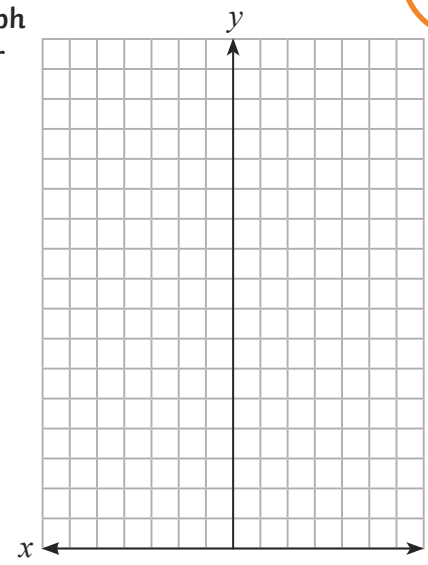


**a** The highest common factor of two numbers is 3. The lowest common multiple of these two numbers is 45. What could the two numbers be?

**b** The value of a car depreciates by 3.1% per annum. If it cost £28 000 new, find the value of the car after 3 years.

**c** Simplify  $\sqrt{\frac{a^{\frac{2}{5}} \times a^{\frac{3}{4}}}{a^{\frac{7}{20}}}}$

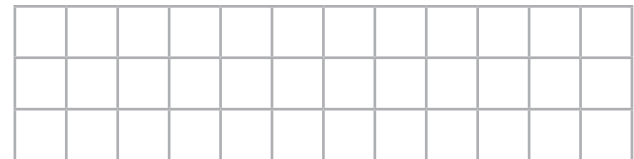
**d** Draw the graph of  $y = (\frac{1}{2})^x$  for the values  $-4 \leq x \leq 4$ .



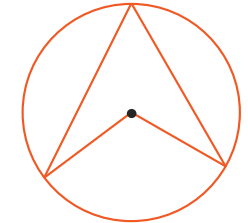
**e** The table gives the weights of 30 cabbages in grams.

Smallest	650
Biggest	1200
Median	800
Lower quartile	720
Interquartile range	280

Draw a box and whisker plot to show this information.



**f** Prove that the angle at the centre is always twice the angle at the circumference.



$a = 4 \times 10^5$  and  $b = 5 \times 10^4$ .

$$c = \frac{ab}{a+b}$$

Work out the value of  $c$ , leaving your answer in standard form correct to 1 decimal place.

a

The functions  $f(x)$  and  $g(x)$  are given by the following:

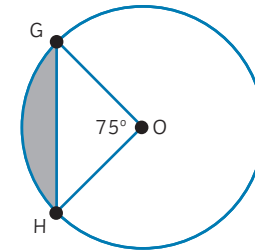
$$f(x) = x^2 + 3$$

$$g(x) = x + 9$$

Find the values of  $a$  such that  $f(a) = g(a)$ .

c

$O$  is the centre of a circle with radius 5cm. Find the area of the shaded region, giving your answer correct to 3 significant figures.




e

Write  $1.7\dot{2}\dot{5}$  as a fraction. Show all your working.

b

Prove that the sum of three consecutive even numbers is always a multiple of 6.

d

A biased coin is flipped twice.

The probability of the coin landing on tails is 0.4. Find the probability the coin lands on tails exactly once.

f

**a** Write the following numbers in order of size, starting with the smallest.

$0.23, \frac{7}{25}, 2.03 \times 10^{-1}, 2^{-2}$

**b** Solve

$$\frac{a+5}{a-3} = a$$

**c** Solve the simultaneous equations:

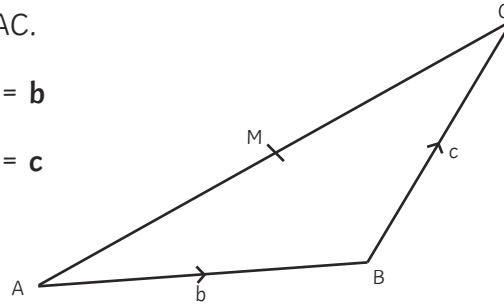
$$2x^2 + y^2 = 11$$

$$y = x + 4$$

**d** ABC is a triangle. M is the midpoint of AC.

$$\vec{AB} = \mathbf{b}$$

$$\vec{BC} = \mathbf{c}$$



Express BM in terms of b and c.

**e** The table shows the ages of 30 staff members.

Age, x, years	Frequency
$16 \leq x < 20$	5
$20 \leq x < 24$	7
$24 \leq x < 40$	12
$40 \leq x < 60$	6

Find an estimate for the median age, showing clear justification for your answer.

**f** There are four types of chocolate bar in a machine: Fairy Milk, Kit Kit, Sneakers and Snars Bars.

The probability of choosing a Fairy Milk is the same as choosing a Kit Kit. The probability of choosing a Sneakers is double the probability of choosing a Fairy Milk, and a third of the probability of choosing a Snars Bar.

Find the probability of choosing a Snars Bar at random.

**a**

Work out, without using a calculator:

i)  $-7.5 \div 1.5$

ii)  $-0.3 \times -0.47$

iii)  $(-\frac{1}{4})^2$

**b**

Eleanor thinks of a number,  $x$ , then adds 5. She would have got the same answer had she initially doubled  $x$  and then subtracted 2.

Form an equation and solve to find the value of  $x$ .

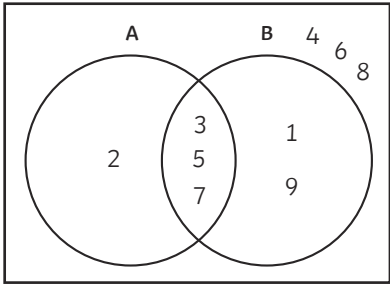
**c**

Look at the Venn diagram. Write down the numbers that are in set:

i)  $A \cap B$

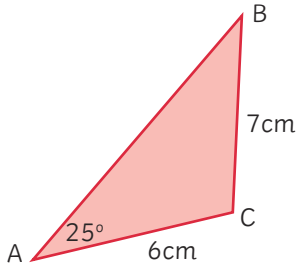
ii)  $A'$

iii) One of the numbers is chosen at random. Find the probability the number is in set  $A \cup B$ .



**d**

For the given triangle, work out the angle  $ABC$ , giving your answer correct to 3 significant figures.



**e**

A cube of iron has edges 0.78m long. The density of the iron is  $8\text{g/cm}^3$ .

Find the mass of the iron, giving your answer in kilograms to 3 significant figures.

**f**

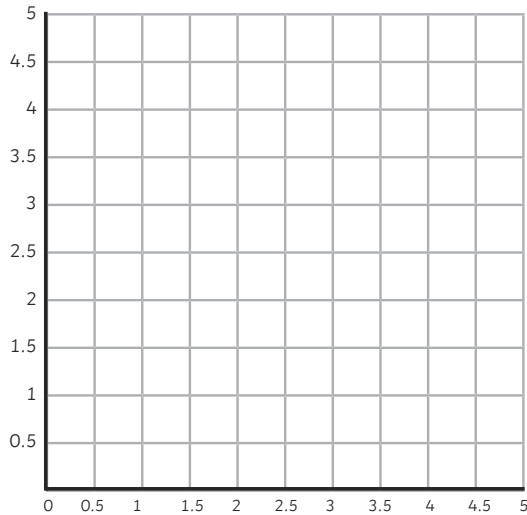
Factorise  $6x^2 - 13x - 28$

a) Complete the table for the graph

$$y = 4x - x^2.$$

x	0	0.5	1	1.5	2	2.5	3	3.5	4
y									

b) Plot the graph of  $y = 4x - x^2$  on the coordinate axes.



c) By using trapezia of width 0.5 units, find an estimate for the area between the curve and the x-axis.

a

Use the iterative formula

$$x_{n+1} = \sqrt{28 - x_n}$$

with  $x_0 = 4$  to find a solution to the equation  $x^2 + x = 28$ . Give your answer correct to 3 decimal places.

b

Expand  $(3x + 2)(2x - 4)(x - 5)$

c

Find the nth term of the sequence:

-3, 8, 23, 42, 65

d

The number of students in a school increases from 210 to 275. Find the percentage increase, giving your answer correct to 3 significant figures.

e

A piece of string measures 72.3cm correct to 3 significant figures. Find the lower bound of the length of the piece of string.

f

Solve the simultaneous equations:

$$3x^2 + 2y^2 = 29$$

$$y = x + 4$$

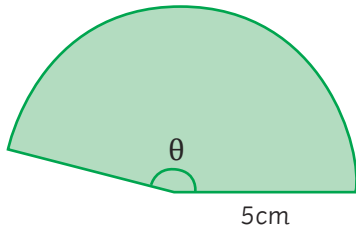
a

i) Write the expression  $x^2 + 3x - 5$  in the form  $(x + a)^2 + b$  where  $a$  and  $b$  are integers.

ii) Hence write down the turning point of the graph  $y = x^2 + 3x - 5$ .

c

The diagram shows a sector of a circle. It has a perimeter of 24cm and a radius of 5cm. Find the size of the angle,  $\theta$ , giving your answer correct to 3 significant figures.




b

Ben, Georgie and Sajid share some money. Ben gets  $\frac{4}{9}$ , and Georgie and Sajid share the remainder in the ratio 2:5. Work out what proportion of the money Georgie gets.

d

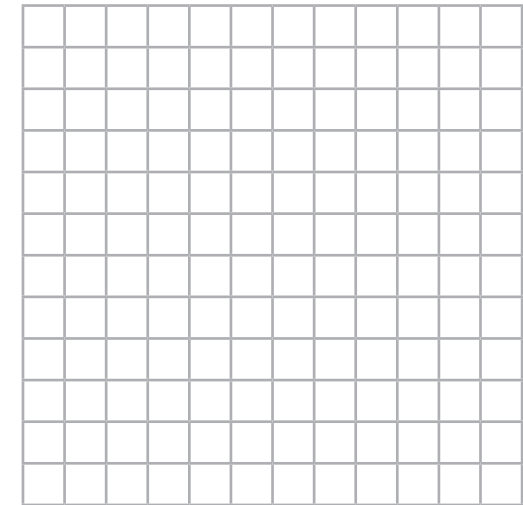
Simplify  $(3x^{\frac{1}{3}} y^{\frac{2}{7}})^3$

e

The table shows the ages of 40 employees.

a) Draw a histogram to represent the data.

Age, $x$ , years	Frequency
$16 \leq x < 20$	6
$20 \leq x < 26$	12
$26 \leq x < 30$	7
$30 \leq x < 40$	10
$40 \leq x < 60$	5



b) Estimate the number of staff aged 34 and over.

f

**a**  
The highest common factor of two numbers is 3. The lowest common multiple of these two numbers is 45. What could the two numbers be?

9 and 15

**b**  
The value of a car depreciates by 3.1% per annum. If it cost £28 000 new, find the value of the car after 3 years.

£25 475.89 (to 2 decimal places)

**c**  
Simplify  $\sqrt{\frac{a^{\frac{2}{5}} \times a^{\frac{3}{4}}}{a^{\frac{7}{20}}}}$

$a^{\frac{2}{5}}$

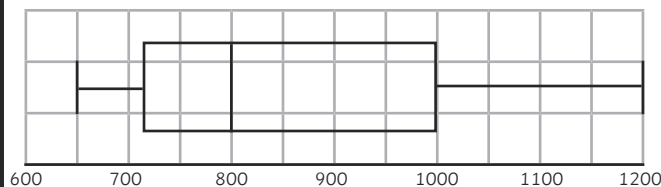
**d**  
Draw the graph of  $y = (\frac{1}{2})^x$  for the values  $-4 \leq x \leq 4$ .

Correctly drawn exponential graph passing through (0,1)

**e**  
The table gives the weights of 30 cabbages in grams.

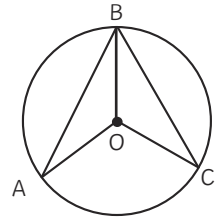
Smallest	650
Biggest	1200
Median	800
Lower quartile	720
Interquartile range	280

Draw a box and whisker plot to show this information.

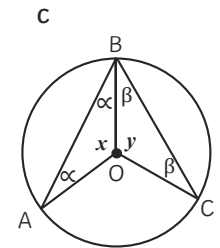


**f**  
Start by drawing the radius from the centre to the point on the circumference (the two points we are interested in). It helps to label the diagram as below.

1) Two radii form an isosceles triangle therefore triangle AOB and BOC are both isosceles triangles. Therefore angle OAB = angle OBA and angle OBC = angle OCB.



2) Labelling the diagram further you can see that  $x + 2\alpha = 180^\circ$ , therefore  $x = 180^\circ - 2\alpha$ . Similarly  $y + 2\beta = 180^\circ$ , therefore  $y = 180^\circ - 2\beta$ .



3) Now use the fact that angles around a point add up to  $360^\circ$  to form the equation  $x + y + \text{AOC} = 360^\circ$ , therefore  $\text{AOC} = 360^\circ - x - y$ . Substituting the equations from part 2) into this one gives  $\text{AOC} = 360^\circ - (180 - 2\alpha) - (180 - 2\beta)$ .

Simplify to give  $\text{AOC} = 2\alpha + 2\beta$ . Looking at the diagram you can see that the angle ABC is  $\alpha + \beta$ . We have proven that the angle at the centre

$a = 4 \times 10^5$  and  $b = 5 \times 10^4$ .

$$c = \frac{ab}{a+b}$$

Work out the value of  $c$ , leaving your answer in standard form correct to 1 decimal place.

$$4.4 \times 10^4$$

a

The functions  $f(x)$  and  $g(x)$  are given by the following:

$$f(x) = x^2 + 3$$

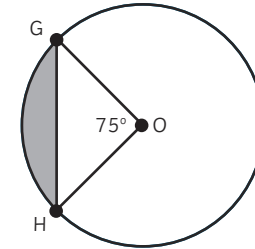
$$g(x) = x + 9$$

Find the values of  $a$  such that  $f(a) = g(a)$ .

$$a = 3 \text{ or } a = -2$$

c

$O$  is the centre of a circle with radius 5cm. Find the area of the shaded region, giving your answer correct to 3 significant figures.



$$4.29\text{cm}^2$$

e

Write  $1.7\dot{2}\dot{5}$  as a fraction. Show all your working.

$$n = 1.7\dot{2}\dot{5}$$

$$1000n = 1725.\dot{2}\dot{5}$$

$$10n = 17.\dot{2}\dot{5}$$

$$990n = 1708$$

$$\frac{1708}{990} = \frac{854}{495}$$

$$\text{or } 1\frac{359}{495}$$

b

Prove that the sum of three consecutive even numbers is always a multiple of 6.

Let  $n$  be any integer. Then  $2n$  is always even. The next two consecutive even numbers are  $2n + 2$  and  $2n + 4$ .

The sum is  $2n + 2n + 2 + 2n + 4 = 6n + 6$ .

This can be written as  $6(n + 1)$  which is a multiple of 6.

d

A biased coin is flipped twice.

The probability of the coin landing on tails is 0.4. Find the probability the coin lands on tails exactly once.

$$0.48$$

f



Write the following numbers in order of size, starting with the smallest.

$0.23, \frac{7}{25}, 2.03 \times 10^{-1}, 2^{-2}$

$2.03 \times 10^{-1}, 0.23, 2^{-2}, \frac{7}{25}$

Solve

$\frac{a+5}{a-3} = a$

$a = 5$  or  $a = -1$

Solve the simultaneous equations:

$2x^2 + y^2 = 11$

$y = x + 4$

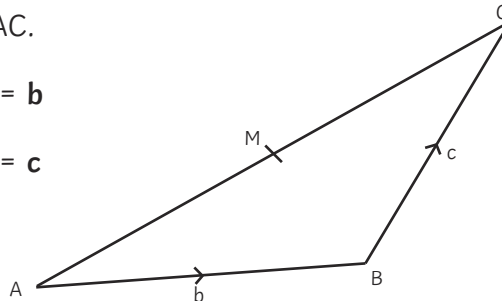
$x = -1, y = 3$

$x = \frac{-3}{5}, y = \frac{17}{5}$

ABC is a triangle. M is the midpoint of AC.

$\vec{AB} = \mathbf{b}$

$\vec{BC} = \mathbf{c}$



Express BM in terms of b and c.

$BM = 0.5(c - b)$

The table shows the ages of 30 staff members.

Age, x, years	Frequency
$16 \leq x < 20$	5
$20 \leq x < 24$	7
$24 \leq x < 40$	12
$40 \leq x < 60$	6

Find an estimate for the median age, showing clear justification for your answer.

The median lies in the interval  $24 \leq x < 40$ , however very able students might also use linear interpolation to get an answer of 28.

There are four types of chocolate bar in a machine: Fairy Milk, Kit Kit, Sneakers and Snars Bars.

The probability of choosing a Fairy Milk is the same as choosing a Kit Kit. The probability of choosing a Sneakers is double the probability of choosing a Fairy Milk, and a third of the probability of choosing a Snars Bar.

Find the probability of choosing a Snars Bar at random.

Fairy Milk	Sneakers	Snars Bar	Kit Kit
0.1	0.2	0.6	0.1

$10x = 1$

So  $x = 0.1$

Work out, without using a calculator:

i)  $-7.5 \div 1.5$

-5

ii)  $-0.3 \times -0.47$

0.141

iii)  $(-\frac{1}{4})^2$

$\frac{1}{16}$

a

Look at the Venn diagram. Write down the numbers that are in set:

i)  $A \cap B$

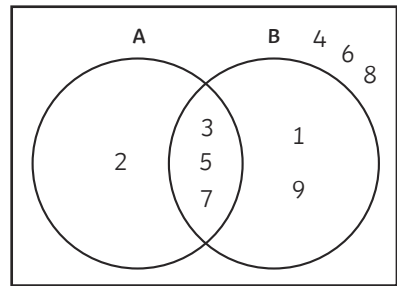
3, 5, 7

ii)  $A'$

1, 4, 6, 8, 9

iii) One of the numbers is chosen at random. Find the probability the number is in set  $A \cup B$ .

$\frac{6}{9} = \frac{2}{3}$



c

A cube of iron has edges 0.78m long. The density of the iron is  $8\text{g/cm}^3$ .

Find the mass of the iron, giving your answer in kilograms to 3 significant figures.

3800 kilograms

e

Eleanor thinks of a number,  $x$ , then adds 5. She would have got the same answer had she initially doubled  $x$  and then subtracted 2.

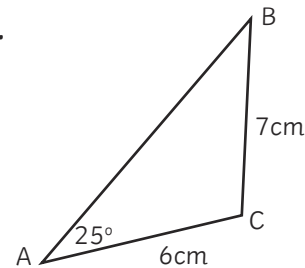
Form an equation and solve to find the value of  $x$ .

$x + 5 = 2x - 2$   
 $x = 7$

b

For the given triangle, work out the angle  $ABC$ , giving your answer correct to 3 significant figures.

$21.2^\circ$



d

Factorise  $6x^2 - 13x - 28$

$(2x - 7)(3x + 4)$

f

a) Complete the table for the graph

$$y = 4x - x^2.$$

x	0	0.5	1	1.5	2	2.5	3	3.5	4
y	0	1.75	3	3.75	4	3.75	3	1.75	0

b) Plot the graph of  $y = 4x - x^2$  on the coordinate axes.

Correctly drawn graph with smooth curve

c) By using trapezia of width 0.5 units, find an estimate for the area between the curve and the x-axis.

10.5 units<sup>2</sup>

Use the iterative formula

$$x_{n+1} = \sqrt{28 - x_n}$$

with  $x_0 = 4$  to find a solution to the equation  $x^2 + x = 28$ . Give your answer correct to 3 decimal places.

$x \approx 4.815$

Expand  $(3x + 2)(2x - 4)(x - 5)$

$$6x^3 - 38x^2 + 32x + 40$$

Find the nth term of the sequence:

-3, 8, 23, 42, 65

$$2n^2 + 5n - 10$$

The number of students in a school increases from 210 to 275. Find the percentage increase, giving your answer correct to 3 significant figures.

31.0%

A piece of string measures 72.3cm correct to 3 significant figures. Find the lower bound of the length of the piece of string.

72.25cm

Solve the simultaneous equations:

$$3x^2 + 2y^2 = 29$$

$$y = x + 4$$

$$x = -3, y = 1$$

$$x = -\frac{1}{5}, y = 3\frac{4}{5}$$

a

i) Write the expression  $x^2 + 3x - 5$  in the form  $(x + a)^2 + b$  where  $a$  and  $b$  are integers.

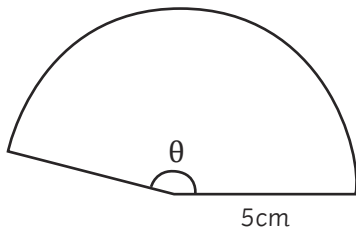
$$(x + 1.5)^2 - 7.25$$

ii) Hence write down the turning point of the graph  $y = x^2 + 3x - 5$ .

$$(-1.5, -7.25)$$

c

The diagram shows a sector of a circle. It has a perimeter of 24cm and a radius of 5cm. Find the size of the angle,  $\theta$ , giving your answer correct to 3 significant figures.



$$160^\circ$$

b

Ben, Georgie and Sajid share some money. Ben gets  $\frac{4}{9}$ , and Georgie and Sajid share the remainder in the ratio 2:5. Work out what proportion of the money Georgie gets.

$$\frac{10}{63}$$

d

Simplify  $(3x^{\frac{1}{3}} y^{\frac{2}{7}})^3$

$$27xy^{\frac{6}{7}}$$

e

The table shows the ages of 40 employees.

a) Draw a histogram to represent the data.

Histogram with following frequency densities:

Age, $x$ , years	Frequency Density
$16 \leq x < 20$	1.5
$20 \leq x < 26$	2
$26 \leq x < 30$	1.75
$30 \leq x < 40$	1
$40 \leq x < 60$	0.25

b) Estimate the number of staff aged 34 and over.

$$11$$

f