FOR OFFICIAL USE

N5

National Qualifications 2024

Mark

X847/75/01

Mathematics Paper 1 (Non-calculator)

FRIDAY, 3 MAY

9:00 AM – 10:00 AM

X847751

Fill in these boxes and read what is printed below.

Full name of centre: WORKED SOLUTIONS

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.

FORMULAE LIST

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

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

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

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

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

MARKS | DO NOT WRITE IN THIS MARGIN

Total marks — 40

Attempt ALL questions

1. Evaluate $3\frac{2}{3}-1\frac{1}{4}$. 2

$3\frac{2}{3} - 1\frac{1}{4}$

$2\frac{2}{3} - \frac{1}{4}$

$2\frac{8}{12} - \frac{3}{12}$

$= 2\frac{5}{12}$

Alternative method:

$\frac{11}{3} - \frac{5}{4}$

$\frac{44}{12} - \frac{15}{12}$

$= \frac{29}{12}$

2. Given that $f(x)=(x+3)^2$, evaluate $f(7)$. 2

$f(7) = (7+3)^2$

$= 10^2$

$f(7) = 100$

[Turn over

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

MARKS | DO NOT WRITE IN THIS MARGIN

3. Expand and simplify $(x+1)(x^2-4x+5)$. 3

	x^2	$-4x$	$+5$
x	x^3	$-4x^2$	$+5x$
$+1$	$+x^2$	$-4x$	$+5$

$$= x^3 - 3x^2 + x + 5$$

4. Given $\mathbf{a} = \begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix}$, find the resultant vector $3\mathbf{a}+\mathbf{b}$.

Express your answer in component form. 2

$3a + b$

$$3\begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 9 \\ 12 \\ -3 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 14 \\ 15 \\ -1 \end{pmatrix}$$

X847750104

MARKS | DO NOT WRITE IN THIS MARGIN

5. The prices, in pounds (£), of the cameras on display in a shop are listed below.

Q_1 Q_3

155 160 190 | 210 230 240

Q_2

(a) Calculate the median and the interquartile range of these prices. 3

Median, $Q_2 = £200$

$Q_1 = 160$

$Q_3 = 230$

$IQR = Q_3 - Q_1$

$= 230 - 160$

$IQR = £70$

On a website, a sample of camera prices have a median of £195 and an interquartile range of £73.

(b) Make two valid comments comparing the **prices** of the cameras in the shop and on the website. 2

On average, the camera prices are cheaper on the website, than in the shop.

The camera prices on the website are more variable than they are in the shop.

[Turn over

	median	IQR
Shop	200	70
Website	195	73

X847750105

MARKS | DO NOT WRITE IN THIS MARGIN

6. Simplify $\sqrt{75} - \sqrt{3}$. 2

$\sqrt{25}\sqrt{3} - \sqrt{3}$

$5\sqrt{3} - \sqrt{3}$

$= 4\sqrt{3}$

7. Solve, algebraically, the system of equations 3

$$2p - 7r = 11 \quad \times 2$$
$$3p + 2r = 4 \quad \times 7$$

$4p - 14r = 22$

$+ \quad 21p + 14r = 28$

$25p = 50$

$p = 2$

$3p + 2r = 4$

$3(2) + 2r = 4$

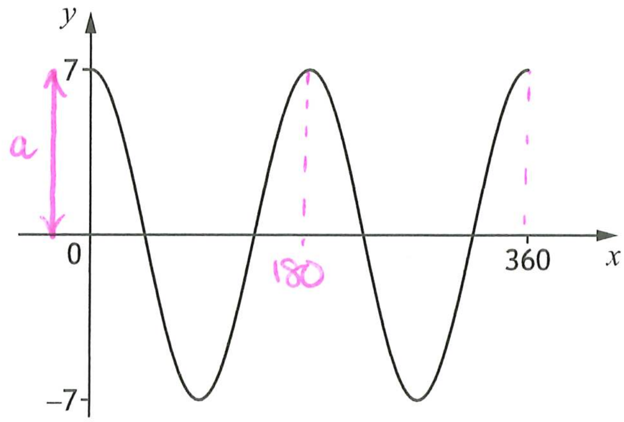
$6 + 2r = 4$

$2r = -2$

$r = -1.$

Solution: $p = 2$ and $r = -1.$

8. The graph of $y = a\cos bx°$, $0 \leq x \leq 360$, is shown.



(a) State the value of a. **1**

$a = 7$

(b) State the value of b. **1**

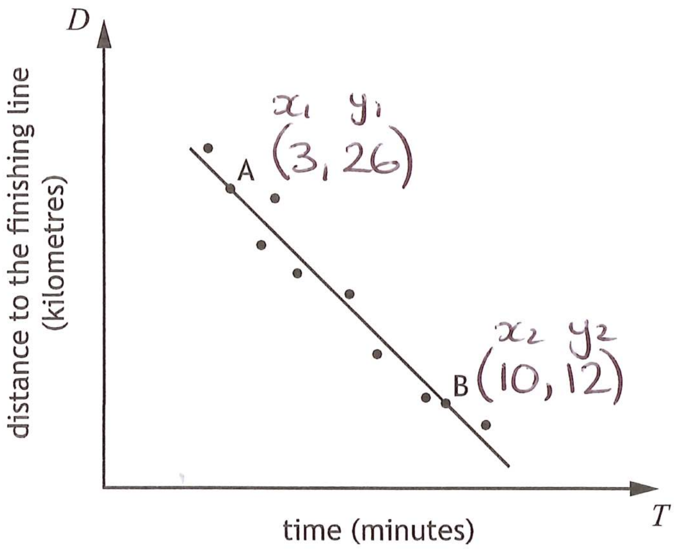
2 cosine waves in 360°

$\therefore$ $b = 2$.

[Turn over

9. In a car rally, competitors start at different times.

The scattergraph shows the relationship between the length of time they have been driving, T minutes, and the distance to the finishing line, D kilometres.



A line of best fit has been drawn.

Point A represents a competitor who has been driving for 3 minutes and is 26 kilometres from the finishing line.

Point B represents a competitor who has been driving for 10 minutes and is 12 kilometres from the finishing line.

(a) Find the equation of the line of best fit in terms of D and T.

Give the equation in its simplest form. **3**

Gradient

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$m = \frac{12 - 26}{10 - 3}$

$m = -\frac{14}{7}$

$m = -2$

Equation of Line

$y - b = m(x - a)$

$y - 12 = -2(x - 10)$

$y - 12 = -2x + 20$

$y = -2x + 32$

$\hookrightarrow$ $D = -2T + 32$.

MARKS | DO NOT WRITE IN THIS MARGIN

9. **(continued)**

Another competitor has been driving for 7 minutes.

(b) Use your equation from part (a) to estimate the distance the competitor is from the finishing line. **1**

Let $T = 7$

$\therefore \quad D = -2(7) + 32$

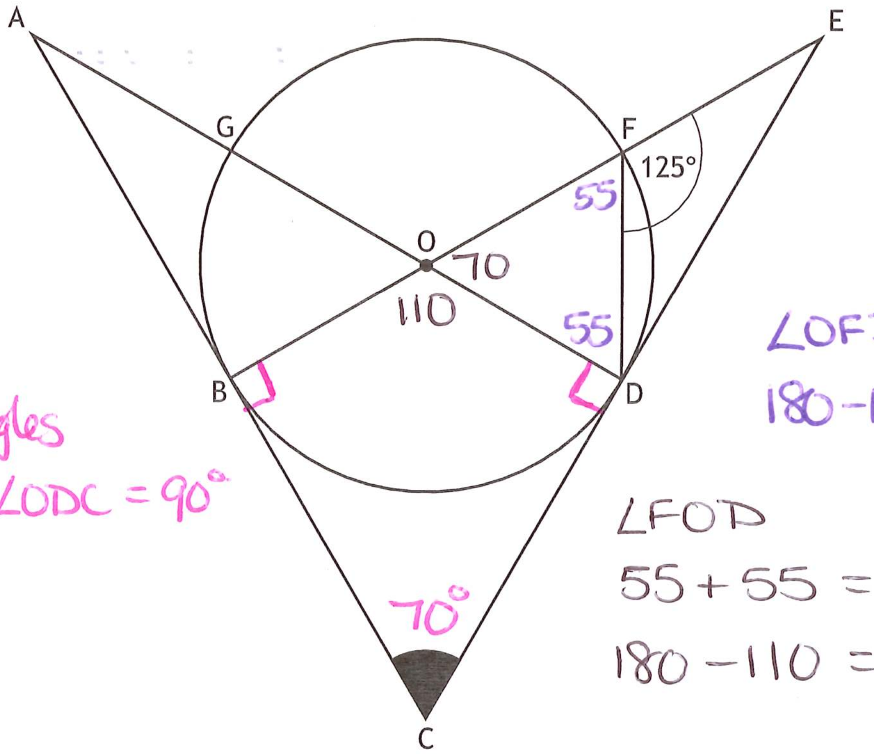
$= -14 + 32$

$D = 18$ Kilometres.

[Turn over

10. The diagram below shows a circle centre O.

- AC is a tangent to the circle at the point B.
- CE is a tangent to the circle at the point D.
- DG and BF are diameters of the circle.
- Angle DFE is 125°.



Right angles
∠OBC = ∠ODC = 90°

∠OFD
180 − 125 = 55°

∠FOD
55 + 55 = 110
180 − 110 = 70°

Calculate the size of shaded angle BCD. **3**

∠BOD = 110°

Tangent kite

360 − (90 + 90 + 110)

∠BCD = 70°

MARKS | DO NOT WRITE IN THIS MARGIN

11. A straight line has equation $x + 4y - 24 = 0$.

Find the gradient of this line. **2**

$$x + 4y - 24 = 0$$

$$4y = -x + 24$$

$$y = -\frac{1}{4}x + 6$$

$$y = mx + c$$

Gradient, $m = -\frac{1}{4}$.

[Turn over

12. (a) Express $x^2 - 6x + 8$ in the form $(x-a)^2 + b$. **2**

$[(x-3)^2 - 3^2] + 8$

$(x-3)^2 - 9 + 8$

$= (x-3)^2 - 1$

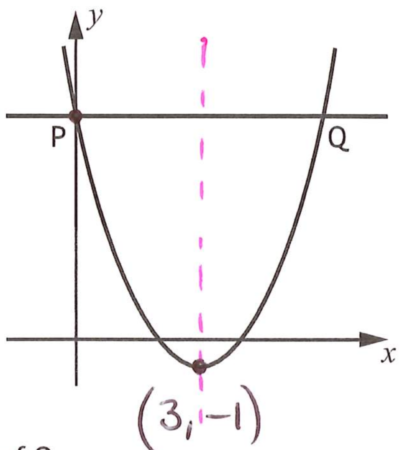
(b) Hence, or otherwise, state the coordinates of the turning point of the graph of $y = x^2 - 6x + 8$. **1**

Minimum TP $(3, -1)$.

The diagram shows the graph of $y = x^2 - 6x + 8$.

A line PQ has been drawn parallel to the x-axis, where:

- P lies on the y-axis
- P and Q lie on the graph of $y = x^2 - 6x + 8$.



P and Q have same y-coord.

(c) Find the coordinates of Q. **2**

Using axis of symmetry $x_Q = 6$

Using y-intercept at $x=0$, $y = 0^2 - 6(0) + 8$

$y_Q = 8$

Point Q $(6, 8)$.

MARKS | DO NOT WRITE IN THIS MARGIN

13. Expand and simplify fully $x\left(x^{\frac{1}{2}} + x^{-1}\right)$. 2

$$x^1 \times x^{\frac{1}{2}} + x^1 \times x^{-1}$$

$$x^{\frac{3}{2}} + x^0$$

$$= \underline{\underline{x^{\frac{3}{2}} + 1}}$$

[Turn over

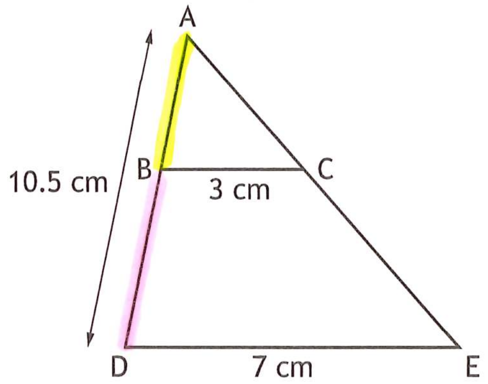
OR $\underline{\sqrt{x^3} + 1}$ also correct.

X847750113

MARKS | DO NOT WRITE IN THIS MARGIN

14. In the diagram, triangles ABC and ADE are mathematically similar.

- BC = 3 centimetres
- DE = 7 centimetres
- AD = 10.5 centimetres



Calculate the length of BD. **3**

To find BD, we must find AB first.

Linear $SF_R = \frac{\text{wee}}{\text{big}} = \frac{3}{7}$

$AB = \frac{3}{7}$ of $10.5 = 4.5\text{cm}$ $\quad 7\overline{)31.{}^{3}5}$ 4.5

$BD = 10.5 - 4.5$

$BD = 6$ cm.

[END OF QUESTION PAPER]