



CANDIDATE  
NAME

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CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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## 0580/42

May/June 2020

**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For  $\pi$ , use either your calculator value or 3.142.

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Blank pages are indicated.

- 1 (a) (i) Divide \$24 in the ratio 7 : 5.

\$ ..... , \$ ..... [2]

- (ii) Write \$24.60 as a fraction of \$2870.  
Give your answer in its lowest terms.

..... [2]

- (iii) Write \$1.92 as a percentage of \$1.60 .

..... % [1]

- (b) In a sale the original prices are reduced by 15%.

- (i) Calculate the sale price of a book that has an original price of \$12.

\$ ..... [2]

- (ii) Calculate the original price of a jacket that has a sale price of \$38.25 .

\$ ..... [2]

- (c) (i) Dean invests \$500 for 10 years at a rate of 1.7% per year simple interest.

Calculate the total interest earned during the 10 years.

\$ ..... [2]

- (ii) Ollie invests \$200 at a rate of 0.0035% **per day** compound interest.

Calculate the value of Ollie's investment at the end of 1 year.

[1 year = 365 days.]

\$ ..... [2]

- (iii) Edna invests \$500 at a rate of  $r\%$  per year compound interest.  
At the end of 6 years, the value of Edna's investment is \$559.78 .

Find the value of  $r$ .

$r =$  ..... [3]

2 (a)  $\mathbf{p} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$   $\mathbf{q} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$

(i) Find  $2\mathbf{p} + \mathbf{q}$ .

$$\begin{pmatrix} \phantom{0} \\ \phantom{0} \end{pmatrix} \quad [2]$$

(ii) Find  $|\mathbf{p}|$ .

(b)  $A$  is the point  $(4, 1)$  and  $\overrightarrow{AB} = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$ .

Find the coordinates of  $B$ .

..... [2]

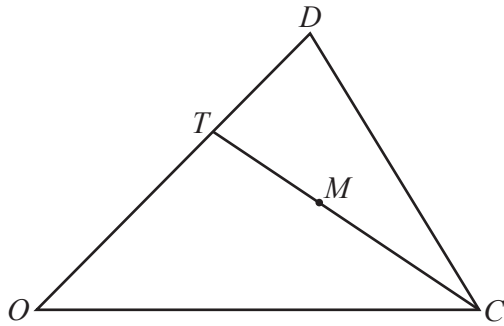
( ..... , ..... ) [1]

(c) The line  $y = 3x - 2$  crosses the  $y$ -axis at  $G$ .

Write down the coordinates of  $G$ .

( ..... , ..... ) [1]

(d)



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In the diagram,  $O$  is the origin,  $OT = 2TD$  and  $M$  is the midpoint of  $TC$ .  
 $\overrightarrow{OC} = \mathbf{c}$  and  $\overrightarrow{OD} = \mathbf{d}$ .

Find the position vector of  $M$ .

Give your answer in terms of  $\mathbf{c}$  and  $\mathbf{d}$  in its simplest form.

..... [3]

- 3 The speed,  $v$  km/h, of each of 200 cars passing a building is measured. The table shows the results.

Speed ( $v$ km/h)	$0 < v \leq 20$	$20 < v \leq 40$	$40 < v \leq 45$	$45 < v \leq 50$	$50 < v \leq 60$	$60 < v \leq 80$
Frequency	16	34	62	58	26	4

- (a) Calculate an estimate of the mean.

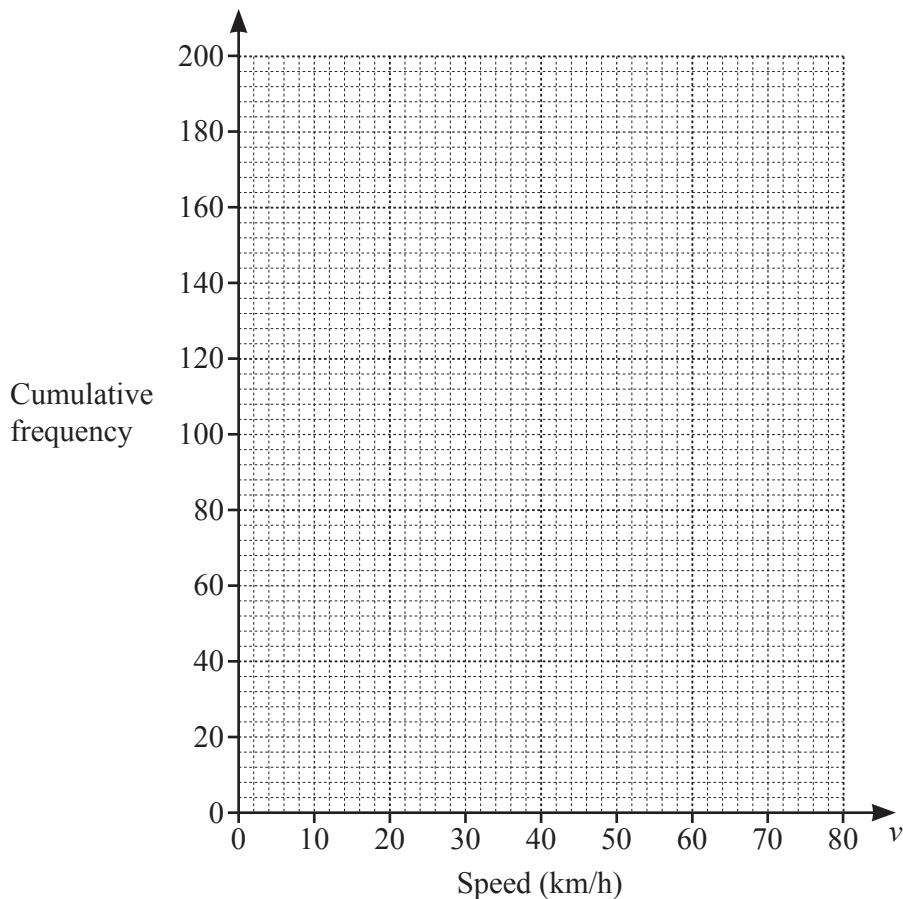
..... km/h [4]

- (b) (i) Use the frequency table to complete the cumulative frequency table.

Speed ( $v$ km/h)	$v \leq 20$	$v \leq 40$	$v \leq 45$	$v \leq 50$	$v \leq 60$	$v \leq 80$
Cumulative frequency	16	50			196	200

[1]

- (ii) On the grid, draw a cumulative frequency diagram.



[3]

(iii) Use your diagram to find an estimate of

(a) the upper quartile,

..... km/h [1]

(b) the number of cars with a speed greater than 35 km/h.

..... [2]

(c) Two of the 200 cars are chosen at random.

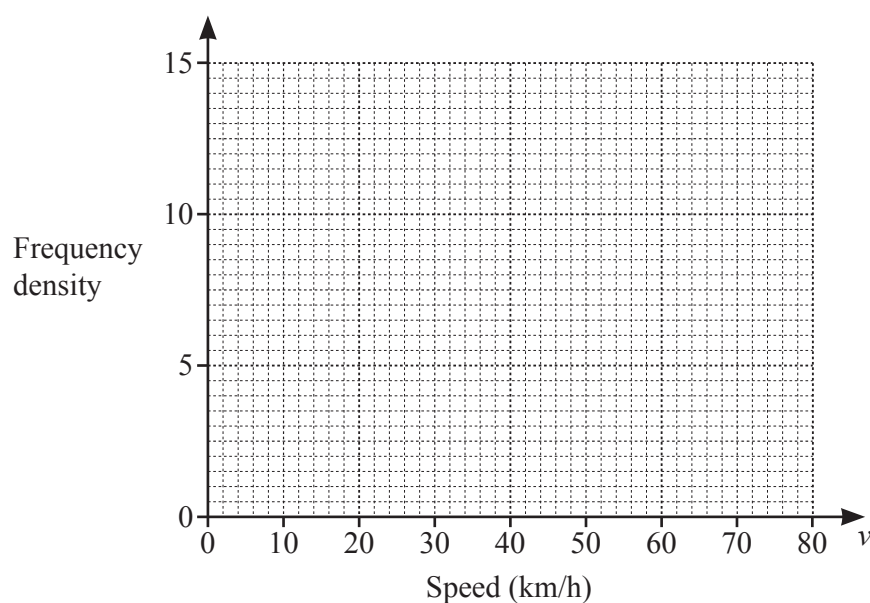
Find the probability that they both have a speed greater than 50 km/h.

..... [2]

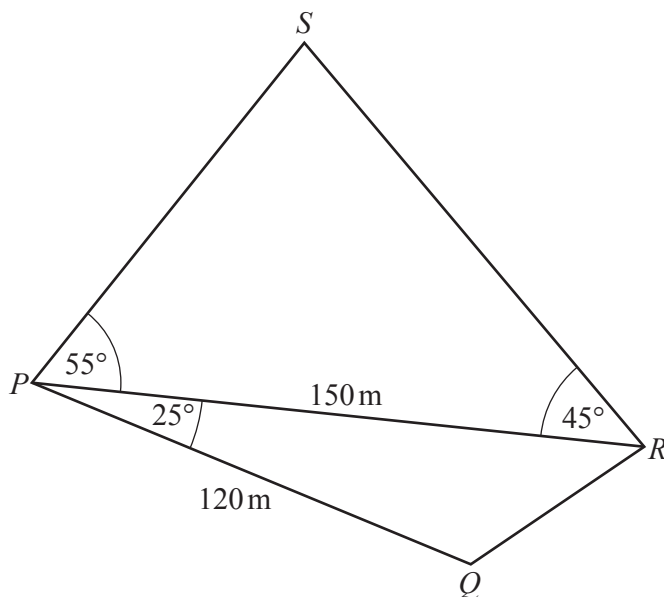
(d) A new frequency table is made by combining intervals.

Speed ( $v$ km/h)	$0 < v \leq 40$	$40 < v \leq 50$	$50 < v \leq 80$
Frequency	50	120	30

On the grid, draw a histogram to show the information in this table.



[3]



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The diagram shows two triangles.

(a) Calculate  $QR$ .

$QR = \dots\dots\dots\text{ m}$  [3]

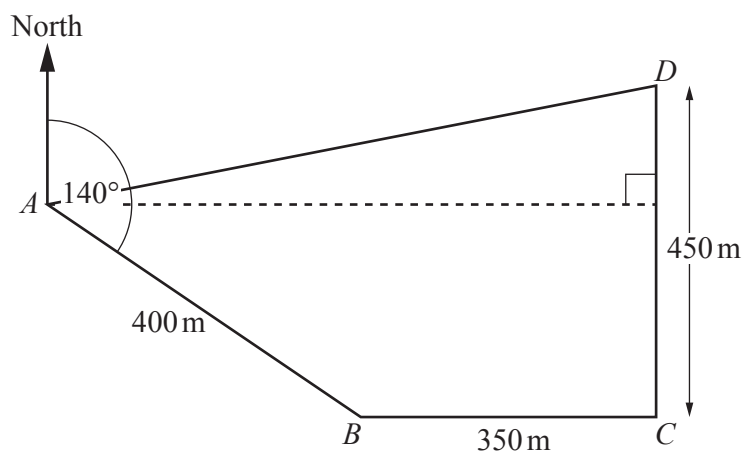
(b) Calculate  $RS$ .

$RS = \dots\dots\dots\text{ m}$  [4]



- (c) Calculate the total area of the two triangles.

.....  $\text{m}^2$  [3]



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The diagram shows a field  $ABCD$ .  
 The bearing of  $B$  from  $A$  is  $140^\circ$ .  
 $C$  is due east of  $B$  and  $D$  is due north of  $C$ .  
 $AB = 400\text{ m}$ ,  $BC = 350\text{ m}$  and  $CD = 450\text{ m}$ .

(a) Find the bearing of  $D$  from  $B$ .

..... [2]

- (b) Calculate the distance from  $D$  to  $A$ .

..... m [6]

- (c) Jono runs around the field from  $A$  to  $B$ ,  $B$  to  $C$ ,  $C$  to  $D$  and  $D$  to  $A$ .  
 He runs at a speed of 3 m/s.

Calculate the total time Jono takes to run around the field.  
 Give your answer in minutes and seconds, correct to the nearest second.

..... min ..... s [4]

12

6       $f(x) = 3x + 2$        $g(x) = x^2 + 1$        $h(x) = 4^x$

(a) Find  $h(4)$ .

..... [1]

(b) Find  $fg(1)$ .

..... [2]

(c) Find  $gf(x)$  in the form  $ax^2 + bx + c$ .

..... [3]

(d) Find  $x$  when  $f(x) = g(7)$ .

$x =$  ..... [2]

(e) Find  $f^{-1}(x)$ .

$f^{-1}(x) =$  ..... [2]

(f) Find  $\frac{g(x)}{f(x)} + x$ .

Give your answer as a single fraction, in terms of  $x$ , in its simplest form.

..... [3]

(g) Find  $x$  when  $h^{-1}(x) = 2$ .

$x =$  ..... [1]

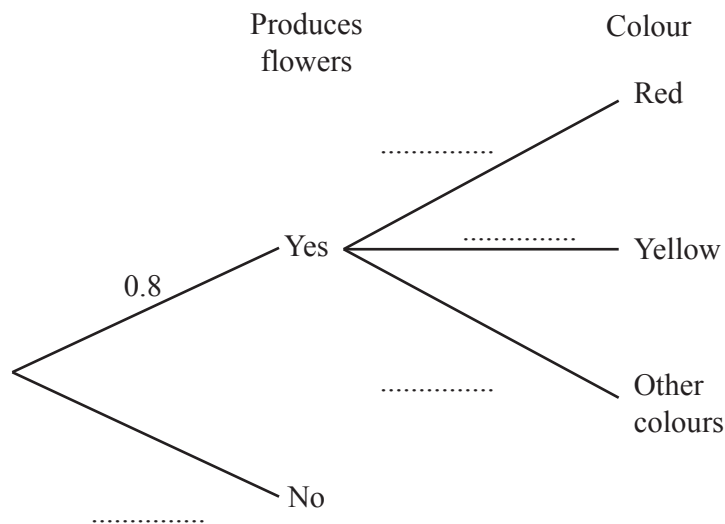
- 7 Tanya plants some seeds.  
 The probability that a seed will produce flowers is 0.8 .  
 When a seed produces flowers, the probability that the flowers are red is 0.6 and the probability that the flowers are yellow is 0.3 .

(a) Tanya has a seed that produces flowers.

Find the probability that the flowers are not red and not yellow.

..... [1]

(b) (i) Complete the tree diagram.



[2]

(ii) Find the probability that a seed chosen at random produces red flowers.

..... [2]

- (iii) Tanya chooses a seed at random.

Find the probability that this seed does not produce red flowers and does not produce yellow flowers.

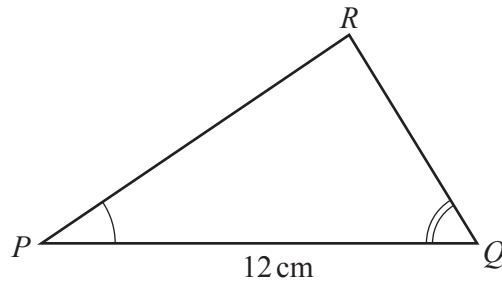
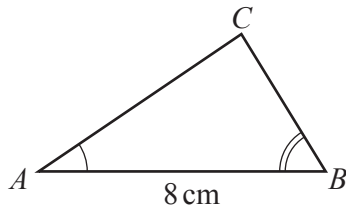
..... [3]

- (c) Two of the seeds are chosen at random.

Find the probability that one produces flowers and one does not produce flowers.

..... [3]

8 (a)



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Triangle  $ABC$  is mathematically similar to triangle  $PQR$ .  
The area of triangle  $ABC$  is  $16\text{ cm}^2$ .

(i) Calculate the area of triangle  $PQR$ .

.....  $\text{cm}^2$  [2]

(ii) The triangles are the cross-sections of prisms which are also mathematically similar.  
The volume of the smaller prism is  $320\text{ cm}^3$ .

Calculate the length of the larger prism.

.....  $\text{cm}$  [3]



- (b) A cylinder with radius 6 cm and height  $h$  cm has the same volume as a sphere with radius 4.5 cm.

Find the value of  $h$ .

[The volume,  $V$ , of a sphere with radius  $r$  is  $V = \frac{4}{3}\pi r^3$ .]

$$h = \dots\dots\dots [3]$$

- (c) A solid metal cube of side 20 cm is melted down and made into 40 solid spheres, each of radius  $r$  cm.

Find the value of  $r$ .

[The volume,  $V$ , of a sphere with radius  $r$  is  $V = \frac{4}{3}\pi r^3$ .]

$$r = \dots\dots\dots [3]$$

- (d) A solid cylinder has radius  $x$  cm and height  $\frac{7x}{2}$  cm.

The surface area of a sphere with radius  $R$  cm is equal to the total surface area of the cylinder.

Find an expression for  $R$  in terms of  $x$ .

[The surface area,  $A$ , of a sphere with radius  $r$  is  $A = 4\pi r^2$ .]

$$R = \dots\dots\dots [3]$$

- 9 (a) (i) Write  $x^2 + 8x - 9$  in the form  $(x + k)^2 + h$ .

..... [2]

- (ii) Use your answer to **part (a)(i)** to solve the equation  $x^2 + 8x - 9 = 0$ .

$x =$  ..... or  $x =$  ..... [2]

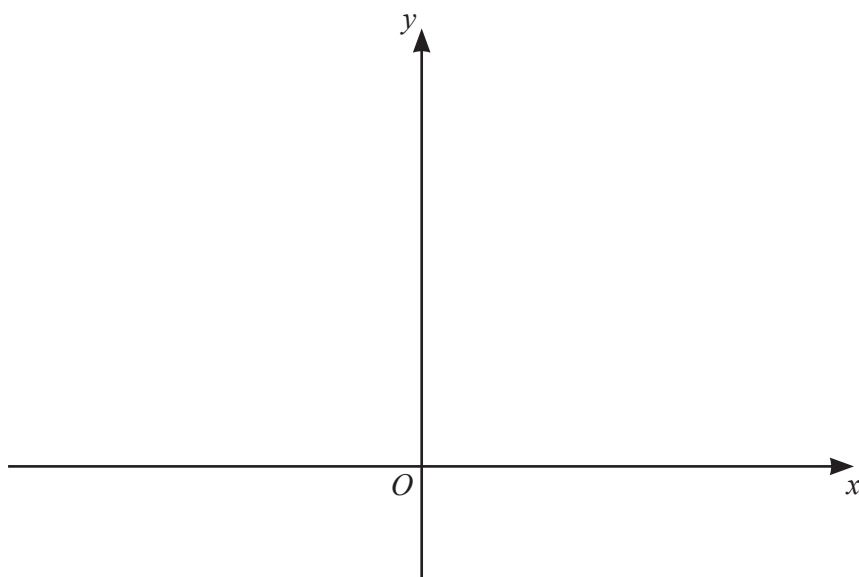
- (b) The solutions of the equation  $x^2 + bx + c = 0$  are  $\frac{-7 + \sqrt{61}}{2}$  and  $\frac{-7 - \sqrt{61}}{2}$ .

Find the value of  $b$  and the value of  $c$ .

$b =$  .....

$c =$  ..... [3]

(c) (i)



On the diagram,

(a) sketch the graph of  $y = (x-1)^2$ , [2]

(b) sketch the graph of  $y = \frac{1}{2}x + 1$ . [2]

(ii) The graphs of  $y = (x-1)^2$  and  $y = \frac{1}{2}x + 1$  intersect at  $A$  and  $B$ .

Find the length of  $AB$ .

$AB = \dots\dots\dots$  [7]

**Question 10 is printed on the next page.**

10 (a)  $y = x^4 - 4x^3$

(i) Find the value of  $y$  when  $x = -1$ .

$$y = \dots\dots\dots [2]$$

(ii) Find the two stationary points on the graph of  $y = x^4 - 4x^3$ .

$$(\dots\dots\dots, \dots\dots\dots)$$

$$(\dots\dots\dots, \dots\dots\dots) [6]$$

(b)  $y = x^p + 2x^q$

$$\frac{dy}{dx} = 11x^{10} + 10x^4, \text{ where } \frac{dy}{dx} \text{ is the derived function.}$$

Find the value of  $p$  and the value of  $q$ .

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots [2]$$

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