National Qualifications

2024 Mock Paper
Mathematics
Paper 1 (Non-calculator)

Duration – 1 hour

Fill in these boxes and read what is printed below.

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

Total marks – 40

Attempt ALL questions

DO NOT WRITE IN THIS MARGIN

MARKS

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

$6x^3 - 2x^2 + 10x$ ✓1

$+ 3x^2 - x + 5$ ✓2

$= 6x^3 + x^2 + 9x + 5$ ✓3

2. Evaluate $2\frac{1}{5}+\frac{3}{4}$. **2**

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

$= \frac{44}{20} + \frac{15}{20}$ ✓1

$= \frac{59}{20}$ ✓2

3. Vectors $\mathbf{a}$ and $\mathbf{b}$ are given by $\mathbf{a} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -6 \\ -3 \end{pmatrix}$.

Find the resultant vector $\mathbf{a} + \frac{2}{3}\mathbf{b}$.

Express your answer in component form. **2**

$\begin{pmatrix} 4 \\ -1 \end{pmatrix} + \frac{2}{3}\begin{pmatrix} -6 \\ -3 \end{pmatrix}$ ✓1

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

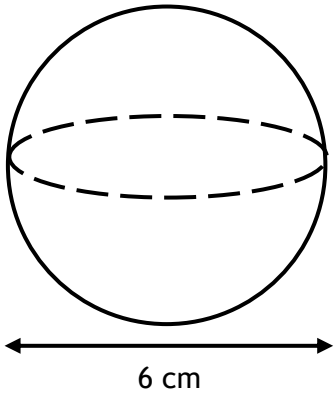
$= \begin{pmatrix} 0 \\ -3 \end{pmatrix}$ ✓2

[Turn over

4. Express $x^2 - 6x + 11$ in the form $(x-a)^2 + b$. **2**

$(x-3)^2 + 2$ ✓1 ✓2

5. The diagram shows a sphere with diameter 6 centimetres.



Calculate the volume of the sphere.

Give your answer in terms of π. **2**

$V = \frac{4}{3} \times \pi \times 3^3$ ✓1

$V = \frac{4}{3} \times \pi \times 27$

$V = 36\pi \text{ cm}^3$. ✓2

$\frac{4}{3} \times 27$

$= 4 \times 9$

$= 36$

MARKS

DO NOT WRITE IN THIS MARGIN

6. Stephanie buys 4 large dracaena plants and 3 small dracaena plants.
The total cost is £52.

(a) Write down an equation to illustrate this information. **1**

$4l + 3s = 52$ ✓1

Colin buys 2 large dracaena plants and 5 small dracaena plants.
The total cost is £40.

(b) Write down an equation to illustrate this information. **1**

$2l + 5s = 40$ ✓2

(c) Calculate the cost of one large dracaena plant and the cost of one small dracaena plant. **4**

$4l + 3s = 52$ ① $\times 1$

$2l + 5s = 40$ ② $\times 2$

✓3

$4l + 3s = 52$ ①

$4l + 10s = 80$ ③ ③ − ①

$7s = 28$

$s = 4$ ✓4

sub $s = 4$ into ②: $2l + 5(4) = 40$

$2l + 20 = 40$

$2l = 20$

$l = 10$ ✓5

large plant costs £10
small plant costs £4. ✓6

[Turn over

7. WrestleMania is a global professional wrestling event, taking place in early April each year.

At the first WrestleMania, the attendance was 19,200.

This is 15% of the expected attendance for WrestleMania 40.

Calculate the expected attendance for WrestleMania 40. **3**

15% = 19 200 ✓1

5% = 6400 ✓2

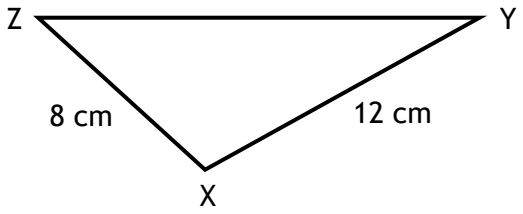
100% = 128 000 ✓3

$$3\overline{)19\,200} = 6400$$

6400 × 20
= 128 000

8. In triangle XYZ:

- $\sin Y = \frac{1}{3}$
- XY = 12 centimetres
- XZ = 8 centimetres



Find the value of $\sin Z$.

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

$$\frac{\sin Z}{12} = \frac{\frac{1}{3}}{8}$$ ✓1

$$\sin Z = \frac{12 \times \frac{1}{3}}{8}$$

$$\sin Z = \frac{4}{8}$$

$$\sin Z = \frac{1}{2}$$ ✓2

9. A function $f(x)$ is defined by $f(x)=3\sqrt{x}$ where $x \geq 0$.

(a) Evaluate $f(20)$.

Give your answer as a surd in its simplest form. **2**

$3\sqrt{20}$ ✓1

$= 3\sqrt{4}\sqrt{5}$

$= 3 \cdot 2\sqrt{5}$

$= 6\sqrt{5}$ ✓2

(b) Find the value of a such that $f(a)=15$. **2**

$3\sqrt{a} = 15$ ✓3

$\sqrt{a} = 5$

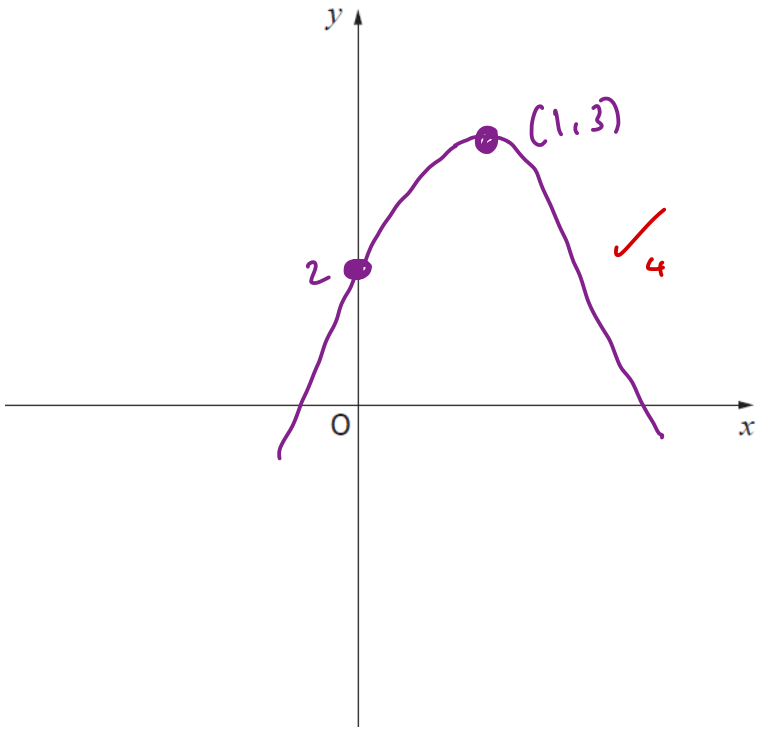
$a = 25$ ✓4

10. A parabola has equation $y = 3-(x-1)^2$.

(a) State the axis of symmetry of the parabola. **1**

$x = 1$ ✓1

(b) Sketch the graph of $y = 3-(x-1)^2$.
On your diagram, show the clearly the coordinates of the turning point and the point of intersection with the y–axis. **3**



✓4

Max TP : (1, 3) ✓3

shape :

y-int : $x = 0$

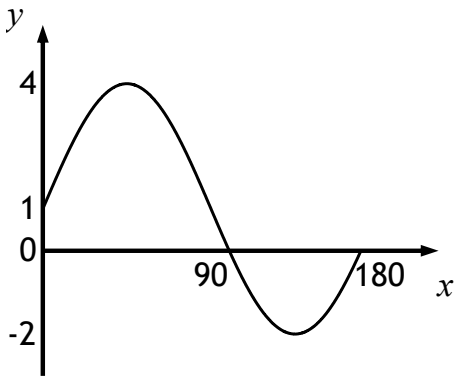
$y = 3-(0-1)^2$

$y = 3-1$

$y = 2$

$(0, 2)$ ✓2

11. Part of the graph of $y = a\sin bx° + c$ is shown.



State the values of a, b and c. **3**

$a = 3$ ✓1

$b = 2$ ✓2

$c = 1$ ✓3

$y = 3\sin 2x + 1$

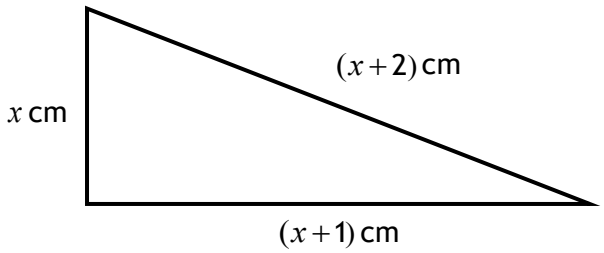
12. Evaluate $125^{\frac{2}{3}}$. **2**

$(\sqrt[3]{125})^2$ ✓1

$= 5^2$

$= 25$ ✓2

13. A right-angled triangle has dimensions x centimetres, $(x+1)$ centimetres and $(x+2)$ centimetres as shown in the diagram below.



Find the value of x. **5**

$(x+2)^2 = (x+1)^2 + x^2$ ✓1

$x^2 + 4x + 4 = x^2 + 2x + 1 + x^2$ ✓2

$x^2 + 4x + 4 = 2x^2 + 2x + 1$

$0 = x^2 - 2x - 3$ ✓3

$x^2 - 2x - 3 = 0$

$(x+1)(x-3) = 0$ ✓4

~~$x = -1$~~ $x = 3$ ✓5

[END OF QUESTION PAPER]