8.9
Gold	19.3
Silver	10.5

The metal used to make the solid is one of the metals in the table.

Determine the metal used to make the solid.

22

(a) Calculate the area of the trapezium.

(b) Work out the length of BC.

23 An arithmetic series has first term 1 and common difference 4

Find the sum of all terms of the series from the 41st term to the 100th term inclusive.