FOR OFFICIAL USE

N5

National Qualifications 2025

Mark

X847/75/02

Mathematics Paper 2

WEDNESDAY, 14 MAY

10:30 AM – 12:00 NOON

X8477502

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 — 50

Attempt ALL questions.

You may 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.

SQA ©

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

MARKS | DO NOT WRITE IN THIS MARGIN

Total marks — 50

Attempt ALL questions

1. The number of visitors to a zoo in 2024 was 118 750.

   The number of visitors is expected to increase by 4% each year over the next two years.

   Calculate the expected number of visitors in 2026. 3

$100\% + 4\% = 104\% = 1.04$

$118\,750 \times 1.04^2 = 128,440$ visitors.

[Turn over

2. A shop sells footballs in the shape of a sphere with diameter 21 centimetres.

Calculate the volume of the football.

Give your answer correct to 3 significant figures. **3**

$D = 21$

$r = 10.5\text{cm}$

$$V_{sphere} = \frac{4}{3}\pi r^3$$

$$= \frac{4}{3} \times \pi \times 10.5^3$$

$$= 4849.048261$$

Volume $= 4850\text{cm}^3$ (3sf)

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3. The mass of one atom of gold is 3.27×10^{-22} grams.
The mass of one atom of carbon is 6.1% of the mass of an atom of gold.
Calculate the mass of one atom of carbon.
Give your answer in scientific notation. 2

6.1% of 3.27×10^{-22}

$0.061 \times 3.27 \times 10^{-22}$

$(0.19947 \times 10^{-22})$

$= 1.9947 \times 10^{-23}$ grams.

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

4. The weights, in kilograms, of a sample of rugby players in Scotland are shown.

93 103 99 105 88 106 92

(a) Calculate the mean and standard deviation of these weights. 4

x	$x-\bar{x}$	$(x-\bar{x})^2$
93	−5	25
103	5	25
99	1	1
105	7	49
88	−10	100
106	8	64
92	−6	36
686	x	300

$$\text{Mean} = \frac{\Sigma x}{n} = \frac{686}{7}$$

mean = 98 kg.

$$sd = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}} = \sqrt{\frac{300}{6}} = \sqrt{50}$$

sd = 7.0710678...

sd = 7.1 kg (1dp)

4. **(continued)**

A sample of rugby players in France has a mean weight of 105 kilograms and a standard deviation of 5.9 kilograms.

(b) Make two valid comments comparing the **weights** of the rugby players in the samples from Scotland and France. 2

	Mean	sd
Scot.	98	7.1
France	105	5.9

On average, the rugby players sampled in France weigh more than the players in Scotland.

The weights of the sampled players in France are less variable (more consistent) than the weights of the players in Scotland.

5. Express $x^2+10x+19$ in the form $(x+a)^2+b$. 2

$$[(x+5)^2-5^2]+19$$

$$(x+5)^2-25+19$$

$$=(x+5)^2-6.$$

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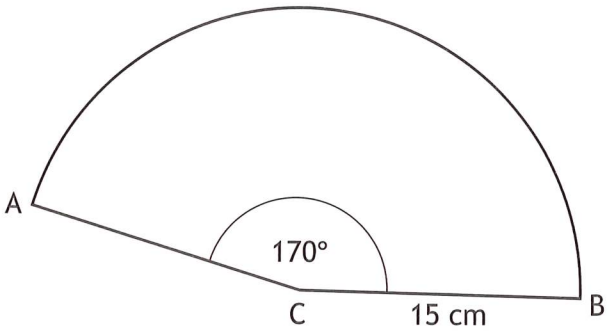
MARKS | DO NOT WRITE IN THIS MARGIN

6. A party hat is made in the shape of a cone, as shown.

The piece of card used for making the hat is a sector of a circle, centre C.



The radius of the circle is 15 centimetres and angle ACB is 170°.

Calculate the area of the sector. 3

$$\frac{\text{Angle}}{360} = \frac{\text{Area}}{\pi r^2}$$

$$\text{Sector Area} = \frac{170}{360} \times \pi \times 15^2$$

$$= 333.7942\ldots$$

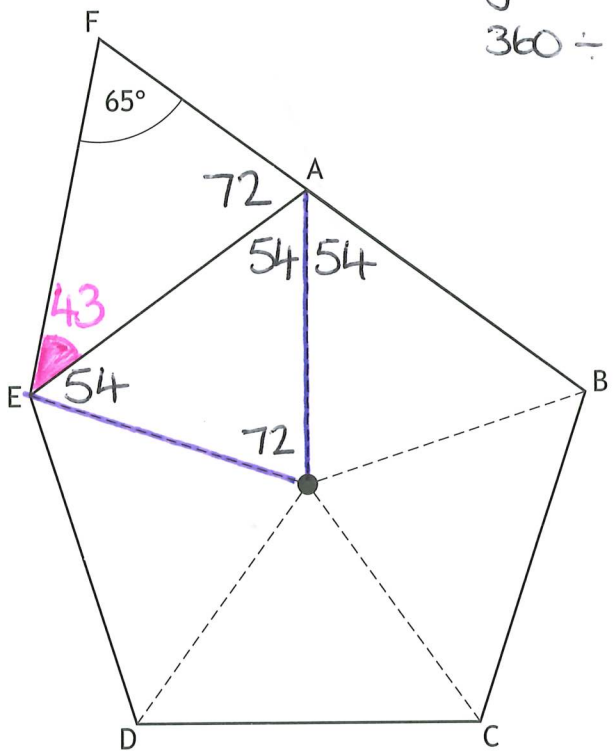
$$\text{Sector Area} = 333.79\ \text{cm}^2 \quad (2\text{dp})$$

MARKS | DO NOT WRITE IN THIS MARGIN

7. In the diagram, ABCDE is a regular pentagon.

- Angle EFA is 65°.
- FAB is a straight line.

Angle at centre
$360 \div 5 = 72°$



Calculate the size of angle FEA. 2

Isosceles Δ

$180 - 72 = 108$

$108 \div 2 = 54°$

$\angle FAE = 180 - (54 + 54)$

$= 72°$ exterior angle

$\angle FEA = 180 - (72 + 65)$

$\angle FEA = 43°$

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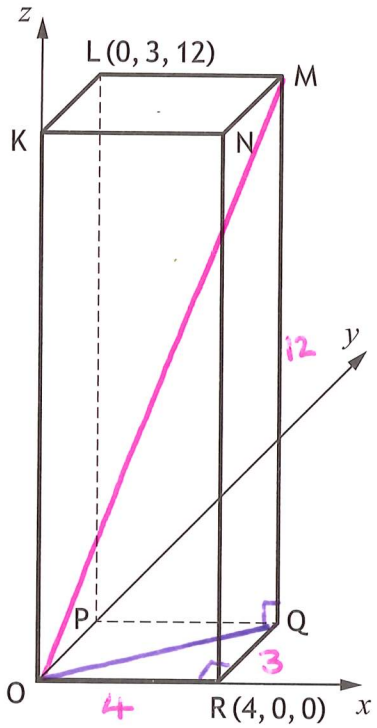
8. The diagram shows a cuboid, KLMNOPQR, relative to the coordinate axes.



5-12-13 Δ
OM = 13 units.

3-4-5 Δ
OQ = 5 units

L has coordinates (0, 3, 12).

R has coordinates (4, 0, 0).

(a) Write down the coordinates of M. **1**

M(4, 3, 12)

(b) Calculate the length of the space diagonal OM. **3**

$OM = \sqrt{4^2 + 3^2 + 12^2}$.

$= \sqrt{169}$

OM = 13 units.

MARKS | DO NOT WRITE IN THIS MARGIN

9. Change the subject of the formula $B = \frac{1}{4}kc^2 - 3c$ to k. 3

$$\frac{1}{4}kc^2 - 3c = B.$$

$$\frac{1}{4}kc^2 = B + 3c$$

$$kc^2 = 4(B + 3c)$$

$$k = \frac{4(B+3c)}{c^2}$$

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

10. On Bob's lorry there are 7 stacks of paving slabs and 3 stacks of edging blocks.

The total weight of these stacks is 2400 kilograms.

Let p be the weight of a stack of paving slabs and e be the weight of a stack of edging blocks.

(a) Write down an equation in p and e to illustrate this information. 1

$7p + 3e = 2400$

Imran has 3 stacks of paving slabs and 4 stacks of edging blocks on his lorry.

The total weight of these stacks is 1300 kilograms.

(b) Write down an equation in p and e to illustrate this information. 1

$3p + 4e = 1300$

Beth has 6 stacks of paving slabs and 5 stacks of edging blocks on her lorry.

(c) Calculate the **total weight** of the stacks of paving slabs and edging blocks on Beth's lorry. 4

$7p + 3e = 2400$ (×4)

$3p + 4e = 1300$ (×3)

$28p + 12e = 9600$

$- \quad 9p + 12e = 3900$

$19p = 5700$

$p = 300$

If $3p + 4e = 1300$

$3(300) + 4e = 1300$

$900 + 4e = 1300$

$4e = 400$

$e = 100$

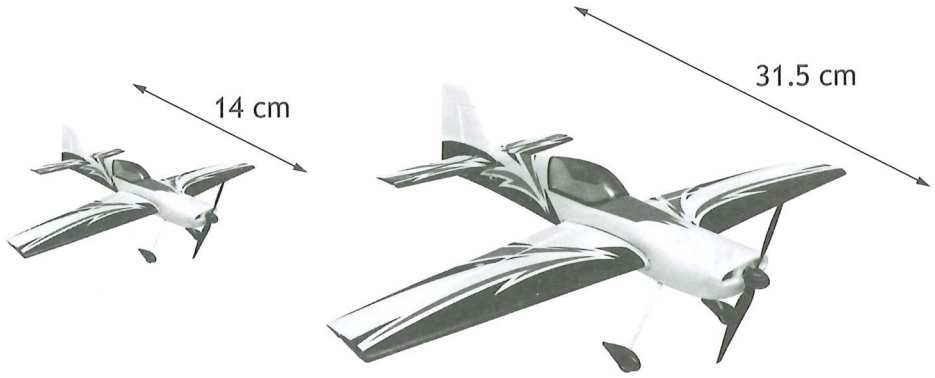
↳ Beth's total weight $= 6p + 5e$

$= 6(300) + 5(100)$

$= 2300$ kg

MARKS | DO NOT WRITE IN THIS MARGIN

11. Two model aircraft are mathematically similar.



The small model is 14 centimetres long, and the area of one wing is 24 square centimetres.

The large model is 31.5 centimetres long.

Calculate the **area** of one wing of the large model. **3**

Linear $SF_E = \frac{\text{big}}{\text{wee}} = \frac{31.5}{14} = \frac{9}{4}$

Area $SF_E = \left(\frac{9}{4}\right)^2 = \frac{81}{16}$

Large Area of wing $= \frac{81}{16} \times 24$

$= 121.5\ cm^2$.

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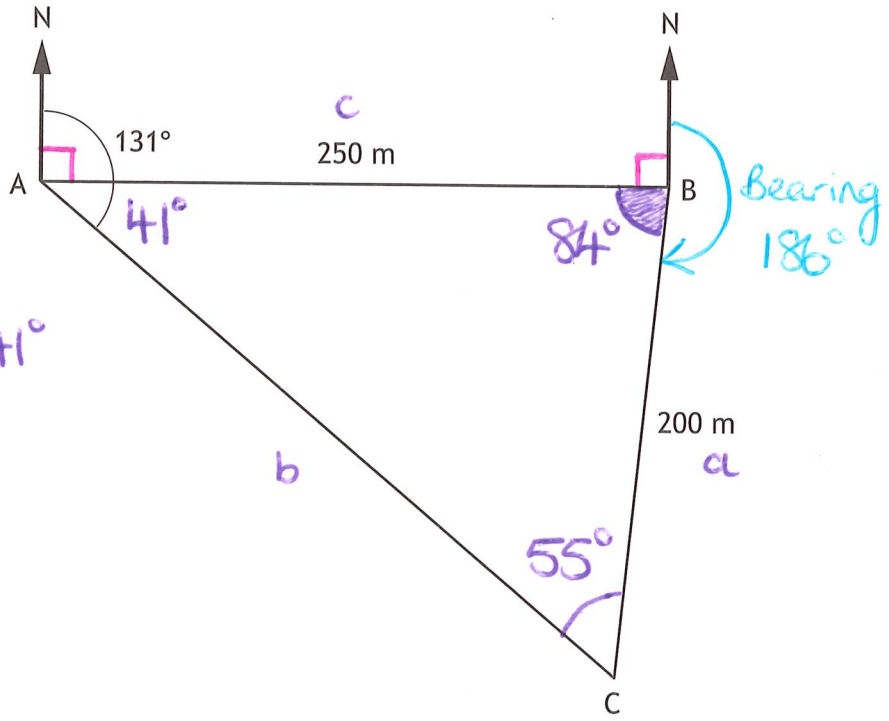
MARKS | DO NOT WRITE IN THIS MARGIN

12. In the diagram A, B and C represent the positions of three checkpoints in an orienteering course.



- B is 250 metres **east** of A.
- The bearing of C from A is 131°.
- C is 200 metres from B.

Calculate the bearing of C from B.

Do not use a scale drawing.

4

Find C, then B, then bearing!

$\frac{\sin C}{c} = \frac{\sin A}{a}$

$\angle ABC = 180 - (41 + 55)$
$= 84°$

$\frac{\sin C}{250} = \frac{\sin 41}{200}$

Bearing $= 360 - (90 + 84)$
$= 360 - 174$

$\sin C = \frac{250 \sin 41}{200}$

Bearing $= 186°$

$\sin C = 0.820073786$

$C = \sin^{-1}(\text{ANS}) = 55.09218...$

$\angle ACB = 55°$

MARKS | DO NOT WRITE IN THIS MARGIN

13. Solve the equation $\frac{5x+1}{2} = \frac{4x}{3} + 1$.

3

$$\frac{5x+1}{2} = \frac{4x}{3} + 1$$

$\times 6$ $\times 6$ $\times 6$

$$3(5x+1) = 2(4x) + 6$$

$$15x + 3 = 8x + 6$$

$$7x + 3 = 6$$

$$7x = 3$$

$$x = \frac{3}{7}$$

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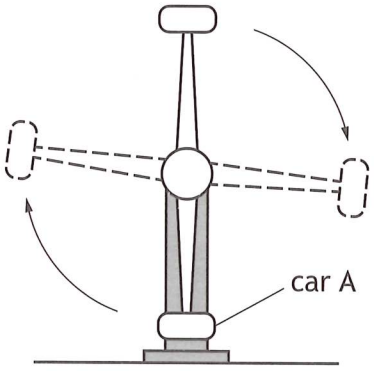
MARKS | DO NOT WRITE IN THIS MARGIN

14. A ride at a theme park has a car attached to each end of a rotating arm.

The starting position of car A is shown in the diagram.



As the arm rotates clockwise, the height, h metres, of car A above the ground in each rotation is given by

$$h = 10 - 8\cos x°, \quad 0 \leq x < 360$$

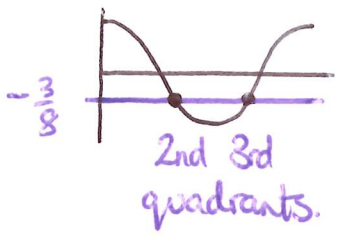
where $x°$ is the angle the arm has turned from car A's starting position.

Calculate the **two** values of x for which the height of car A is 13 metres above the ground. 4

Let $h = 13$ $\therefore$ $13 = 10 - 8\cos x°$

$8\cos x° = -3$

$\cos x° = -\frac{3}{8}$



180-ra	ra
S ✓	A
T ✓	C
180+ra	360-ra

$ra = \cos^{-1}\left(\frac{3}{8}\right) = 68.0°$ (1 dp)

$x = 180 - 68, \quad 180 + 68$

$x° = 112°, 248°$

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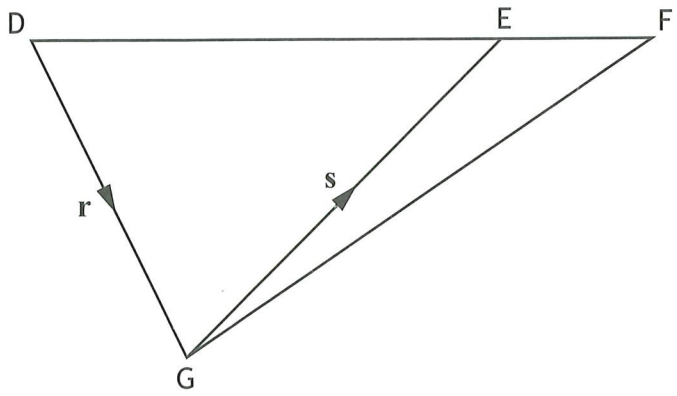
15. In the diagram, $\overrightarrow{DG}$ and $\overrightarrow{GE}$ are represented by the vectors $\mathbf{r}$ and $\mathbf{s}$ respectively, and $\overrightarrow{DE} = 3\overrightarrow{EF}$.



Express $\overrightarrow{GF}$ in terms of $\mathbf{r}$ and $\mathbf{s}$.

Give your answer in its simplest form. **2**

$$\overrightarrow{DE} = r + s$$

$$\overrightarrow{EF} = \frac{1}{3}\overrightarrow{DE} = \frac{1}{3}(r + s)$$

$$\therefore \overrightarrow{GF} = \overrightarrow{GE} + \overrightarrow{EF}$$

$$= s + \frac{1}{3}(r + s)$$

$$= s + \frac{r}{3} + \frac{s}{3}$$

$$\overrightarrow{GF} = \frac{4s}{3} + \frac{r}{3}$$

[END OF QUESTION PAPER]

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ADDITIONAL SPACE FOR ANSWERS