

Answer ALL TWENTY questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify  $e^8 \div e^2$

.....  
(1)

(b) Expand and simplify  $(x - 3)(x + 1)$

.....  
(2)

(Total for Question 1 is 3 marks)

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- 2 Here is a right-angled triangle.

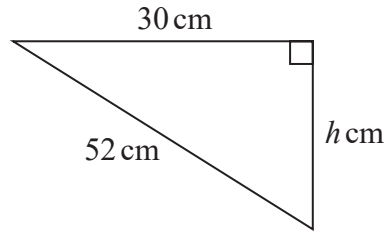


Diagram **NOT**  
accurately drawn

Calculate the value of  $h$ .  
Give your answer correct to 3 significant figures.

$h = \dots\dots\dots$

(Total for Question 2 is 3 marks)

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- 3 There are 54 fish in a tank.  
Some of the fish are white and the rest of the fish are red.

Jeevan takes at random a fish from the tank.

The probability that he takes a white fish is  $\frac{4}{9}$

- (a) Work out the number of white fish originally in the tank.

(2)

Jeevan puts the fish he took out, back into the tank.  
He puts some more white fish into the tank.

Jeevan takes at random a fish from the tank.

The probability that he takes a white fish is now  $\frac{1}{2}$

- (b) Work out the number of white fish Jeevan put into the tank.

(2)

(Total for Question 3 is 4 marks)



- 4 The diagram shows the front of a wooden door with a semicircular glass window.

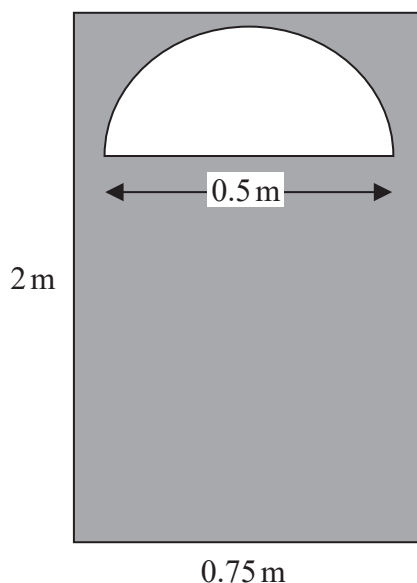


Diagram **NOT**  
accurately drawn

Julie wants to apply 2 coats of wood varnish to the front of the door, shown shaded in the diagram.

250 millilitres of wood varnish covers  $4\text{ m}^2$  of the wood.

Work out how many millilitres of wood varnish Julie will need.  
Give your answer correct to the nearest millilitre.

..... millilitres

(Total for Question 4 is 5 marks)



- 5 Yasmin has some identical rectangular tiles.  
Each tile is  $L$  cm by  $W$  cm.

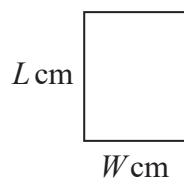


Diagram **NOT**  
accurately drawn

Using 9 of her tiles, Yasmin makes rectangle  $ABCD$ , shown in the diagram below.

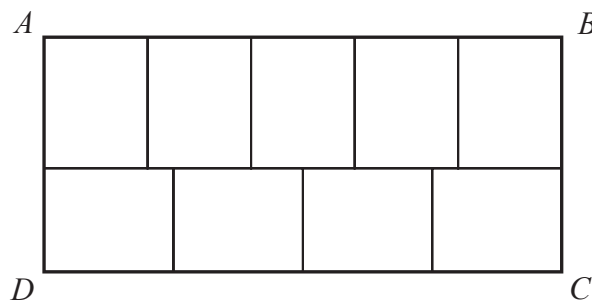


Diagram **NOT**  
accurately drawn

The area of  $ABCD$  is  $1620 \text{ cm}^2$

Work out the value of  $L$  and the value of  $W$ .

$$L = \dots\dots\dots W = \dots\dots\dots$$

(Total for Question 5 is 5 marks)



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- 6 Alison buys 5 apples and 3 pears for a total cost of \$1.96  
Greg buys 3 apples and 2 pears for a total cost of \$1.22

Michael buys 10 apples and 10 pears.

Work out how much Michael pays for his 10 apples and 10 pears.  
Show your working clearly.

\$.....

(Total for Question 6 is 5 marks)



- 7 Write  $3.6 \times 10^3$  as a product of powers of its prime factors.  
Show your working clearly.

(Total for Question 7 is 3 marks)



- 8 In 2018, the population of Sydney was 5.48 million.  
This was 22% of the total population of Australia.

Work out the total population of Australia in 2018  
Give your answer correct to 3 significant figures.

..... million

(Total for Question 8 is 3 marks)

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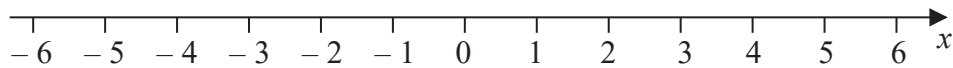




9 (i) Solve the inequalities  $-7 \leq 2x - 3 < 5$

(3)

(ii) On the number line, represent the solution set to part (i)



(2)

(Total for Question 9 is 5 marks)

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- 10 A solid aluminium cylinder has radius 10 cm and height  $h$  cm.

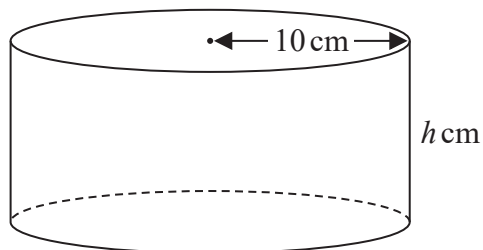


Diagram **NOT**  
accurately drawn

The mass of the cylinder is 5.4 kg.

The density of aluminium is  $0.0027 \text{ kg/cm}^3$

Calculate the value of  $h$ .

Give your answer correct to one decimal place.

$h = \dots\dots\dots$

(Total for Question 10 is 5 marks)



- 11 The table gives information about the times taken by 90 runners to complete a 10 km race.

Time ( $t$ minutes)	Frequency
$25 < t \leq 35$	12
$35 < t \leq 45$	24
$45 < t \leq 55$	28
$55 < t \leq 65$	12
$65 < t \leq 75$	10
$75 < t \leq 85$	4

- (a) Complete the cumulative frequency table.

Time ( $t$ minutes)	Cumulative frequency
$25 < t \leq 35$	12
$25 < t \leq 45$	
$25 < t \leq 55$	
$25 < t \leq 65$	
$25 < t \leq 75$	
$25 < t \leq 85$	

(1)

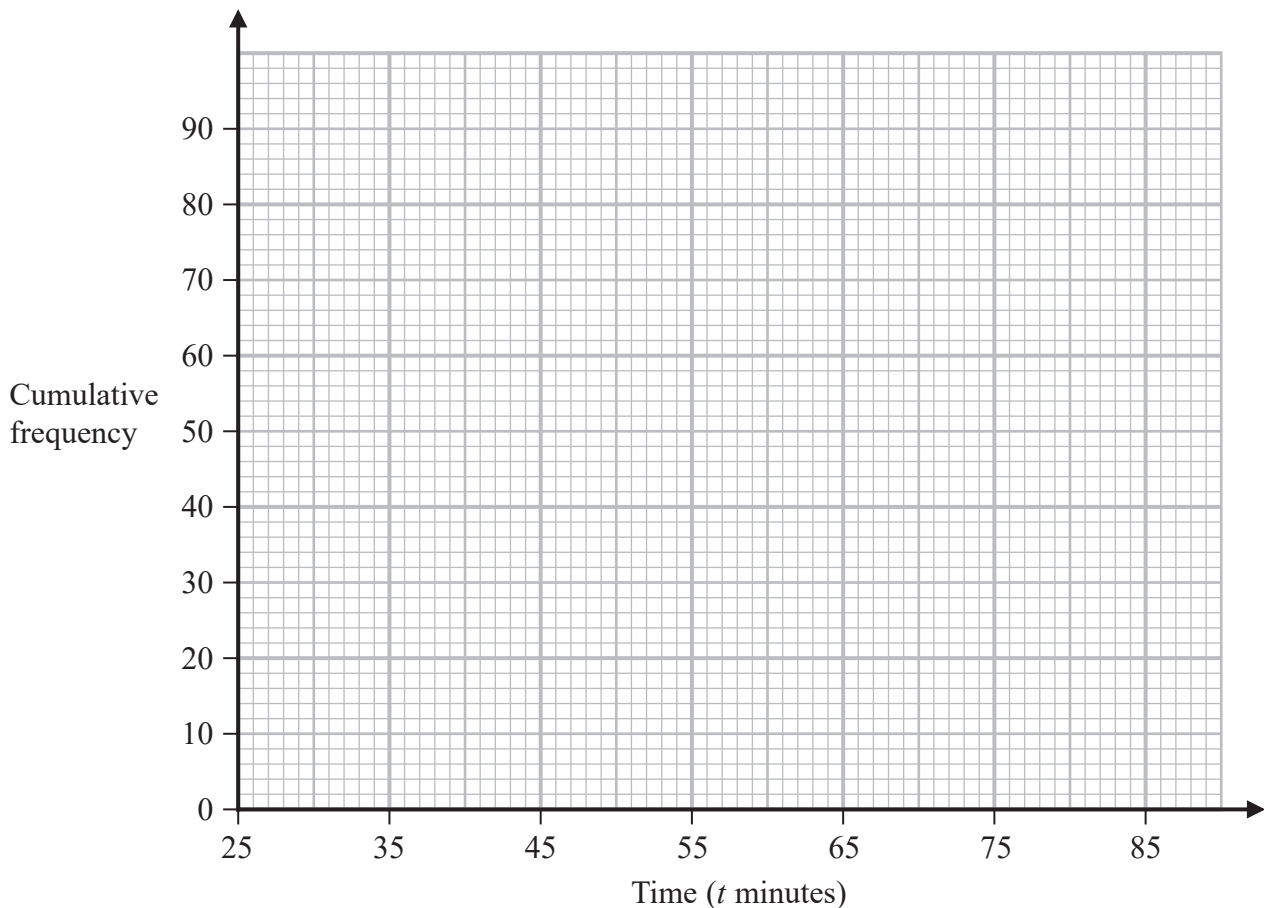
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(b) On the grid below, draw a cumulative frequency graph for your table.



(2)

Any runner who completed the race in a time  $T$  minutes such that  $42 < T \leq 52$  minutes was awarded a silver medal.

(c) Use your graph to find an estimate for the number of runners who were awarded a silver medal.

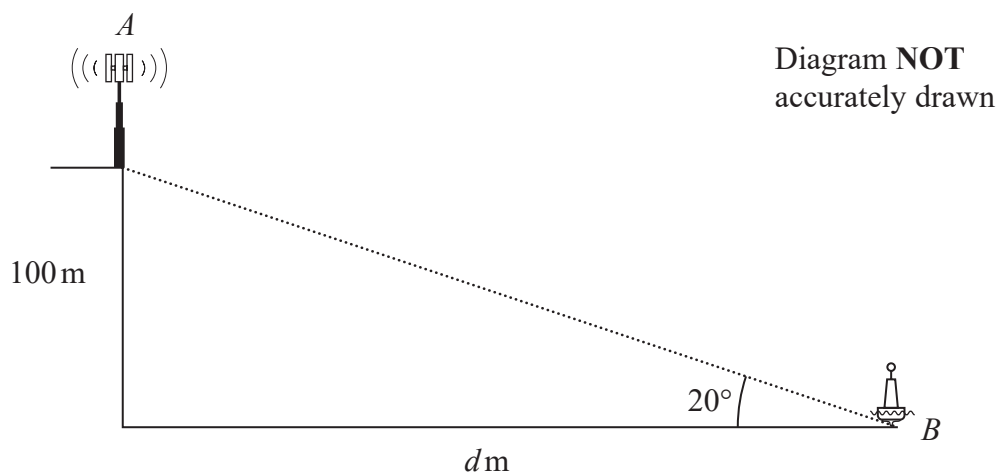
..... runners

(2)

(Total for Question 11 is 5 marks)



- 12 The diagram shows a vertical cliff with a vertical radio mast on top of the cliff and a buoy in the sea.



The height of the cliff is 100 metres.

The buoy is at the point  $B$  that is  $d$  metres from the base of the cliff.

The angle of elevation from  $B$  to the top of the cliff is  $20^\circ$

- (a) Calculate the value of  $d$ .  
Give your answer correct to 3 significant figures.

$d = \dots\dots\dots$   
(3)

The point  $A$  at the top of the radio mast is vertically above the top of the cliff.

The angle of elevation from  $B$  to  $A$  is  $25^\circ$

- (b) Calculate the height of the radio mast.  
Give your answer correct to 3 significant figures.

$\dots\dots\dots$  m  
(3)

(Total for Question 12 is 6 marks)



13 Here is a triangle  $XYZ$ .

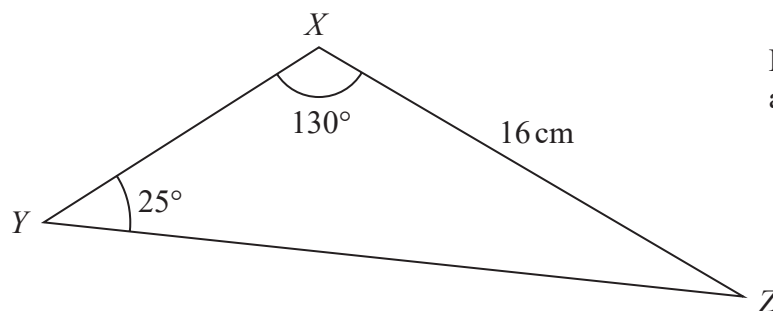


Diagram **NOT**  
accurately drawn

The length  $XZ$  and the angles  $YXZ$  and  $XYZ$  are each given correct to 2 significant figures.

Calculate the upper bound for the length  $YZ$ .

Give your answer correct to one decimal place.

Show your working clearly.

..... cm

(Total for Question 13 is 3 marks)



14  $ABCDEF$  and  $GHIJKL$  are regular hexagons each with centre  $O$ .

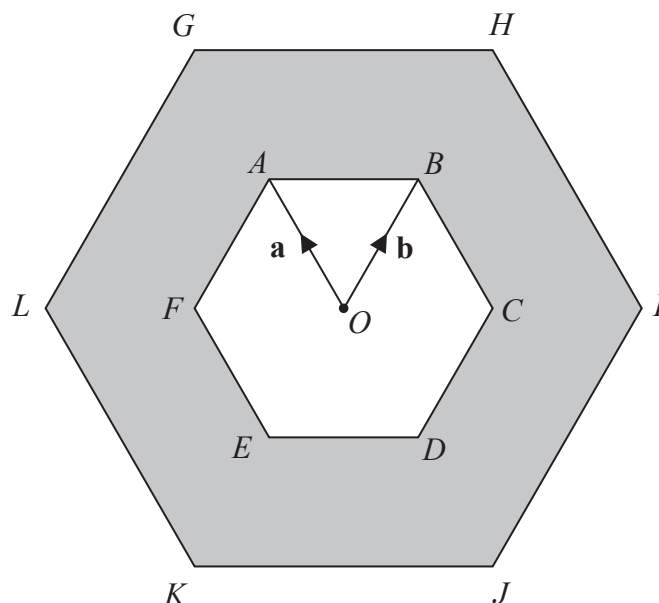


Diagram **NOT**  
accurately drawn

$GHIJKL$  is an enlargement of  $ABCDEF$ , with centre  $O$  and scale factor 2

$$\vec{OA} = \mathbf{a} \quad \vec{OB} = \mathbf{b}$$

(a) Write the following vectors, in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .  
Simplify your answers.

(i)  $\vec{AB}$

(1)

(ii)  $\vec{KI}$

(2)

(iii)  $\vec{LD}$

(2)



The triangle  $OAB$  has an area of  $5 \text{ cm}^2$

(b) Calculate the area of the shaded region.

.....  $\text{cm}^2$   
(3)

(Total for Question 14 is 8 marks)

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- (a) Complete the probability tree diagram.

(2)

For each game of chess,

the winner gets 2 points and the loser gets 0 points,  
when the game is drawn, each player gets 1 point.

- (b) Work out the probability that, after 2 games, Magnus and Garry have the same number of points.

.....  
(3)

Magnus and Garry now play a third game of chess.

- (c) Work out the probability that, after 3 games, Magnus and Garry have the same number of points.

.....  
(3)

(Total for Question 15 is 8 marks)



16 There are 32 students in a class.

In one term these 32 students each took a test in Maths ( $M$ ), in English ( $E$ ) and in French ( $F$ ).

25 students passed the test in Maths.

20 students passed the test in English.

14 students passed the test in French.

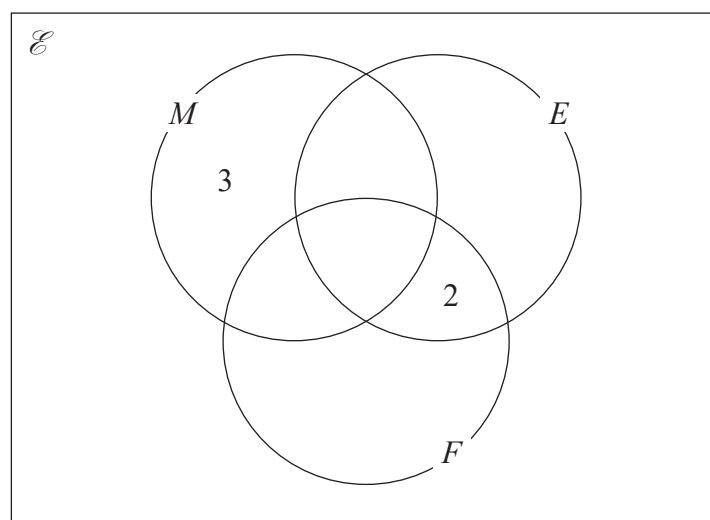
18 students passed the tests in Maths and English.

11 students passed the tests in Maths and French.

4 students failed all three tests.

$x$  students passed all three tests.

The incomplete Venn diagram gives some more information about the results of the 32 students.



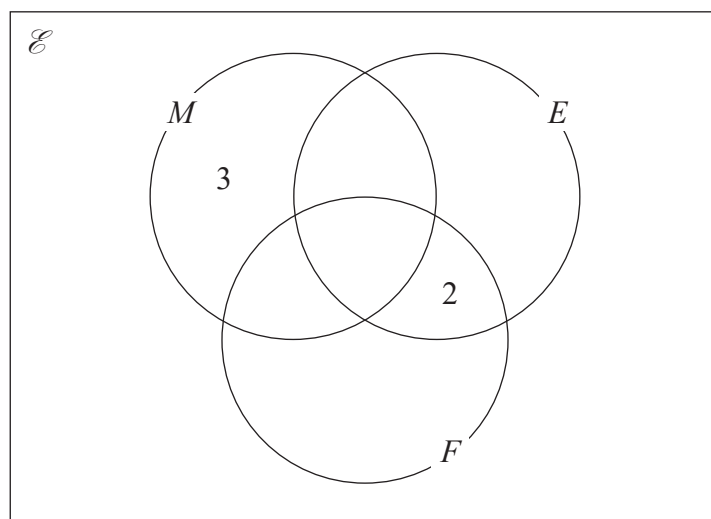
- (a) Use all the given information about the results of students who passed the test in Maths to find the value of  $x$ .

$x = \dots\dots\dots$

(2)



- (b) Use your value of  $x$  to complete the Venn diagram to show the number of students in each subset.



(2)

A student who passed the test in Maths is chosen at random.

- (c) Find the probability that this student failed the test in French.

(1)

(Total for Question 16 is 5 marks)



17 (a) Factorise  $6y^2 - y - 5$

(2)

(b) Make  $f$  the subject of  $w = \frac{2f + 3}{8 - f}$

(3)

(c) Express  $4x^2 - 8x + 7$  in the form  $a(x + b)^2 + c$  where  $a$ ,  $b$  and  $c$  are integers.

(3)

(Total for Question 17 is 8 marks)



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18  $0.4\dot{x}$  is a recurring decimal.

$x$  is a whole number such that  $1 \leq x \leq 9$

Find, in terms of  $x$ , the recurring decimal  $0.4\dot{x}$  as a fraction.

Give your fraction in its simplest form.

Show clear algebraic working.

(Total for Question 18 is 3 marks)



19  $ABCED$  is a five-sided shape.

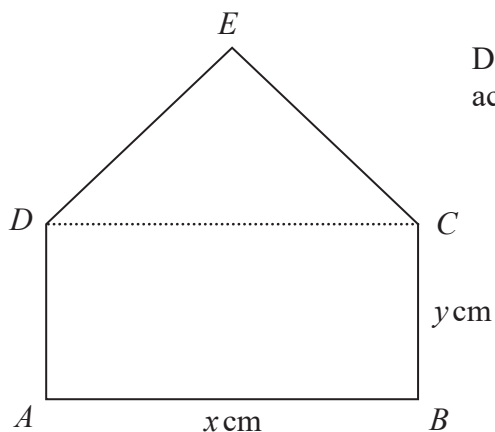


Diagram **NOT**  
accurately drawn

$ABCD$  is a rectangle.

$CED$  is an equilateral triangle.

$$AB = x \text{ cm} \quad BC = y \text{ cm}$$

The perimeter of  $ABCED$  is 100 cm.

The area of  $ABCED$  is  $R \text{ cm}^2$

(a) Show that  $R = \frac{x}{4} \left( 200 - [6 - \sqrt{3}]x \right)$

(3)



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- (b) (i) Find the value of  $x$  for which  $R$  has its maximum value.

Give your answer in the form  $\frac{p}{q - \sqrt{3}}$  where  $p$  and  $q$  are integers.

$x = \dots\dots\dots$   
(2)

- (ii) Explain why the maximum value of  $R$  is given by this value of  $x$ .

.....  
.....  
.....  
(1)

(Total for Question 19 is 6 marks)





- 20** The straight line **L** passes through point  $A(-6, 2)$  and point  $B(5, 3)$   
 The straight line **M** is perpendicular to **L** and passes through the midpoint of  $A$  and  $B$ .  
 The line **M** intersects the line  $x = -1$  at point  $C$ .

Calculate the area of triangle  $ABC$ .

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(Total for Question 20 is 7 marks)

