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MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 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.

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1 **(a)** The Earth has a surface area of approximately 510 100 000 km^2.

View solution

(i) Write this surface area in standard form.

..... km^2 [1]

(ii) Water covers 70.8% of the Earth's surface.

View solution

Work out the area of the Earth's surface covered by water.

..... km^2 [2]

(b) The table shows the surface area of some countries and their estimated population in 2017.

View solution

Country	Surface area (km^2)	Estimated population in 2017
Brunei	5.77×10^3	433 100
China	9.60×10^6	1 388 000 000
France	6.41×10^5	67 000 000
Maldives	3.00×10^2	374 600

(i) Find the total surface area of Brunei and the Maldives.

..... km^2 [1]

(ii) The ratio surface area of the Maldives : surface area of China can be written in the form 1 : n.

View solution

Find the value of n.

$n =$ ..... [2]

(iii) Find the surface area of France as a percentage of the surface area of China.

View solution

..... % [2]

(iv) Find the population density of the Maldives.
[Population density = population ÷ surface area]

View solution

..... people/km^2 [2]

(c) The population of the Earth in 2017 was estimated to be 7.53×10^9.

View solution

The population of the Earth in 2000 was estimated to be 6.02×10^9.

(i) Work out the percentage increase in the Earth's estimated population from 2000 to 2017.

..... % [2]

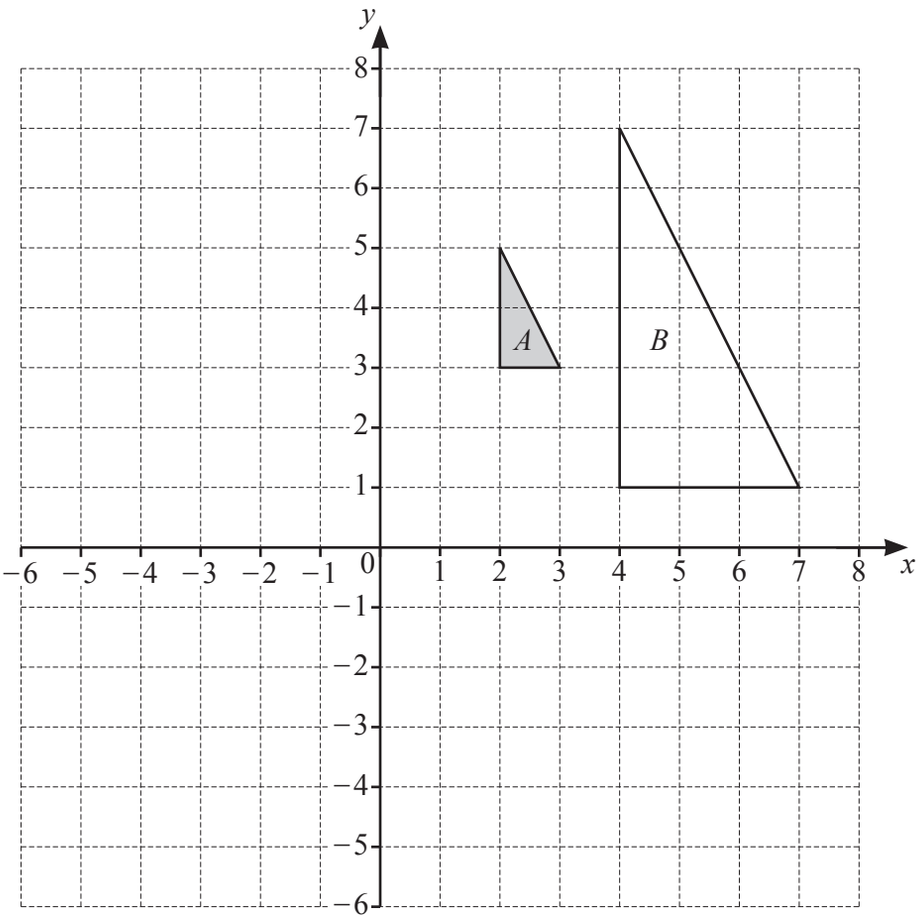
(ii) Assume that the population of the Earth increased exponentially by y% each year for these 17 years.

Find the value of y.

View solution

$y =$ ..... [3]

2



(a) On the grid, draw the image of

View solution

(i) triangle A after a rotation of 90° anticlockwise about (0, 0), [2]

(ii) triangle A after a translation by the vector $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$. [2]

View solution

(b) Describe fully the **single** transformation that maps triangle A onto triangle B.

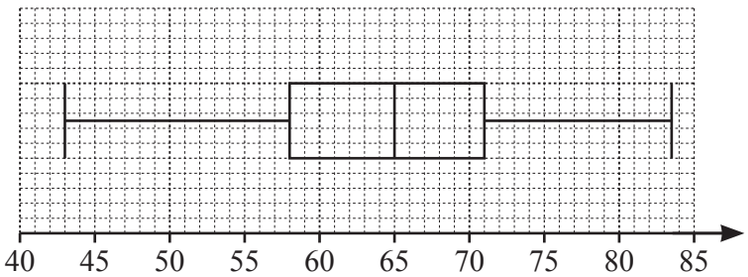
.....

View solution

..... [3]

3 **(a)** The average speeds, in km/h, of cars travelling along a road are recorded.
The box-and-whisker plot shows this information.

View solution



Find

(i) the lowest speed recorded,

..... km/h [1]

(ii) the median,

View solution

..... km/h [1]

(iii) the interquartile range.

View solution

..... km/h [1]

(b) Another car takes 18 seconds to travel 400 m along this road.

View solution

Calculate the average speed of this car in km/h.

..... km/h [3]

4

P	O	S	S	I	B	I	L	I	T	Y

Morgan picks two of these letters, at random, **without** replacement.

(a) Find the probability that he picks

View solution

(i) the letter Y first,

..... [1]

(ii) the letter B then the letter Y,

View solution

..... [2]

(iii) two letters that are the same.

View solution

..... [3]

(b) Morgan now picks a third letter at random.

View solution

Find the probability that

(i) all three letters are the same,

..... [2]

(ii) exactly two of the three letters are the same,

View solution

..... [5]

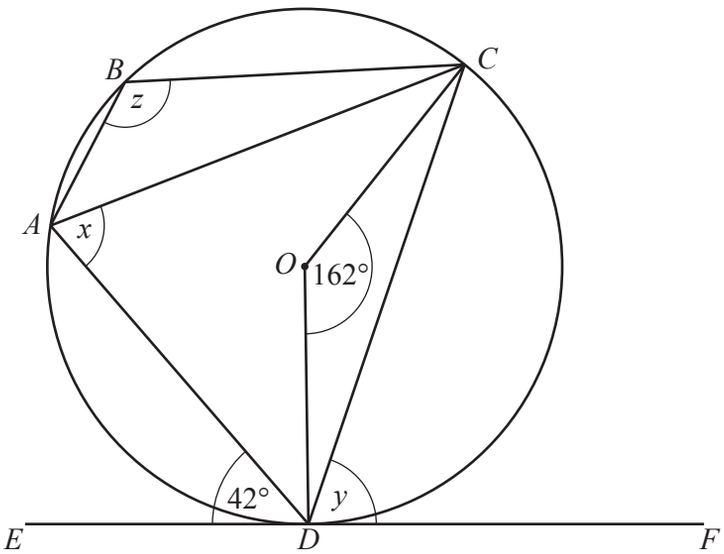
(iii) all three letters are different.

View solution

..... [2]

5 (a)

View solution



NOT TO SCALE

A, *B*, *C* and *D* are points on the circle, centre *O*.
EF is a tangent to the circle at *D*.
Angle *ADE* = 42° and angle *COD* = 162°.

Find the following angles, giving reasons for each of your answers.

(i) Angle *x*

x = ... because .....

..... [2]

(ii) Angle *y*

View solution

y = ... because .....

..... [2]

(iii) Angle *z*

View solution

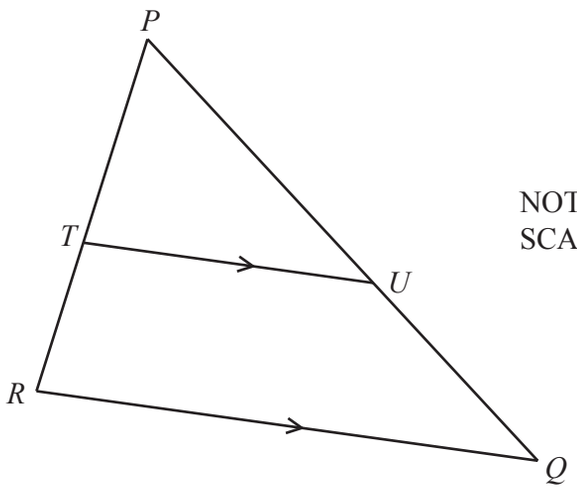
z = ... because .....

.....

..... [3]

(b)

View solution



NOT TO SCALE

PQR is a triangle.
T is a point on *PR* and *U* is a point on *PQ*.
RQ is parallel to *TU*.

(i) Explain why triangle *PQR* is similar to triangle *PUT*.
Give a reason for each statement you make.

.....

.....

.....

..... [3]

(ii) $PT : TR = 4 : 3$

View solution

(a) Find the ratio $PU : PQ$.

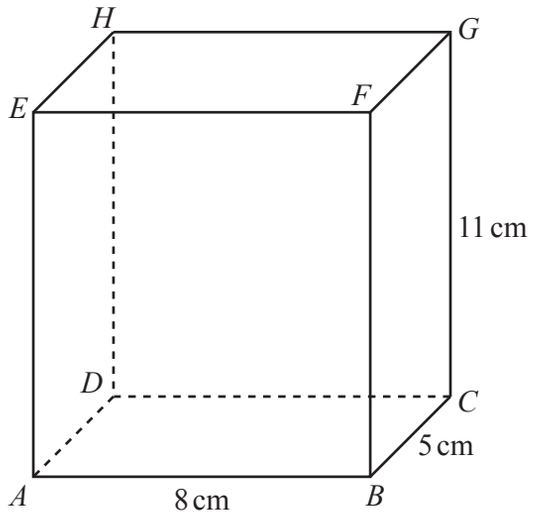
..... : ..... [1]

(b) The area of triangle *PUT* is $20\,\text{cm}^2$.

Find the area of the quadrilateral *QRTU*.

..... cm^2 [3]

6



NOT TO SCALE

ABCDEFGH is a cuboid.
$AB = 8$ cm, $BC = 5$ cm and $CG = 11$ cm.

(a) Work out the volume of the cuboid.

View solution

..... cm^3 [2]

(b) Ivana has a pencil of length 13 cm.

Does this pencil fit completely inside the cuboid?
Show how you decide.

View solution

[4]

(c) (i) Calculate angle *CAB*.

View solution

Angle *CAB* = ... [2]

(ii) Calculate angle *GAC*.

View solution

Angle *GAC* = ... [2]

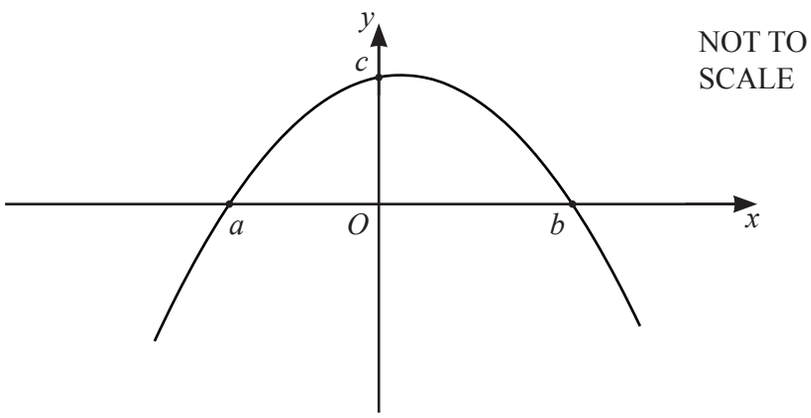
7 **(a)** **(i)** Factorise $24+5x-x^2$.

View solution

..... [2]

(ii) The diagram shows a sketch of $y=24+5x-x^2$.

View solution



Work out the values of a, b and c.

$a=$ .....

$b=$ .....

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

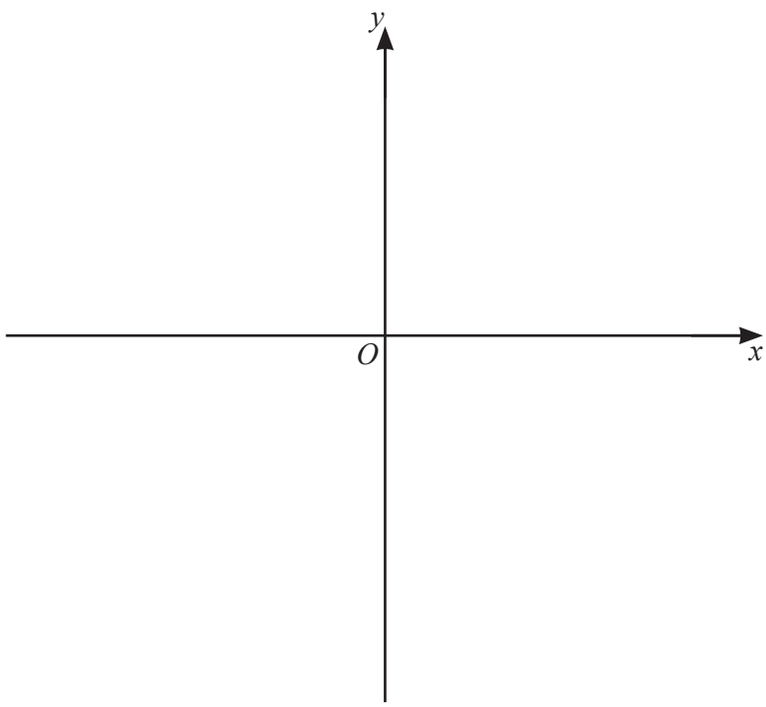
(iii) Calculate the gradient of $y=24+5x-x^2$ at $x=-1.5$.

View solution

..... [3]

(b) (i) On the diagram, sketch the graph of $y = (x+1)(x-3)^2$.
Label the values where the graph meets the x-axis and the y-axis.

View solution



[4]

(ii) Write $(x+1)(x-3)^2$ in the form ax^3+bx^2+cx+d.

View solution

..... [3]

8 **(a)** $\overrightarrow{AB} = \begin{pmatrix} 6 \\ -1 \end{pmatrix}$ $\overrightarrow{BC} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ $\overrightarrow{DC} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

View solution

Find

(i) $\overrightarrow{AC}$,

$\overrightarrow{AC} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

View solution

(ii) $\overrightarrow{BD}$,

$\overrightarrow{BD} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

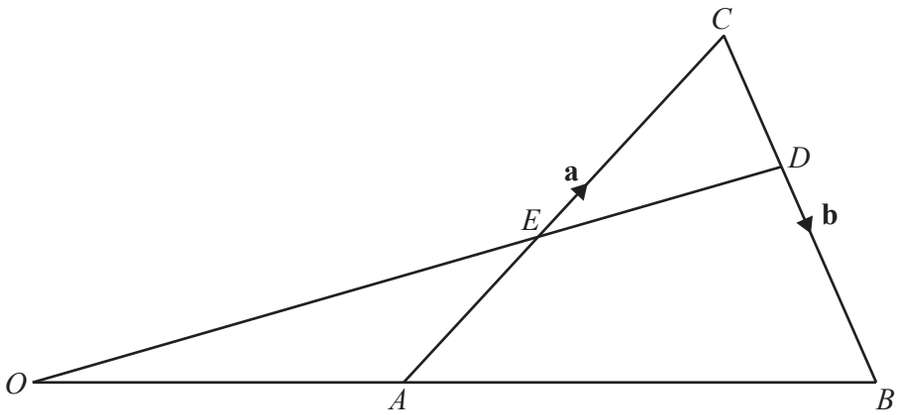
View solution

(iii) $\left|\overrightarrow{BC}\right|$.

..... [2]

(b)

View solution



NOT TO SCALE

In the diagram, OAB and OED are straight lines.
O is the origin, A is the midpoint of OB and E is the midpoint of AC.
$\overrightarrow{AC} = \mathbf{a}$ and $\overrightarrow{CB} = \mathbf{b}$.

Find, in terms of **a** and **b**, in its simplest form

(i) $\overrightarrow{AB}$,

$\overrightarrow{AB} =$ ..... [1]

(ii) $\overrightarrow{OE}$,

View solution

$\overrightarrow{OE} =$ ..... [2]

(iii) the position vector of D.

View solution

..... [3]

9 **(a)** Find the integer values that satisfy the inequality $2 < 2x \leqslant 10$.

View solution

..... [2]

(b) Factorise completely.

View solution

(i) $6y^2 - 15xy$

..... [2]

(ii) $y^2 - 9x^2$

View solution

..... [2]

(c) Simplify.

View solution

$$\frac{3}{x-1} - \frac{2}{2x+1}$$

..... [3]

(d) The straight line $y = 3x + 2$ intersects the curve $y = 2x^2 + 7x - 11$ at two points.

View solution

Find the coordinates of these two points.
Give your answers correct to 2 decimal places.

(..... , ...)

(..... , ...) [6]

10 $f(x) = 4 - 3x$ $g(x) = x^2 + x$ $h(x) = 3^x$

(a) Find $fh(2)$.

View solution

..... [2]

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

View solution

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

(c) Simplify.

View solution

(i) $f(1-2x)$

..... [2]

(ii) $gf(x) - 9g(x)$

View solution

..... [4]

(d) $\frac{1}{h(x)} = 9^{kx}$

View solution

Find the value of k.

$k =$ ..... [2]

11 The table shows the first four terms in sequences A, B, and C.

Sequence	1st term	2nd term	3rd term	4th term	5th term		nth term
A	4	9	14	19			
B	3	10	29	66			
C	1	4	16	64			

Complete the table.

View solution

[9]

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