

FOR OFFICIAL USE



National
Qualifications
SPECIMEN ONLY

Mark

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S847/75/01

**Mathematics
Paper 1
(Non-Calculator)**

Date — Not applicable

Duration — 1 hour 15 minutes



Fill in these boxes and read what is printed below.

Full name of centre

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Town

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Forename(s)

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Surname

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Number of seat

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Date of birth

Day

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Month

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Year

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Scottish candidate number

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Total marks — 50

Attempt ALL questions.

You may 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.



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: $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$

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



MARKS

DO NOT
WRITE IN
THIS
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Total marks — 50
Attempt ALL questions

1. Evaluate

$$2\frac{3}{8} \div \frac{5}{16}.$$

2

2. Solve algebraically the inequality

$$11 - 2(1 + 3x) < 39.$$

3



* S 8 4 7 7 5 0 1 0 3 *

3. Two forces acting on a rocket are represented by vectors \mathbf{u} and \mathbf{v} .

$$\mathbf{u} = \begin{pmatrix} 2 \\ -5 \\ -3 \end{pmatrix} \text{ and } \mathbf{v} = \begin{pmatrix} 7 \\ 4 \\ -1 \end{pmatrix}.$$

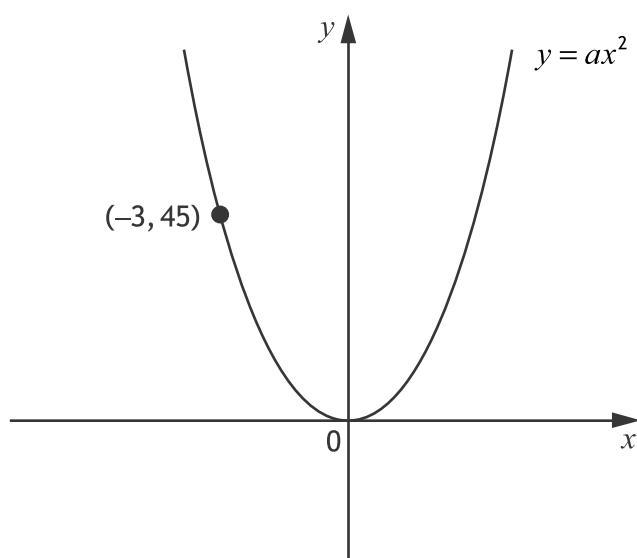
Calculate $|\mathbf{u} + \mathbf{v}|$, the magnitude of the resultant force.

Express your answer as a surd in its simplest form.

3



4. The diagram below shows part of the graph of $y = ax^2$.



Find the value of a .

2



* S 8 4 7 7 5 0 1 0 5 *

5. Determine the nature of the roots of the function $f(x) = 7x^2 + 5x - 1$.

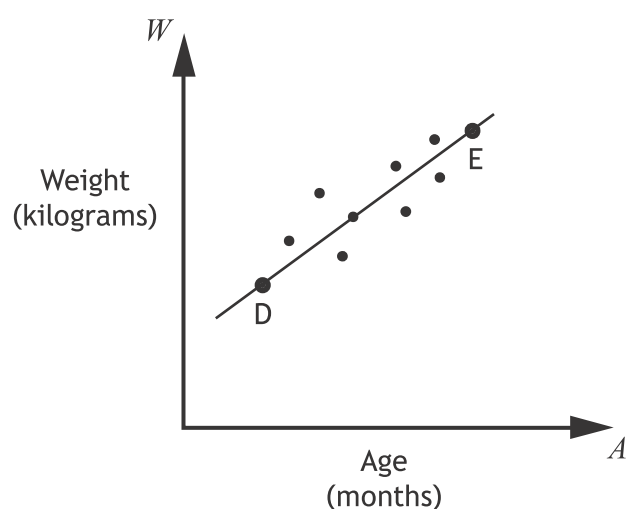
2



* S 8 4 7 7 5 0 1 0 6 *

6. A cattle farmer records the weight of some of his calves.

The scattergraph shows the relationship between the age, A months, and the weight, W kilograms, of the calves.



A line of best fit is drawn.

Point D represents a 3-month-old calf which weighs 100 kilograms.

Point E represents a 15-month-old calf which weighs 340 kilograms.

- (a) Find the equation of the line of best fit in terms of A and W .
Give the equation in its simplest form.

3



6. (continued)

- (b) Use your equation from part (a) to estimate the weight of a 1-year-old calf.

Show your working.

1



* S 8 4 7 7 5 0 1 0 8 *

7. Ten couples took part in a dance competition.

The couples were given a score in each round.

The scores in the first round were

16 27 12 18 26 21 27 22 18 17

- (a) Calculate the median and semi-interquartile range of these scores.

3

- (b) In the second round, the median was 26 and the semi-interquartile range was 2.5.

Make two valid comparisons between the scores in the first and second rounds.

2



* S 8 4 7 7 5 0 1 0 9 *

8. Two groups of people go to a theatre.

Bill buys tickets for 5 adults and 3 children.

The total cost of his tickets is £158.25.

- (a) Write down an equation to illustrate this information.

1

- (b) Ben buys tickets for 3 adults and 2 children.

The total cost of his tickets is £98.

Write down an equation to illustrate this information.

1

- (c) Calculate the cost of a ticket for an adult and the cost of a ticket for a child.

4



* S 8 4 7 7 5 0 1 1 0 *

9. 480 000 tickets were sold for a tennis tournament last year.

This represents 80% of all the available tickets.

Calculate the total number of tickets that were available for this tournament.

3

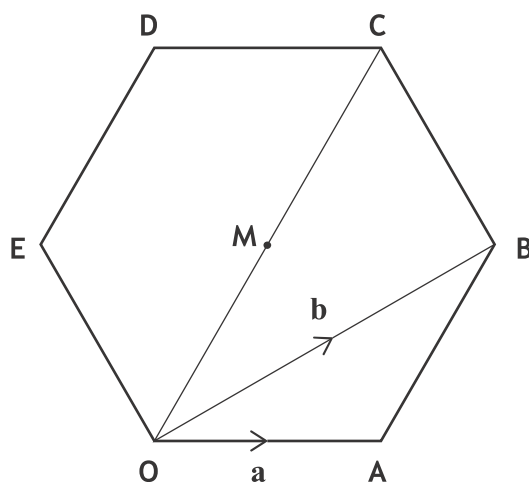
10. The function $f(x)$ is defined by $f(x) = \frac{2}{\sqrt{x}}$, $x > 0$.

Express $f(5)$ as a fraction with a rational denominator.

2



11. In the diagram, OABCDE is a regular hexagon with centre M.
Vectors **a** and **b** are represented by \overrightarrow{OA} and \overrightarrow{OB} respectively.



- (a) Express \overrightarrow{AB} in terms of **a** and **b**.

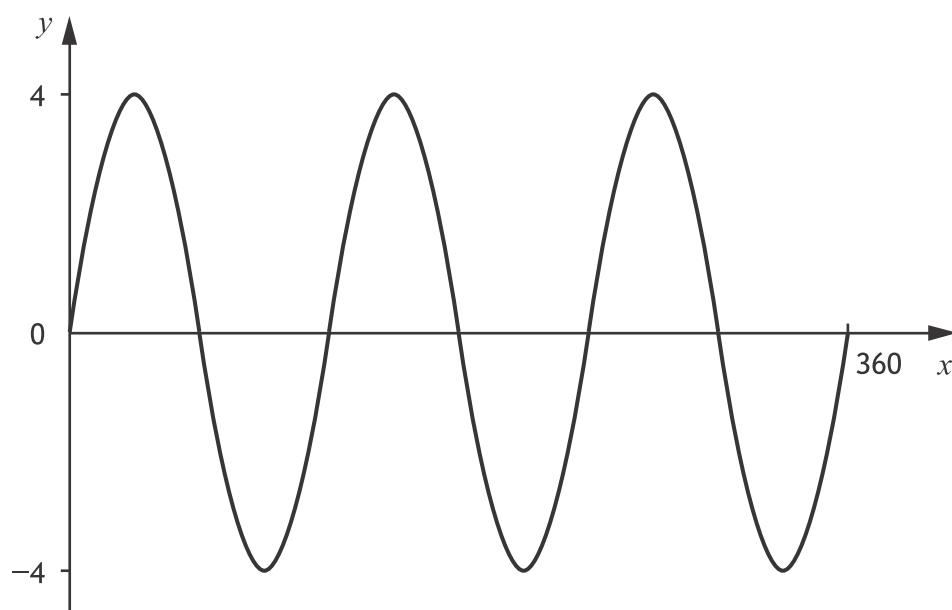
1

- (b) Express \overrightarrow{OC} in terms of **a** and **b**.

1



12. Part of the graph of $y = a \sin bx^\circ$ is shown in the diagram.



State the values of a and b .

2



13. A parabola has equation $y = x^2 - 8x + 19$.

(a) Write the equation in the form $y = (x - p)^2 + q$.

2

(b) Sketch the graph of $y = x^2 - 8x + 19$, showing the coordinates of the turning point and the point of intersection with the y -axis.

3



14. Express

$$\frac{4}{x+2} - \frac{3}{x-4}, \quad x \neq -2, x \neq 4$$

as a single fraction in its simplest form.

3

15. Simplify

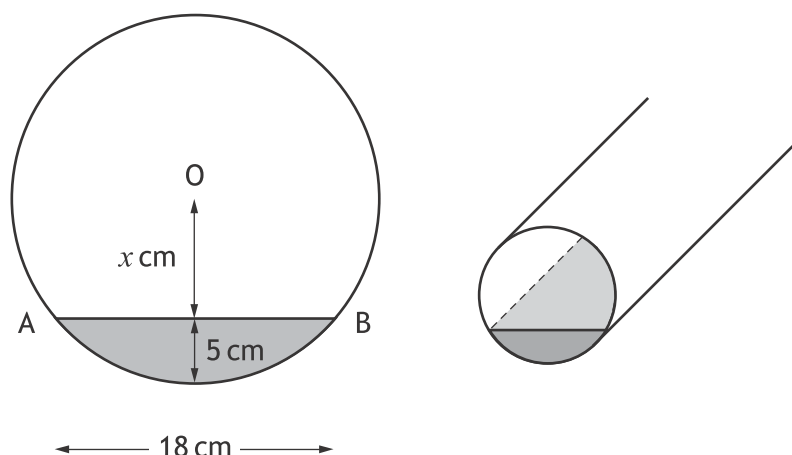
$$\tan^2 x^\circ \cos^2 x^\circ.$$

Show your working.

2



16. A cylindrical pipe has water in it as shown.



The depth of the water at the deepest point is 5 centimetres.

The width of the water surface, AB, is 18 centimetres.

The radius of the pipe is r centimetres.

The distance from the centre, O, of the pipe to the water surface is x centimetres.

- (a) Write down an expression for x in terms of r .

1

- (b) Calculate r , the radius of the pipe.

3

[END OF SPECIMEN QUESTION PAPER]



* S 8 4 7 7 5 0 1 1 6 *

MARKS

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ADDITIONAL SPACE FOR ANSWERS



* S 8 4 7 7 5 0 1 1 7 *

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