

FOR OFFICIAL USE



National  
Qualifications  
2023 MODIFIED

Mark

X847/75/01

# Mathematics Paper 1 (Non-calculator)

WEDNESDAY, 3 MAY

9:00 AM – 10:00 AM



\* X 8 4 7 7 5 0 1 \*

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day

Month

Year

Scottish candidate number

Total marks — 40

Attempt ALL questions.

You must NOT use a calculator.

To earn full marks you must show your working in your answers.

State the units for your answer where appropriate.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use blue or black ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.



\* X 8 4 7 7 5 0 1 0 1 \*

## FORMULAE LIST

The roots of  $ax^2 + bx + c = 0$  are  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule  $a^2 = b^2 + c^2 - 2bc \cos A$  or  $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle  $A = \frac{1}{2}ab \sin C$

Volume of a sphere  $V = \frac{4}{3}\pi r^3$

Volume of a cone  $V = \frac{1}{3}\pi r^2 h$

Volume of a pyramid  $V = \frac{1}{3}Ah$

Standard deviation  $s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$

or  $s = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n - 1}}$ , where  $n$  is the sample size.



\* X 8 4 7 7 5 0 1 0 2 \*

Total marks — 40  
Attempt ALL questions

1. Evaluate  $2\frac{1}{6} \div \frac{8}{9}$ .

Give your answer in its simplest form.

2

2. Expand and simplify  $(x+7)^2 + 6(x^2 - 10)$ .

3

[Turn over



\* X 8 4 7 7 5 0 1 0 3 \*

MARKS

DO NOT  
WRITE IN  
THIS  
MARGIN

3. Solve, algebraically, the system of equations

$$2x + 3y = 8$$

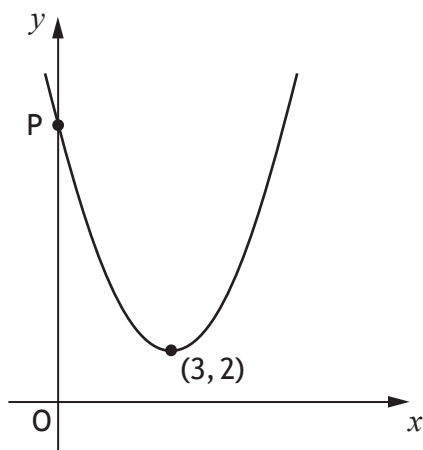
$$5x + 2y = -2.$$

3



\* X 8 4 7 7 5 0 1 0 4 \*

4. The graph below shows part of a parabola of the form  $y = (x + a)^2 + b$ .



- |  |  |   |
|--|--|---|
|  | (a) (i) State the value of $a$ .                         | 1 |
|  | (ii) State the value of $b$ .                            | 1 |
|  | (b) P is the point $(0, c)$ .<br>Find the value of $c$ . | 1 |

[Turn over



MARKS

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5. Determine the nature of the roots of the function  $f(x) = 4x^2 + 6x - 1$ .

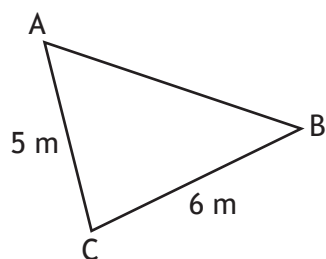
2



\* X 8 4 7 7 5 0 1 0 6 \*

6. In triangle ABC:

- $AC = 5$  metres
- $BC = 6$  metres
- $\cos C = \frac{1}{5}$ .



Calculate the length of AB.

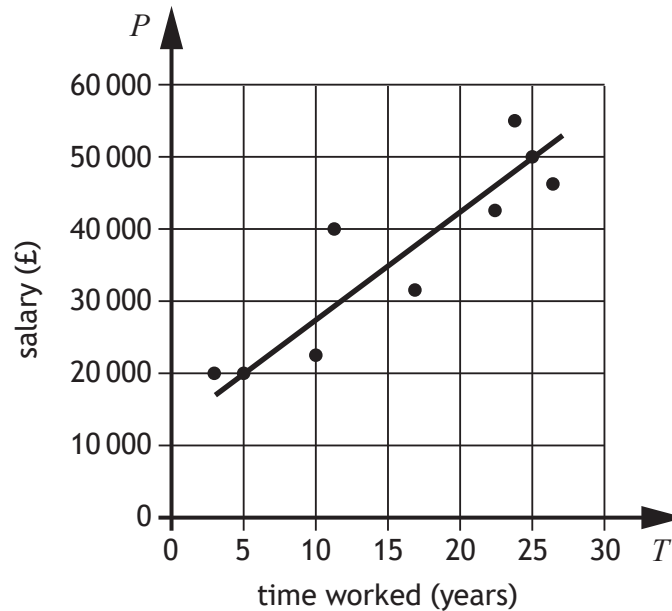
3

[Turn over



7. A business recorded the salaries of a sample of its employees and the length of time they have worked for the business.

The scattergraph shows the relationship between their salary,  $P$  pounds, and the length of time,  $T$  years, they have worked.



A line of the best fit has been drawn.

- (a) Find the equation of the line of best fit in terms of  $P$  and  $T$ .  
Give the equation in its simplest form.

3





7. (continued)

(b) Use your equation from part (a) to estimate the salary of an employee who has worked for the business for 8 years.

1

8. Express  $\frac{12}{\sqrt{15}}$  with a rational denominator.

Give your answer in its simplest form.

2

[Turn over



9. A magazine company conducted a survey of the ages of its readers.  
A sample of ten readers' ages, in years, are shown below.

33 55 38 47 36 41 42 41 35 31

- (a) Calculate the median and interquartile range of the ages of readers for this sample.

3

A newspaper company also conducted a survey of the ages of its readers.

The median age of a sample of its readers was 41 years and the interquartile range was 9 years.

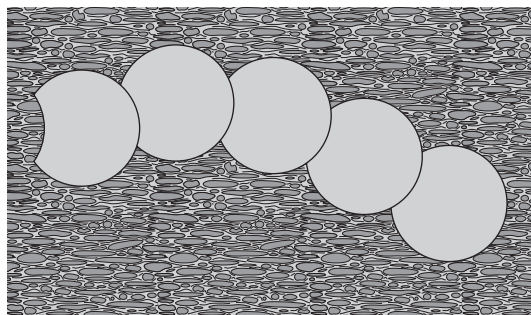
- (b) Make two valid comments comparing the ages of the readers of the magazine and the ages of the readers of the newspaper.

2

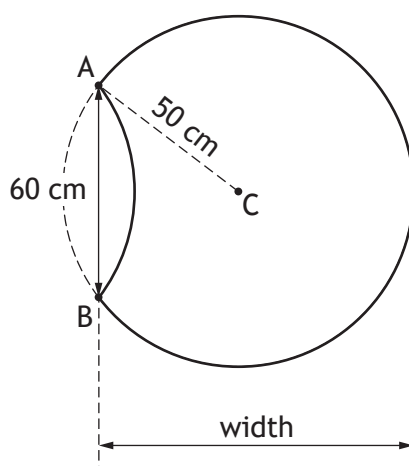


\* X 8 4 7 7 5 0 1 1 0 \*

10. Alan buys some identical paving slabs to make a path.  
Each slab is part of a circle.



The diagram below shows a single slab.



The circle, centre C, has a radius of 50 centimetres.

Length AB is 60 centimetres.

Calculate the width of the paving slab.

4



11. Given that  $\sin 30^\circ = 0.5$ , state the value of  $\sin 330^\circ$ .

1

12. Simplify  $\frac{5c^{-2}}{c^3 \times c^4}$ .

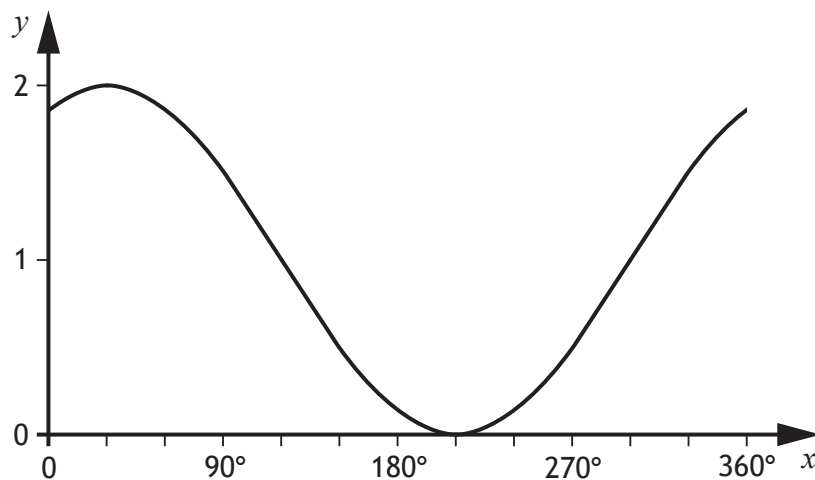
Give your answer with a **positive** power.

3



\* X 8 4 7 7 5 0 1 1 2 \*

13. Part of the graph of  $y = \cos(x + a)^\circ + b$  is shown.



(a) State the value of  $a$ .

1

(b) State the value of  $b$ .

1

[Turn over



MARKS

DO NOT  
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3

14. Solve, algebraically, the inequation  $\frac{x+1}{3} - 2 > \frac{3x}{5}$ .

[END OF QUESTION PAPER]



\* X 8 4 7 7 5 0 1 1 4 \*

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**X847/75/02**

**Mathematics  
Paper 2**

WEDNESDAY, 3 MAY  
10:30 AM – 12:00 NOON



Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day

Month

Year

Scottish candidate number

**Total marks — 50**

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\* X 8 4 7 7 5 0 2 0 2 \*



Total marks — 50  
 Attempt ALL questions

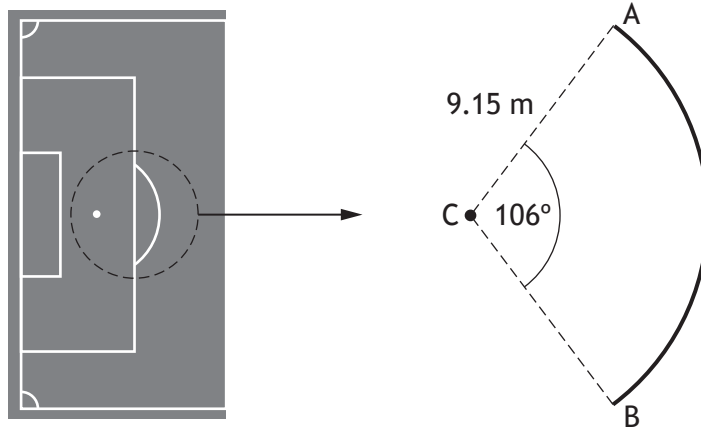
1. A caravan was bought for £20,000.  
 It depreciated by 11% in the first year.  
 It then depreciated by a further 6% each year over the next two years.  
 Calculate the value of the caravan three years after it was bought. 3

2. The mass of a helium atom is  $6.64 \times 10^{-24}$  grams.  
 A flask contains 300 grams of helium.  
 Calculate the number of helium atoms in this flask.  
 Give your answer in scientific notation, correct to 3 significant figures. 3

[Turn over



3. The diagram shows part of a football pitch.

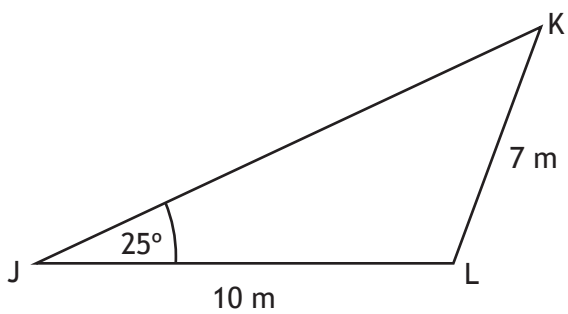


The penalty spot is marked at point C.  
 AB is an arc of a circle, centre C, radius 9.15 metres.  
 Calculate the length of the arc AB.

3

4. The diagram shows triangle JKL.

- Angle KJL =  $25^\circ$
- JL = 10 metres
- KL = 7 metres



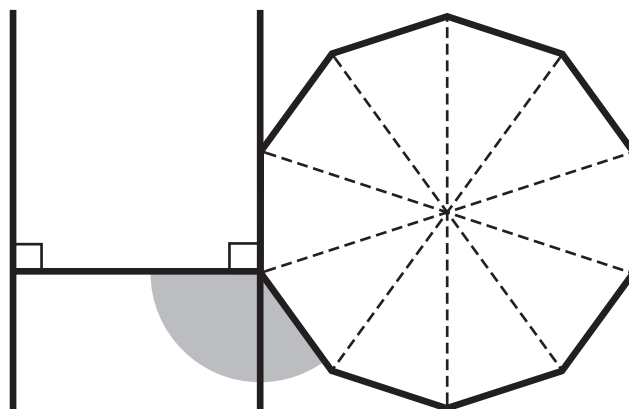
Calculate the size of angle JKL.

3

[Turn over



5. A logo consists of an H shape and a regular decagon.  
The diagram represents the logo.



Calculate the size of the shaded angle.

2



6. Nadim bought a flat last year.  
The value of the flat has increased by 8% and it is now worth £94,500.  
Calculate how much Nadim paid for the flat.

3

7. Change the subject of the formula  $P = \frac{1}{3}mn$   $r$  to  $m$ .

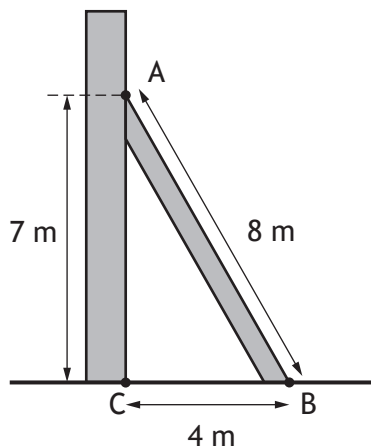
3

[Turn over



\* X 8 4 7 7 5 0 2 0 7 \*

8. A wooden beam is used to support a wall built on horizontal ground as shown in the diagram.



The edge of the beam, AB, is 8 metres long.

C is at the foot of the wall.

A is 7 metres from C.

B is 4 metres from C.

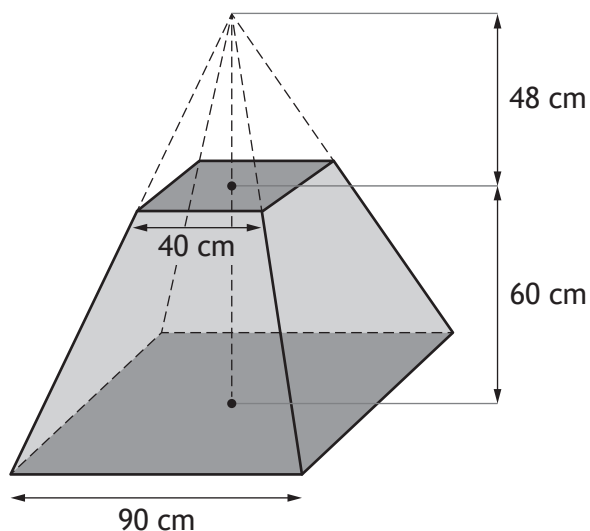
Determine whether the wall is perpendicular to the ground.

Justify your answer.

4



9. A concrete block is in the shape of a large pyramid with a small pyramid removed.



The large pyramid has a square base of length 90 centimetres.

The small pyramid has a square base of length 40 centimetres and a height of 48 centimetres.

The block has height 60 centimetres.

Calculate the volume of the block.

4

[Turn over



10. Express

$$\frac{7}{x-3} - \frac{2}{x}, \quad x \neq 3, x \neq 0$$

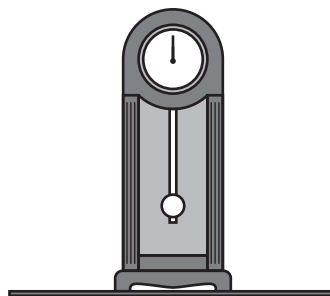
as a single fraction in its simplest form.

3





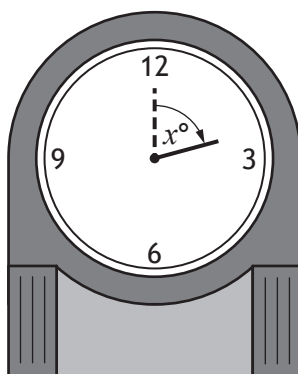
11. Anna has a grandfather clock in her house.



The height of the tip of the hour hand above the floor, in centimetres, is given by

$$h = 20 \cos x^\circ \quad 147$$

where  $x^\circ$  is the angle the **hour hand** has rotated through since 12 o'clock.



Calculate the first two values of  $x$  for which the tip of the hour hand is 150 centimetres above the floor.

4



12. Simplify  $\frac{x^2 - 16}{x^2 + x - 20}$ .

3

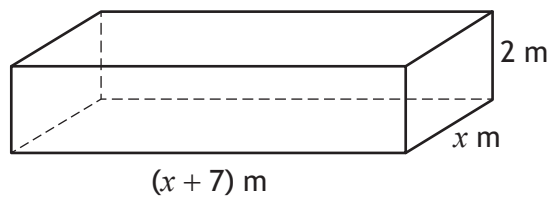
13. Simplify  $2 \sin^2 x^\circ + 2 \cos^2 x^\circ$ .  
Show your working.

2



\* X 8 4 7 7 5 0 2 1 2 \*

14. A storage unit, built in the shape of a cuboid, is shown.



It has length  $(x + 7)$  metres, breadth  $x$  metres and height 2 metres.  
The volume of this unit is 45 cubic metres.

(a) Show that  $2x^2 + 14x - 45 = 0$ .

2

(b) Calculate  $x$ , the breadth of the storage unit.  
Give your answer correct to 1 decimal place.

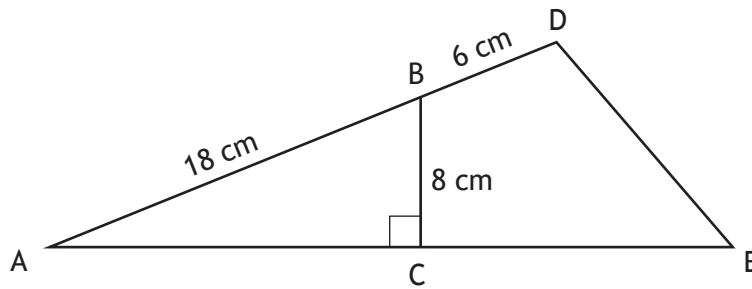
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[Turn over



15. In the diagram:

- AC is perpendicular to BC
- AB = 18 centimetres
- BD = 6 centimetres
- BC = 8 centimetres.



The area of triangle ADE is 160 square centimetres.  
Calculate the length of AE.

4

[END OF QUESTION PAPER]

