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MATHEMATICS

0580/42

Paper 4 (Extended)

May/June 2020

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- 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 π , use either your calculator value or 3.142.

INFORMATION

- 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 $2\mathbf{p} + \mathbf{q}$.

$$\left(\quad \quad \right) \quad [2]$$

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

..... [2]

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

Find the coordinates of B .

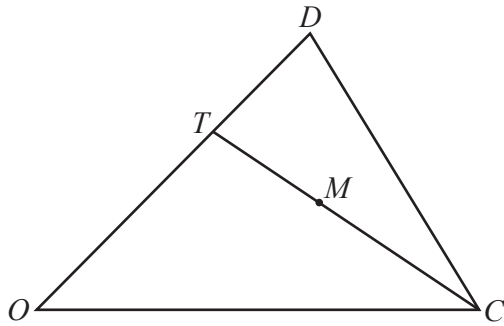
(..... ,) [1]

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

Write down the coordinates of G .

(..... ,) [1]

(d)

NOT TO
SCALE

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.

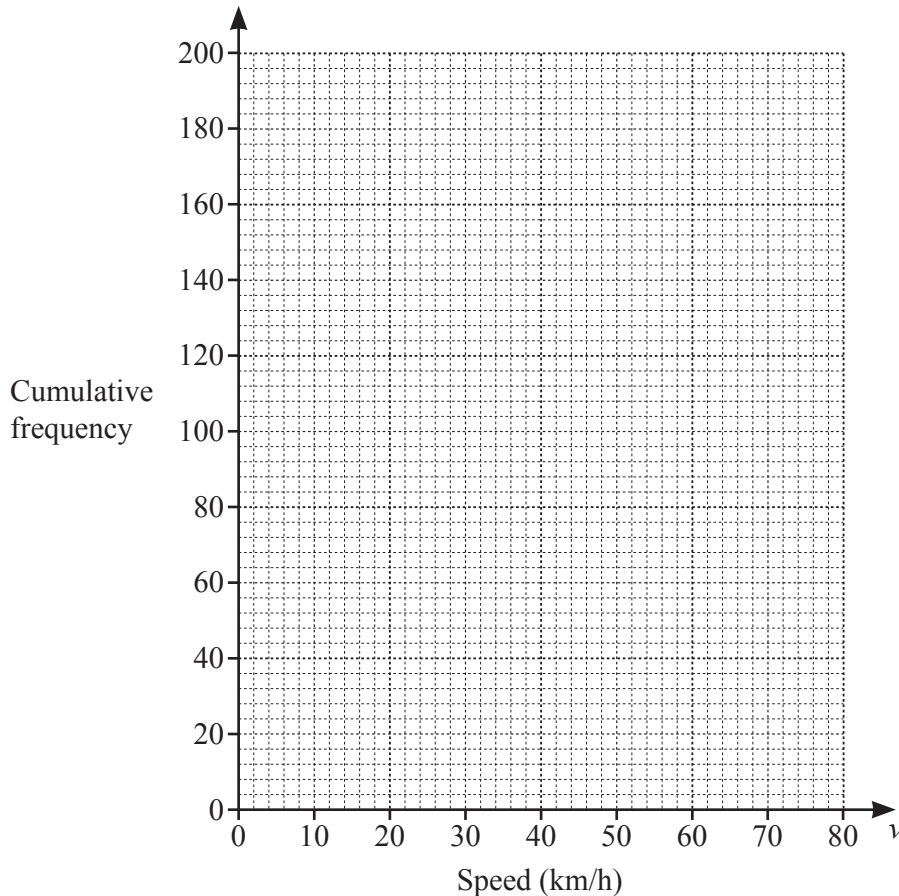
..... km/h [4]

- (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.

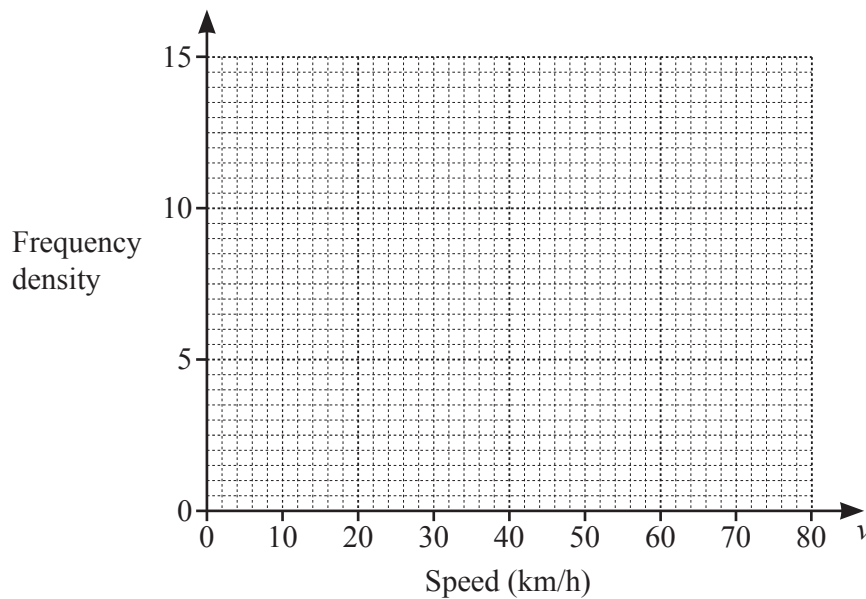
Find the probability that they both have a speed greater than 50 km/h.

..... [2]

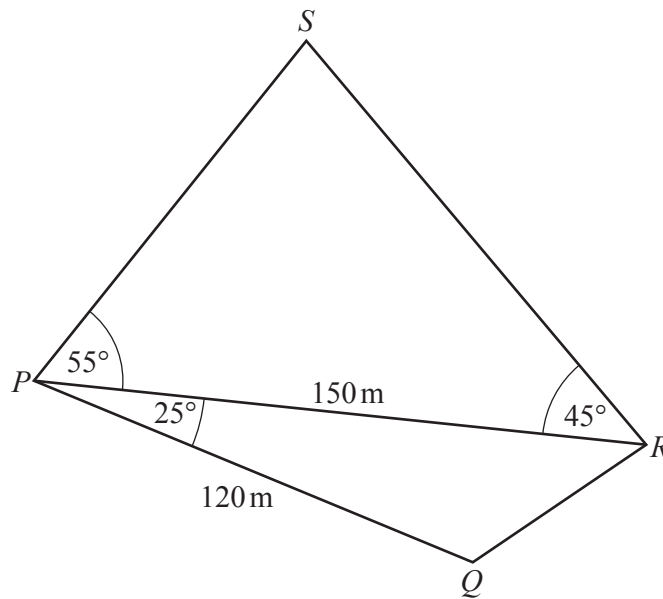
(d) A new frequency table is made by combining intervals.

| | | | |
|-------------------|-----------------|------------------|------------------|
| 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]



NOT TO
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The diagram shows two triangles.

(a) Calculate QR .

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

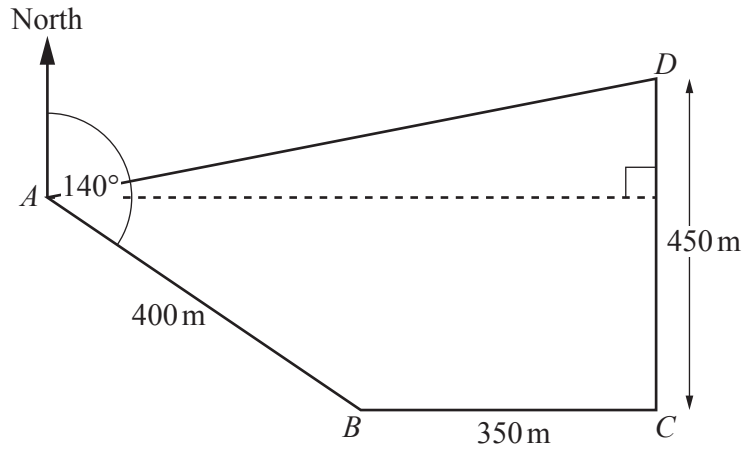
(b) Calculate RS .

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

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

..... m² [3]

5

NOT TO
SCALE

The diagram shows a field $ABCD$.
 The bearing of B from A is 140° .
 C is due east of B and D is due north of C .
 $AB = 400$ m, $BC = 350$ m and $CD = 450$ 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]

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]

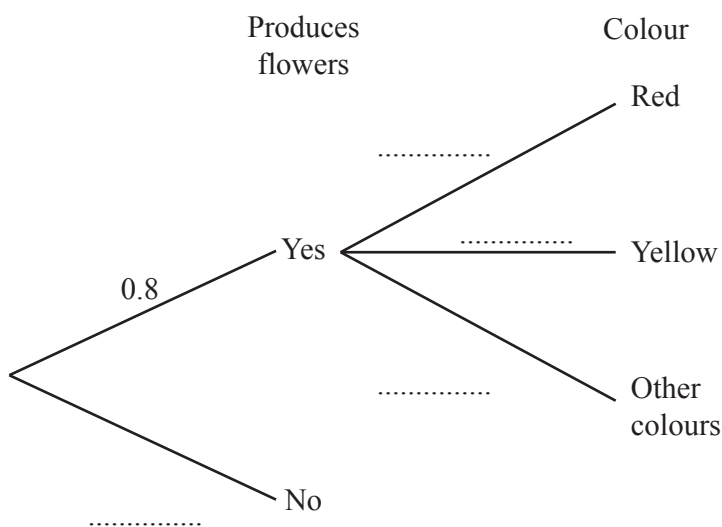
7 Tanya plants some seeds.
 The probability that a seed will produce flowers is 0.8 .
 When a seed produces flowers, the probability that the flowers are red is 0.6 and the probability that the flowers are yellow is 0.3 .

(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.

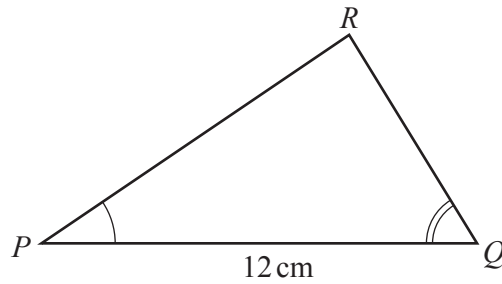
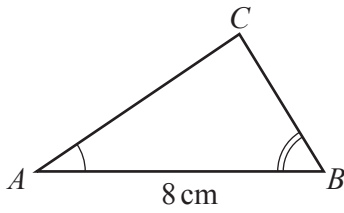
..... [3]

- (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)



NOT TO SCALE

Triangle ABC is mathematically similar to triangle PQR .
The area of triangle ABC is 16 cm^2 .

(i) Calculate the area of triangle PQR .

..... 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 cm^3 .

Calculate the length of the larger prism.

..... 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 $x^2 + 8x - 9 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

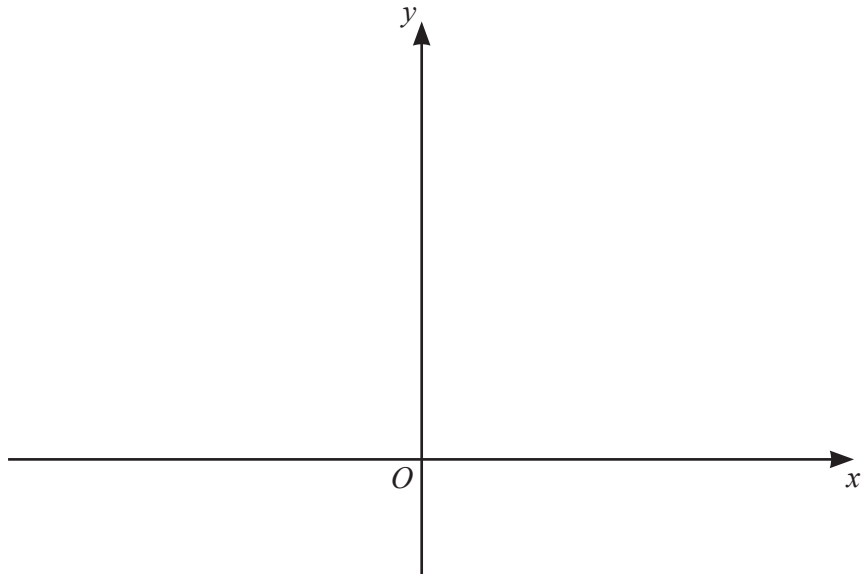
(b) The solutions of the equation $x^2 + bx + c = 0$ are $\frac{-7 + \sqrt{61}}{2}$ and $\frac{-7 - \sqrt{61}}{2}$.

Find the value of b and the value of c .

$b = \dots\dots\dots$

$c = \dots\dots\dots$ [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) $y = x^p + 2x^q$

$\frac{dy}{dx} = 11x^{10} + 10x^4$, where $\frac{dy}{dx}$ 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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