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7392438156

MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2023**

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.

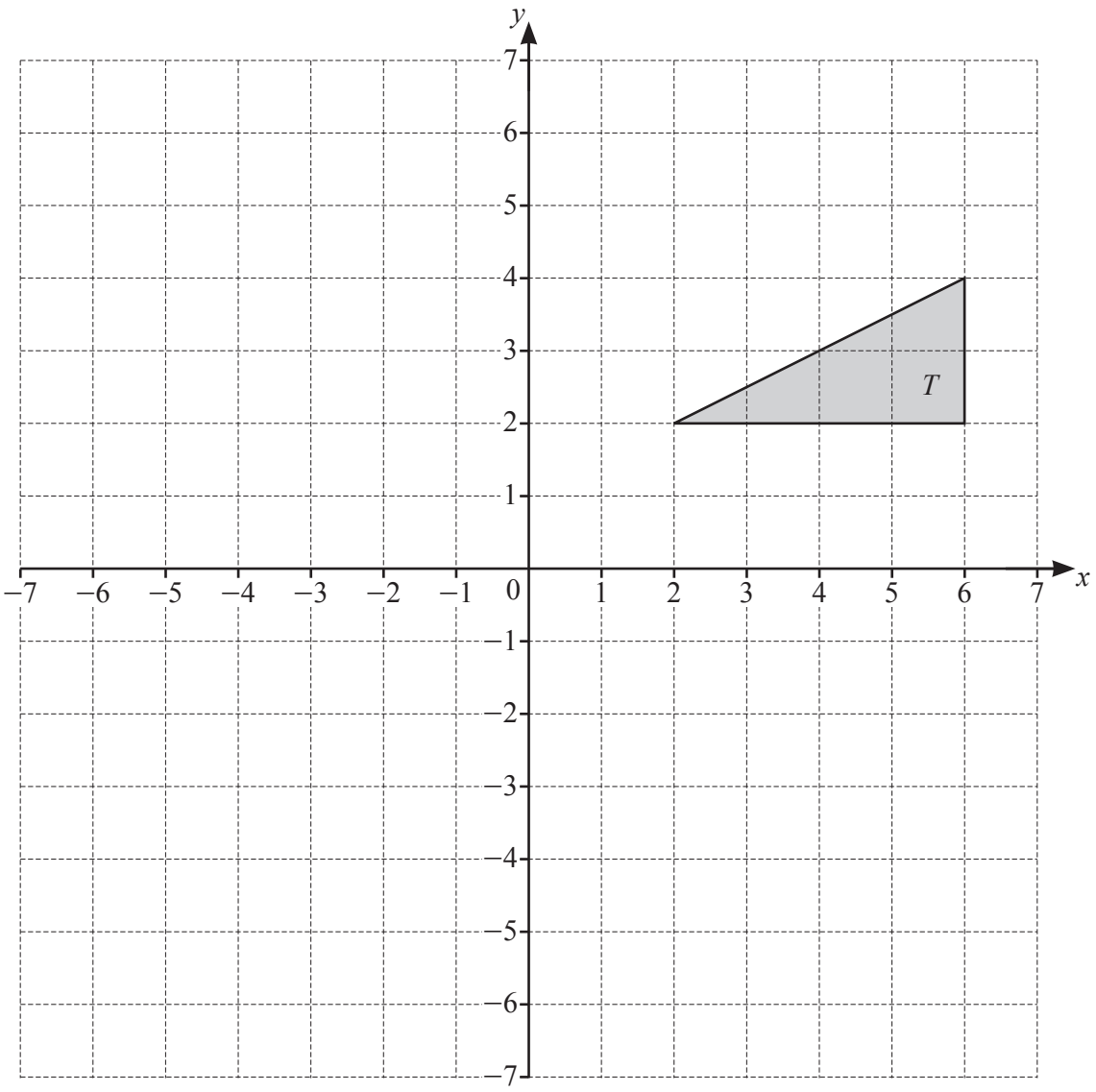
INFORMATION

- 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.

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1



(a) **(i)** Translate triangle T by the vector $\begin{pmatrix} -7 \\ 1 \end{pmatrix}$. Label the image K. [2]

(ii) Describe fully the **single** transformation that maps triangle K onto triangle T.

.....

..... [1]

(b) Reflect triangle T in the line $y = 4$. [2]

(c) Rotate triangle T through 90° clockwise about (0, 0). [2]

(d) **(i)** Enlarge triangle T by scale factor $-\frac{1}{2}$, centre (0, 0). Label the image P. [2]

(ii) Describe fully the **single** transformation that maps triangle P onto triangle T.

.....

..... [2]

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2 **(a)** Daisy records her 50 homework marks.
The table shows the results.

Homework mark	15	16	17	18	19	20
Frequency	1	3	19	11	10	6

(i) Write down the range.

..... [1]

(ii) Write down the mode.

..... [1]

(iii) Find the median.

..... [1]

(iv) Calculate the mean.

..... [3]

(b) 21 33 20 25 21 34 22 21 20 30 18

The list shows Ed's scores in 11 tests.

(i) Complete the stem-and-leaf diagram to show this information.

1	
2	
3	

Key: 2|5 represents 25

[2]

(ii) Find the median.

..... [1]

(iii) Find the interquartile range.

..... [2]

3 **(a)** The value of Priya's car decreases by 10% every year.
The value today is \$7695.

(i) Calculate the value of the car after one year.

\$ ..... [2]

(ii) Calculate the value of the car one year ago.

\$ ..... [2]

(b) Ali invests \$600 at a rate of 2% per year simple interest.

Calculate the value of Ali's investment at the end of 5 years.

\$ ..... [3]

(c) Sara invests \$500 at a rate of r% per year compound interest.
At the end of 12 years, the value of Sara's investment is \$601.35, correct to the nearest cent.

Find the value of r.

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

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(d) The mass of a radioactive substance decreases exponentially at a rate of 3% each day.

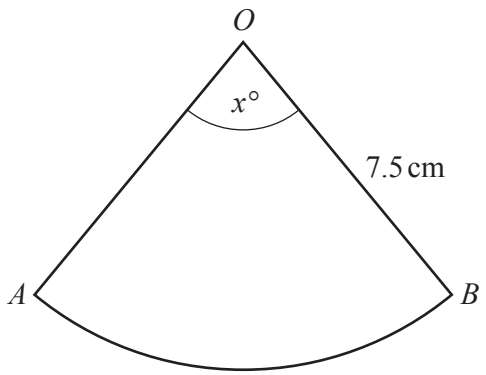
(i) Find the overall percentage decrease at the end of 10 days.

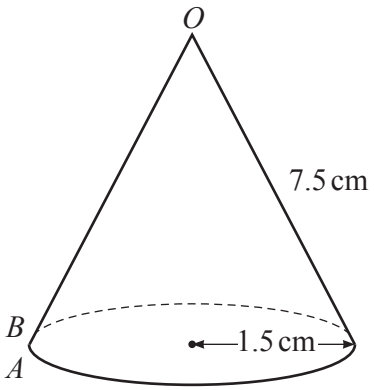
..... % [2]

(ii) Find the number of whole days it takes until the mass of this substance is one half of its original amount.

..... [3]

4 **(a)**





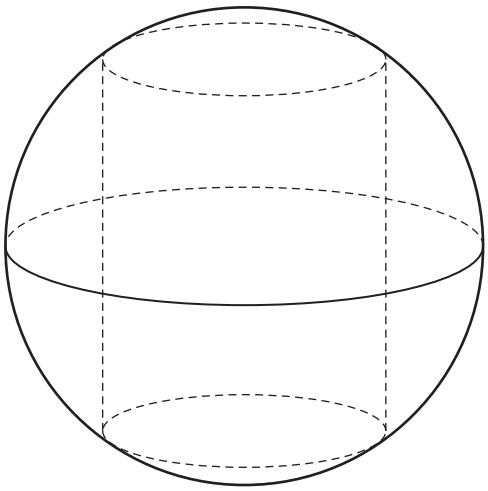
NOT TO SCALE

The diagram shows a sector of a circle that is made into a cone by joining OA to OB.
The sector angle is $x°$ and the radius of the sector is 7.5 cm.
The base radius of the cone is 1.5 cm.

Calculate the value of x.

$x =$ ..... [3]

(b)



NOT TO SCALE

The diagram shows a cylinder with radius 8 cm inside a sphere with radius 17 cm.
Both ends of the cylinder touch the curved surface of the sphere.

(i) Show that the height of the cylinder is 30 cm.

[2]

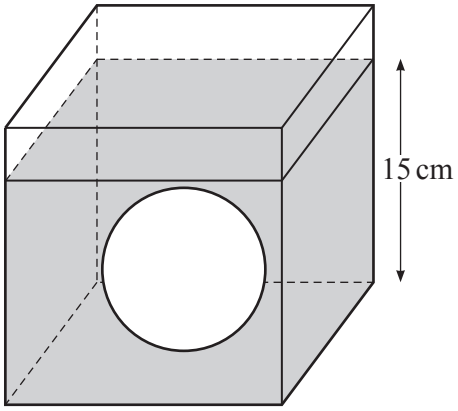
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(ii) Calculate the volume of the cylinder as a percentage of the volume of the sphere.

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

..... % [4]

(c)



NOT TO SCALE

The diagram shows a solid sphere with radius 6 cm inside a cube with side length 20 cm.
The cube contains water to a depth of 15 cm.
The sphere is removed.

Calculate the new depth of water in the cube.

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

..... cm [3]

5 **(a)** In a shop the cost of a fiction book is $\$x$ and the cost of a reference book is $\$(x+2)$.
The cost of 11 fiction books is the same as the cost of 10 reference books.

Find the value of x.

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

(b) In another shop, the cost of a fiction book is $\$y$ and the cost of a reference book is $\$(y+2)$.
Maria spends \$95 on fiction books and \$147 on reference books.
She buys a total of 12 books.

(i) Show that $6y^2 - 109y - 95 = 0$.

[4]

(ii) Factorise $6y^2 - 109y - 95$.

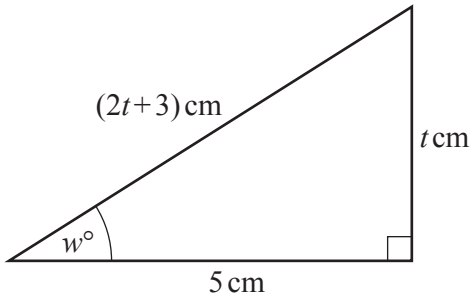
..... [2]

(iii) Find the value of y.

$y =$ ..... [1]

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6



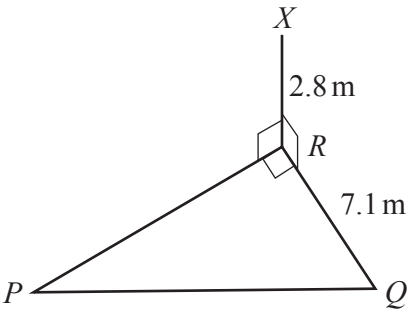
NOT TO SCALE

The diagram shows a right-angled triangle.

Find the value of w.

$w =$ ..... [7]

7 (a)



NOT TO SCALE

The diagram shows a right-angled triangle PQR on horizontal ground.
X is vertically above R and the angle of elevation of X from P is 21°.
$XR = 2.8$ m and $RQ = 7.1$ m.

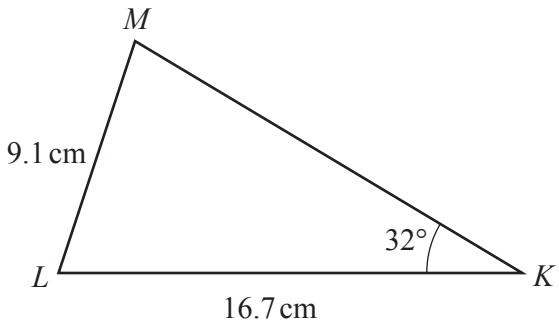
(i) Calculate the angle of elevation of X from Q.

..... [2]

(ii) Calculate PQ.

..... m [3]

(b)

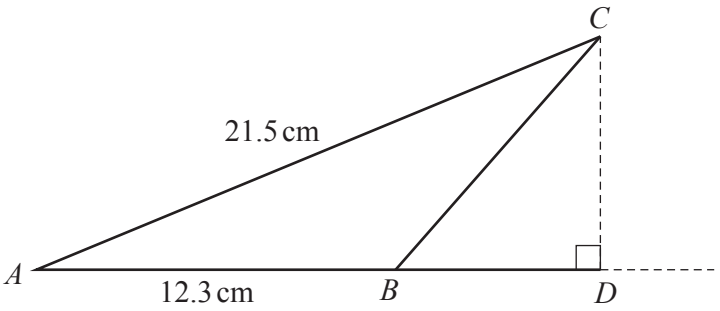


NOT TO SCALE

Calculate the acute angle KML.

Angle KML = ... [3]

(c)



NOT TO SCALE

The area of triangle ABC is $62.89\,\text{cm}^2$.

(i) Show that angle $BAC = 28.4°$, correct to 1 decimal place.

[2]

(ii) Calculate BC.

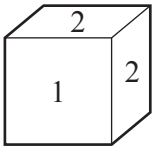
..... cm [3]

(iii) AB is extended to a point D such that angle $BDC = 90°$.

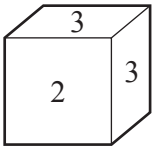
Calculate BD.

..... cm [3]

8



Dice A



Dice B

The diagram shows two fair dice.
Dice A is numbered 1, 2, 2, 2, 3, 6.
Dice B is numbered 2, 3, 3, 4, 4, 4.

(a) (i) Dice A is rolled once.

Write down the probability that it lands on the number 6.

..... [1]

(ii) Dice A is rolled 150 times.

Find the number of times it is expected to land on the number 6.

..... [1]

(b) Dice A and Dice B are each rolled once.

(i) Find the probability that the two numbers they land on have a total of 6.

..... [3]

(ii) Find the probability that when the two numbers they land on have a total of 6, both numbers are 3.

..... [2]

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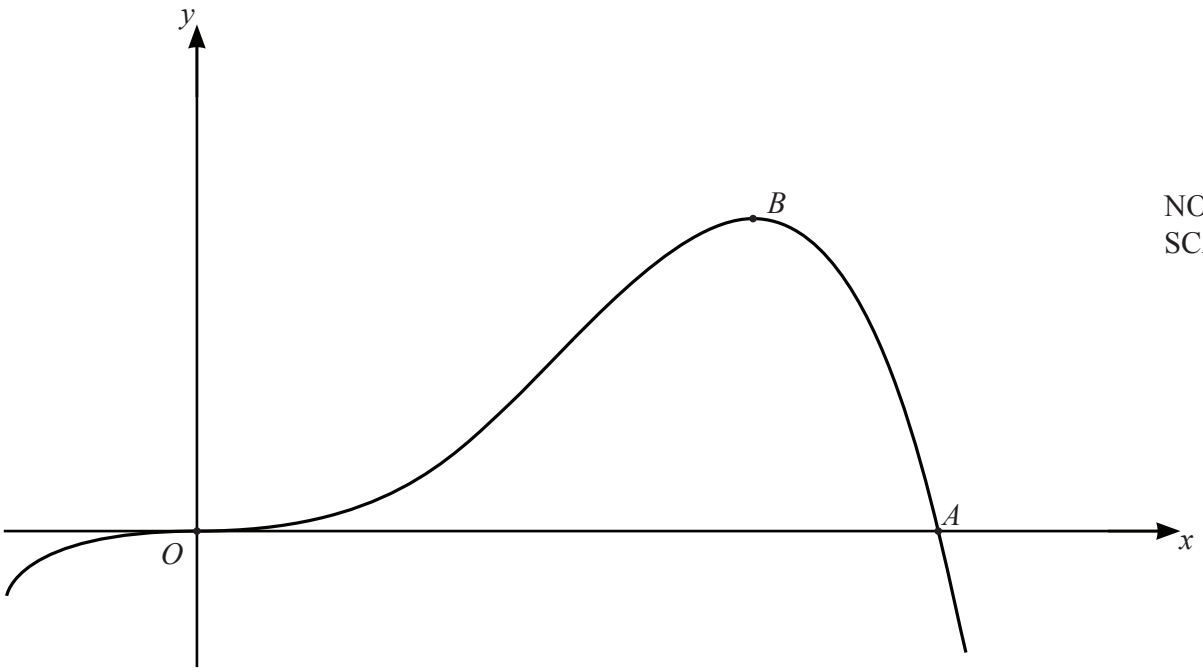
(c) Dice B is rolled n times.

The probability that on the nth roll it first lands on a number 3 is $\frac{32}{729}$.

Find the value of n.

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

9



The diagram shows a sketch of the graph of $y = 4x^3 - x^4$.
The graph crosses the x-axis at the origin O and at the point A.
The point B is a maximum point.

(a) Differentiate $4x^3 - x^4$.

..... [2]

(b) Find the coordinates of B.

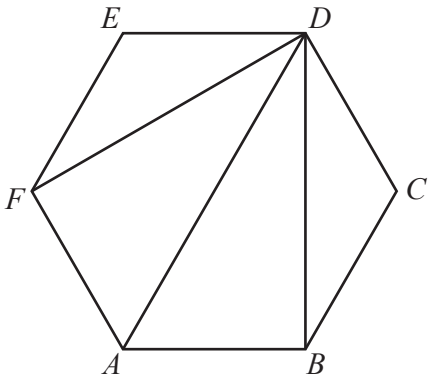
(..... , ...) [3]

(c) Find the gradient of the graph at the point A.

..... [3]

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10 (a)



NOT TO SCALE

ABCDEF is a regular hexagon.
DF, *DA* and *DB* are diagonals.

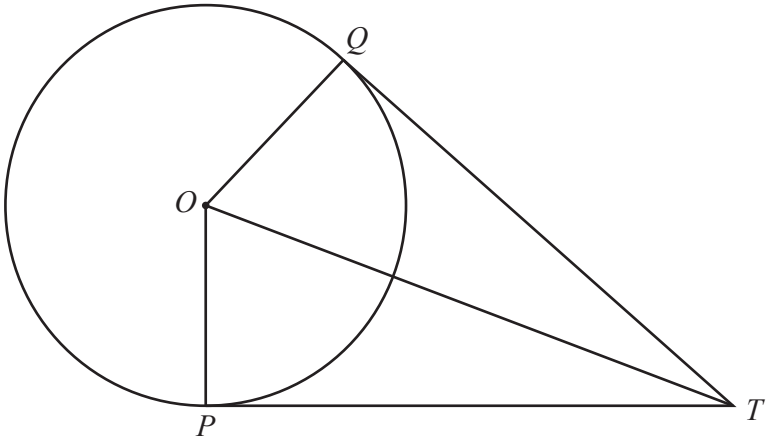
Complete the following statements using three different triangles.

Triangle *DEF* is congruent to triangle .....

Triangle ..... is congruent to triangle .....

[2]

(b)



NOT TO SCALE

P and *Q* are points on the circle with centre *O*.
TP and *TQ* are tangents to the circle from the point *T*.

Complete the following statements and reasons.

In triangles *OPT* and *OQT*

OP = ... because each is a radius of the circle

OT is a common side

Angle *OPT* = angle ..... = 90° because .....

Triangles *OPT* and *OQT* are congruent using the criterion .....

This proves that the tangents *TP* and *TQ* are .....

[5]

11 $f(x) = 1 - 3x$ $g(x) = (x-1)^2$ $h(x) = \frac{3}{x}, x \neq 0$

(a) Find g(3).

..... [1]

(b) Find $f(x-2)$, giving your answer in its simplest form.

..... [2]

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

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

(d) $gf(x) - g(x)f(x) = 3x^3 + ax^2 + bx + c$

Find the value of each of a, b and c.

$a =$ .....

$b =$ .....

$c =$ ..... [5]

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(e) Find $\mathrm{h}(x) - \mathrm{f}(x)$, giving your answer as a single fraction in its simplest form.

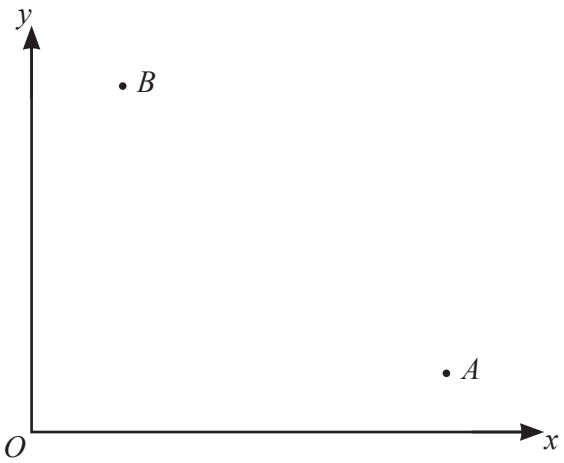
..... [3]

(f) $\mathrm{h}(x^n) = 3x^7$

Find the value of n.

$n =$ ..... [1]

12



NOT TO SCALE

O is the origin (0, 0), A is the point (8, 1) and B is the point (2, 5).

(a) Write as column vectors.

(i) $\overrightarrow{OB}$

$\overrightarrow{OB} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) $\overrightarrow{AB}$

$\overrightarrow{AB} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) Find the equation of the line AB.
Give your answer in the form $y = mx + c$.

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

(c) Find the equation of the perpendicular bisector of AB.
Give your answer in the form $y = mx + c$.

$y =$ ..... [4]

(d) The line AB meets the y-axis at P.
The perpendicular bisector of AB meets the y-axis at Q.

Find the length of PQ.

..... [2]

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