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MATHEMATICS

0580/42

Paper 4 (Extended)

October/November 2022

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. Any blank pages are indicated.



- 1 (a) (i) At a football club, season tickets are sold for seated areas and for standing areas. The cost of season tickets are in the ratio seated : standing = 5 : 3. The cost of a season ticket for the standing area is \$45.

Find the cost of a season ticket for the seated area.

\$ [2]

- (ii) In 2021, the value of the team's players was \$2.65 million. In 2022 this value has decreased by 12%.

Find the value in 2022.

\$ million [2]

- (iii) The number of people at a football match is 1455. This is 6.25% of the total number of people allowed in the stadium.

Find the total number of people allowed in the stadium.

..... [2]

- (iv) The average attendance increased exponentially by 4% each year for the three years from 2016 to 2019. In 2019 the average attendance was 1631.

Find the average attendance for 2016.

..... [3]

- (b) Another club sells season tickets for individuals and for families.
In 2018, the number of season tickets sold is in the ratio family : individual = 2 : 7.

- (i) The number of family season tickets sold is x .

Write an expression, in terms of x , for the number of individual season tickets sold.

..... [1]

- (ii) In 2019, the number of family season tickets sold increases by 12 and the number of individual season tickets sold decreases by 26.

Complete the table by writing expressions, in terms of x , for the number of tickets sold each year.

Year	Family tickets	Individual tickets
2018	x	
2019		

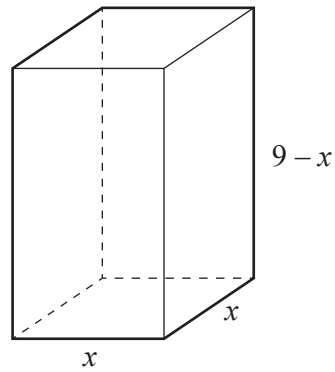
[2]

- (iii) In 2019, the number of individual season tickets sold is 3 times the number of family season tickets sold.

Write an equation in x and solve it to find the number of family tickets sold in 2018.

$x =$ [4]

2 All the lengths in this question are measured in centimetres.



NOT TO
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The diagram shows a solid cuboid with a square base.

- (a) The volume, $V \text{ cm}^3$, of the cuboid is $V = x^2(9 - x)$.
The table shows some values of V for $0 \leq x \leq 9$.

x	0	1	2	3	4	5	6	7	8	9
V	0	8		54	80	100	108	98	64	0

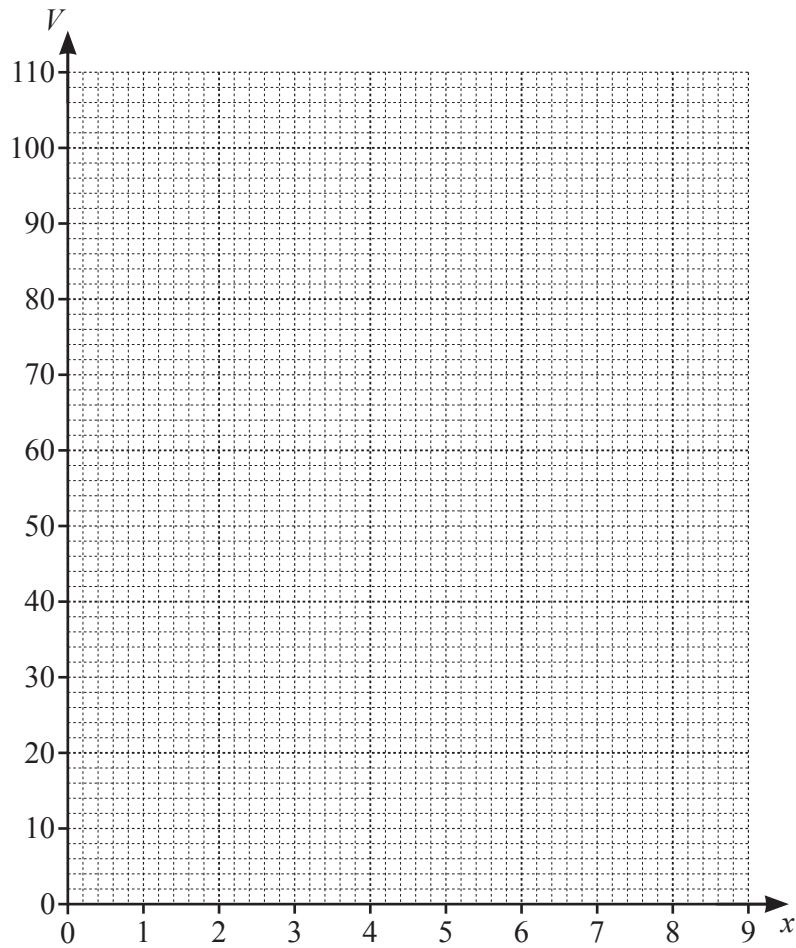
- (i) Complete the table.

[1]

- (ii) On the grid on the opposite page, draw the graph of $V = x^2(9 - x)$ for $0 \leq x \leq 9$. [4]

- (iii) Find the values of x when the volume of the cuboid is 44 cm^3 .

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



(b) (i) Show that the total surface area of the cuboid is $(36x - 2x^2) \text{ cm}^2$.

[2]

(ii) Find the surface area when the volume of the cuboid is a maximum.

..... cm^2 [3]

3 Kai and Ann carry out a survey on the distances travelled, in kilometres, by 200 cars.

Kai completes this frequency table for the data collected.

Distance (d km)	$80 < d \leq 100$	$100 < d \leq 150$	$150 < d \leq 200$	$200 < d \leq 300$	$300 < d \leq 400$
Frequency	7	33	76	52	32

(a) (i) Calculate an estimate of the mean.

..... km [4]

(ii) Ann uses this frequency table for the same data.
There is a different interval for the final group.

Distance (d km)	$80 < d \leq 100$	$100 < d \leq 150$	$150 < d \leq 200$	$200 < d \leq 300$	$300 < d \leq 360$
Frequency	7	33	76	52	32

Without calculating an estimate of the mean for this data, find the difference between Ann's and Kai's estimate of the mean.

You must show all your working.

..... km [2]

- (iii) A histogram is drawn showing the information in **Kai's** frequency table.
The height of the block for the interval $200 < d \leq 300$ is 2.6 cm.

Calculate the height of the block for each of the following intervals.

$80 < d \leq 100$ cm

$150 < d \leq 200$ cm

$300 < d \leq 400$ cm [3]

- (b) One car is picked at random.

Find the probability that the car has travelled more than 300 km.

..... [1]

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

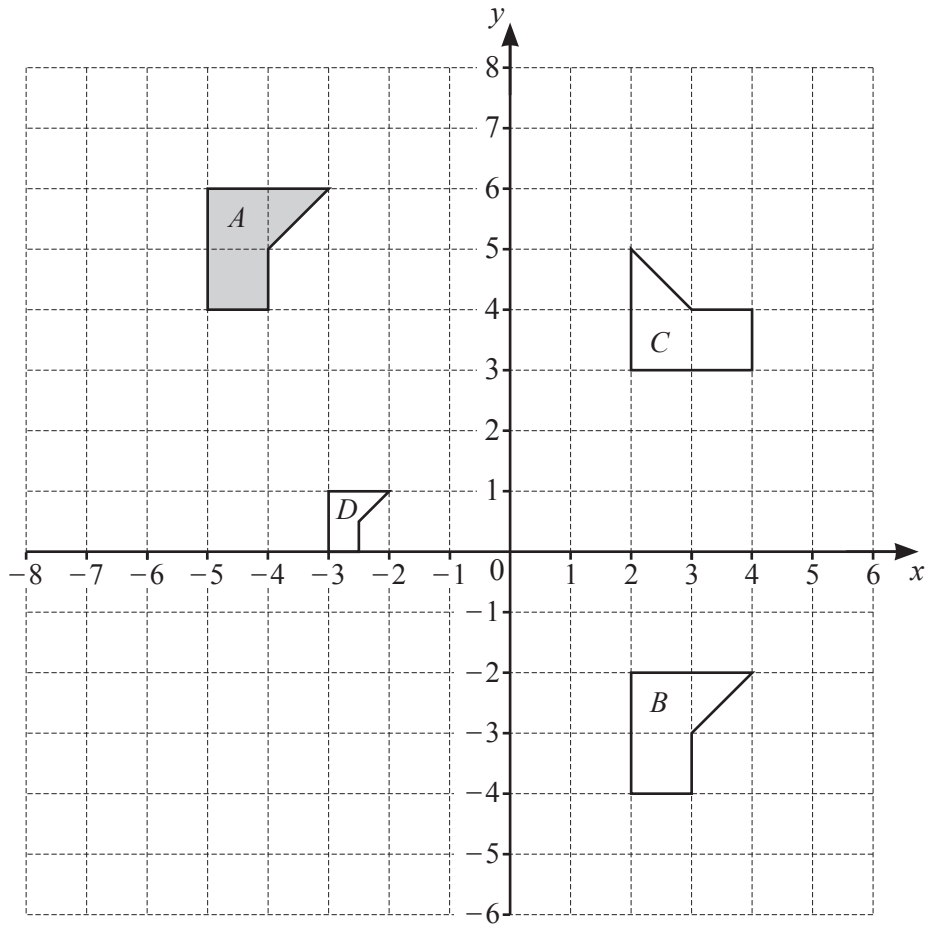
Find the probability that

- (i) both cars have travelled 150 km or less,

..... [2]

- (ii) one car has travelled more than 200 km and the other car has travelled 100 km or less.

..... [3]



(a) Describe fully the **single** transformation that maps

(i) shape *A* onto shape *B*,

.....
 [2]

(ii) shape *A* onto shape *C*,

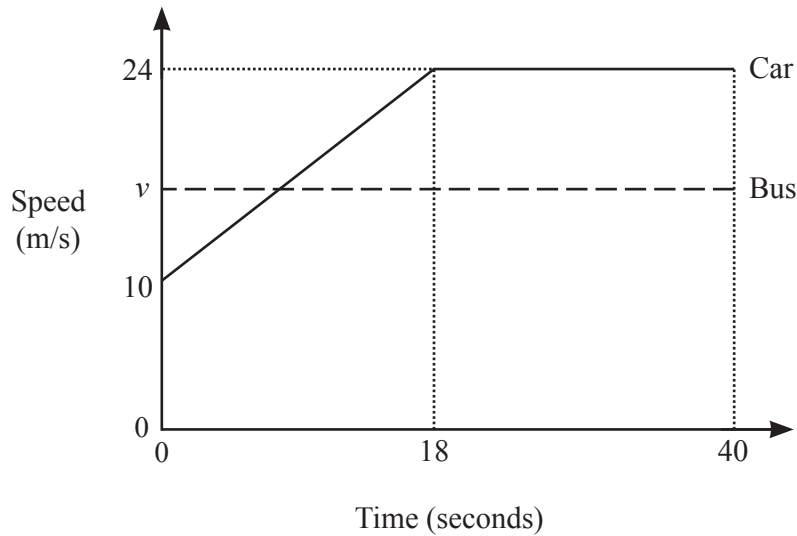
.....
 [3]

(iii) shape *A* onto shape *D*.

.....
 [3]

(b) On the grid, draw the image of shape *A* after a reflection in the line $y = x + 8$. [2]

- 5 (a) The diagram shows the speed–time graph for part of a journey for two vehicles, a car and a bus.



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- (i) Calculate the acceleration of the car during the first 18 seconds.

..... m/s^2 [1]

- (ii) In the first 40 seconds the car travelled 134m more than the bus.

Calculate the constant speed, v , of the bus.

$v =$ m/s [4]

- (b) A train takes 10 minutes 30 seconds to travel 16240 m.

Calculate the average speed of the train.
Give your answer in kilometres per hour.

..... km/h [3]

6 (a) Solve.

$$4x + 15 = 9$$

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

(b) Factorise.

$$a^2 - 9$$

$$\dots\dots\dots [1]$$

(c) Write as a single fraction in its simplest form.

$$\frac{4a}{5} \div \frac{3ad}{10c}$$

$$\dots\dots\dots [3]$$

(d) $5^n + 5^n + 5^n + 5^n + 5^n = 5^m$

Find an expression for m in terms of n .

$$m = \dots\dots\dots [2]$$

(e) Solve by factorisation.

$$4x^2 + 8x - 5 = 0$$

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [3]$$

- (f) (i) y is directly proportional to $(x+3)^3$.
When $x = 2$, $y = 13.5$.

Find x when $y = 108$.

$$x = \dots\dots\dots [3]$$

- (ii) g is inversely proportional to the square of d .
When d is halved, the value of g is multiplied by a factor n .

Find n .

$$n = \dots\dots\dots [2]$$

- (g) Expand and simplify.

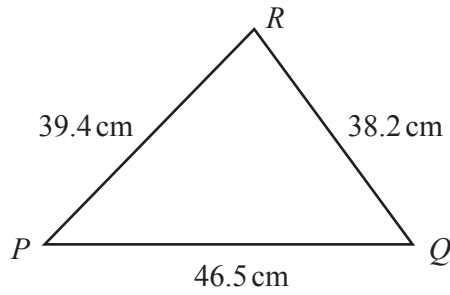
$$(2x+3)(x-1)(x+3)$$

$$\dots\dots\dots [3]$$

- (h) Find the derivative, $\frac{dy}{dx}$, of $y = 3x^2 + 4x - 1$.

$$\dots\dots\dots [2]$$

7 (a)



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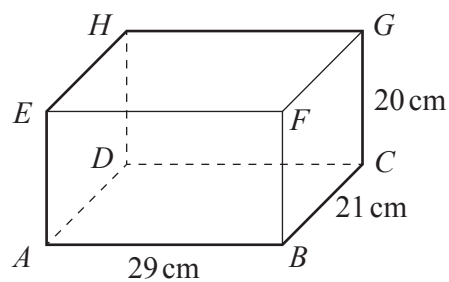
(i) Calculate angle QPR .

Angle $QPR = \dots\dots\dots$ [4]

(ii) Find the shortest distance from Q to PR .

$\dots\dots\dots$ cm [3]

(b) The diagram shows a cuboid.



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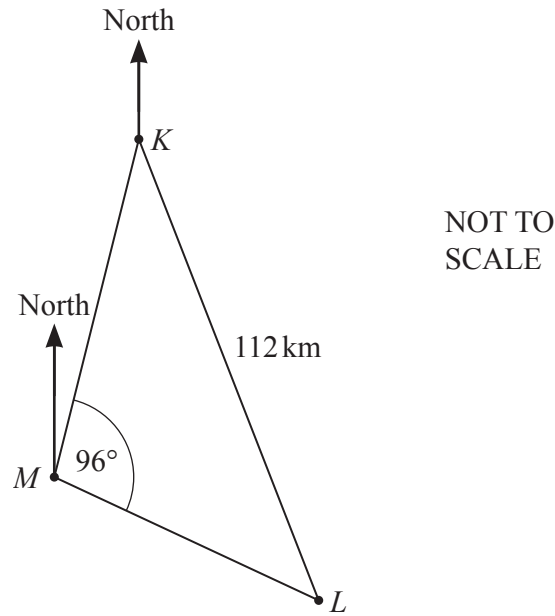
(i) Calculate the length AG .

$AG = \dots\dots\dots$ cm [3]

(ii) Calculate the angle between AG and the base $ABCD$.

..... [3]

(c)



The diagram shows the positions of a lighthouse, L , and two ships, K and M .
 The bearing of L from K is 155° and $KL = 112$ km.
 The bearing of K from M is 010° and angle $KML = 96^\circ$.

Find the bearing and distance of ship M from the lighthouse, L .

Bearing

Distance km [5]

- 8** AB is a line with midpoint M .
 A is the point $(2, 3)$ and M is the point $(12, 7)$.

(a) Find the coordinates of B .

(.....,) [2]

(b) Show that the equation of the perpendicular bisector of AB is $2y + 5x = 74$.

[4]

- (c) The perpendicular bisector of AB passes through the point N .
 The point N has coordinates $(2, n)$.

Find the value of n .

$n = \dots\dots\dots$ [1]

- (d) Points A , M and N form a triangle.

Find the area of the triangle.

..... [2]

9



(a) On the diagram, sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$. [2]

(b) Solve the equation $5 \sin x + 4 = 0$ for $0^\circ \leq x \leq 360^\circ$.

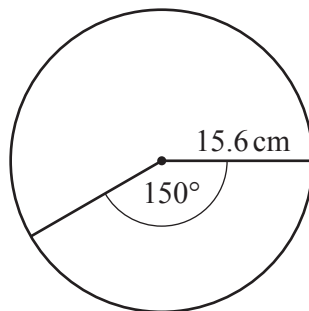
$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

- 10 (a) The lengths of the sides of a triangle are 11.4 cm, 14.8 cm and 15.7 cm, all correct to 1 decimal place.

Calculate the upper bound of the perimeter of the triangle.

..... cm [2]

(b)



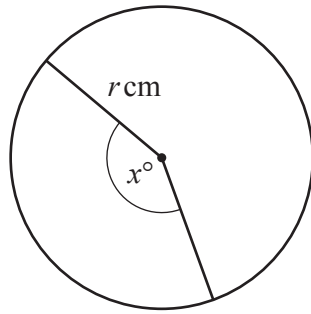
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The diagram shows a circle, radius 15.6 cm.
The angle of the minor sector is 150° .

Calculate the area of the minor sector.

..... cm^2 [2]

(c)

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The diagram shows a circle, radius $r \text{ cm}$ and minor sector angle x° .
The **perimeter** of the major sector is three times the **perimeter** of the minor sector.

Show that $x = \frac{90(\pi - 2)}{\pi}$.

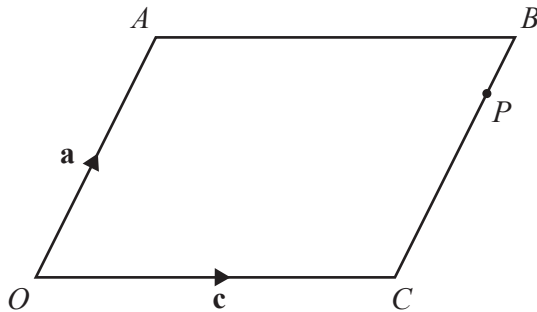
[4]

11 (a) $\left| \begin{pmatrix} 9m \\ 40m \end{pmatrix} \right| = \frac{205}{2}$

Find the two possible values of m .

$m = \dots\dots\dots$ or $\dots\dots\dots$ [3]

(b)



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$OABC$ is a parallelogram.

$\vec{OA} = \mathbf{a}$ and $\vec{OC} = \mathbf{c}$.

P is the point on CB such that $CP : PB = 3 : 1$.

(i) Find, in terms of \mathbf{a} and/or \mathbf{c} , in their simplest form,

(a) \vec{AC} ,

$\vec{AC} = \dots\dots\dots$ [1]

(b) \vec{CP} ,

$\vec{CP} = \dots\dots\dots$ [1]

(c) \vec{OP} .

$\vec{OP} = \dots\dots\dots$ [1]

(ii) OP and AB are extended to meet at Q .

Find the position vector of Q .

..... [2]

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