

N5

Prelim Examination

MATHEMATICS **National Qualifications - National 5** **Paper 1 (non-calculator)** **Testing all units**

Time allowed - 50 minutes

Fill in these boxes and read carefully what is printed below

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

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Candidate number

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Seat number

Total marks - 37

1. You may NOT use a calculator.
2. Use **blue** or **black** ink. Pencil may be used for graphs and diagrams only.
3. Write your working and answers in the spaces provided. Additional space for answers is provided at the end of the booklet. If you use this space, write clearly the number of the question you are attempting.
4. Square ruled paper is provided.
5. Full credit will be given only where the solution contains appropriate working.
6. State the units for your answer where appropriate.
7. Before leaving the examination room you must give up 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: $\text{Area} = \frac{1}{2} ab \sin C$

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

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

Volume of a Pyramid: $\text{Volume} = \frac{1}{3} Ah$

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

All questions should be attempted

- 1.** Multiply out the brackets and simplify

$$(x - 3)(3x + 5)$$

2

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

2

- (b)** If the graph of $y = x^2 + 6x - 4$ is drawn, what would the coordinates and nature of the turning point be?

2

3. Evaluate $\frac{5}{8}$ of $\left[\frac{4}{7} + \frac{4}{5}\right]$ 2

4. A company made a profit of £42 000 in 2014. This was 20% more than the profit the company made in 2013.
How much profit did the company make in 2013? 3

5. Vectors \mathbf{a} and \mathbf{b} have components as shown below.
Find the components of the resultant vector $3\mathbf{b} - \mathbf{a}$. 2

$$\mathbf{a} = \begin{pmatrix} 5 \\ -3 \\ 0 \end{pmatrix} \quad \text{and} \quad \mathbf{b} = \begin{pmatrix} 3 \\ -5 \\ 2 \end{pmatrix}$$

6. By calculating the discriminant, state the nature of the roots of

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

3

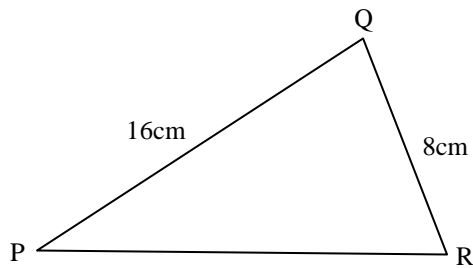
7. Find the equation of the line which is parallel to $y = \frac{4}{3}x + 4$ and passes through the point $(2, -3)$. Give your answer in the form $ax + by = c$.

3

8. Express $\sqrt{6} \times \sqrt{8} - 3\sqrt{3}$ as a surd in its simplest form. 3

9. Simplify $\frac{3x^5 \times 4y^3}{6x^{-2}y^4}$ expressing your answer with positive indices. 3

10.



In this triangle $PQ = 16\text{cm}$ and $QR = 8\text{cm}$.

The value of $\sin P = 0.4$.

Find the value of $\sin R$.

3

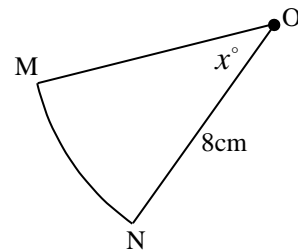
11. Given that $P = \frac{3Q}{R^2}$, change the subject of the formula to R .

3

12. A sector of a circle with radius 8cm is shown opposite.

Angle $MON = x^\circ$

If the exact **length** of the arc MN is 2π centimetres, calculate the size of the angle marked x .



4

13. Simplify $\cos x^\circ \tan x^\circ$

2

End of Question Paper

National 5 All Units Paper 1

Marking Scheme

Qu	Give one mark for each •	Illustrations for awarding mark
1	ans: $3x^2 - 4x - 15$ 2 marks • ¹ starts to multiply brackets • ² completes multiplication and simplifies	• ¹ $3x^2 + 5x \dots$ • ² $\dots - 9x - 15x = 3x^2 - 4x - 15$
2a	ans: $(x + 3)^2 - 13$ 2 marks • ¹ starts to complete square • ² completes and answer	• ¹ $(x + 3)^2 \dots$ • ² $\dots - 9 - 4 = (x + 3)^2 - 13$
b	ans: $(-3, 13)$; minimum 2 marks • ¹ correct coordinates • ² states nature	• ¹ $(-3, 13)$ • ² minimum
3	ans: $\frac{6}{7}$ 2 marks • ¹ first operation • ² second operation	• ¹ $\frac{4}{7} + \frac{4}{5} = \frac{48}{35}$ • ² $\frac{5}{8} \times \frac{48}{35} = \frac{240}{280} = \frac{6}{7}$
4	ans: £35 000 3 marks • ¹ realises 120% • ² finds 20% • ³ finds 100%	• ¹ $120\% = £42\ 000$ • ² $£42\ 000 \div 6 = £7\ 000$ • ³ $£7\ 000 \times 5 = £35\ 000$
5	ans: $\begin{pmatrix} 4 \\ -12 \\ 6 \end{pmatrix}$ 2 marks • ¹ knows how to find components • ² states components	• ¹ $3 \begin{pmatrix} 3 \\ -5 \\ 2 \end{pmatrix} - \begin{pmatrix} 5 \\ -3 \\ 0 \end{pmatrix}$ • ² $\begin{pmatrix} 4 \\ -12 \\ 6 \end{pmatrix}$

Qu	Give one mark for each •	Illustrations for awarding mark
6	ans: see below for 3 marks <ul style="list-style-type: none"> •¹ uses $b^2 - 4ac$ •² finds an answer of 13 •³ writes 2 roots since $b^2 - 4ac > 0$ 	<ul style="list-style-type: none"> •¹ uses $b^2 - 4ac$ •² finds an answer of 13 •³ writes 2 roots since $b^2 - 4ac > 0$
7	ans: $4x - 3y = 17$ 3 marks <ul style="list-style-type: none"> •¹ uses gradient of 4/3 •² subs into straight line equation •³ rearranges to required form 	<ul style="list-style-type: none"> •¹ $m = \frac{4}{3}$ •² $y + 3 = \frac{4}{3}(x - 2)$ $y + 3 = \frac{4}{3}(x - 2)$ •³ $4x - 3y = 17$
8	ans: $\sqrt{3}$ 3 marks <ul style="list-style-type: none"> •¹ first operation •² simplifies surd •³ simplifies expressions 	<ul style="list-style-type: none"> •¹ $\sqrt{6} \times \sqrt{8} = \sqrt{48}$ •² $\sqrt{48} = \sqrt{16} \times \sqrt{3} = 4\sqrt{3}$ •³ $4\sqrt{3} - 3\sqrt{3} = 7\sqrt{3}$
9	ans: $\frac{2x^7}{y}$ 3 marks <ul style="list-style-type: none"> •¹ correct number •² correct x term •³ correct y term 	<ul style="list-style-type: none"> •¹ 2 •² x^7 •³ $\frac{\dots}{y}$
10	ans: 0.8 3 marks <ul style="list-style-type: none"> •¹ uses sine rule •² rearranges formula •³ simplifies 	<ul style="list-style-type: none"> •¹ $\frac{16}{\sin R} = \frac{8}{0.4}$ •² $\sin R = \frac{16 \times 0.4}{8}$ •³ 0.8
11	ans: $R = \sqrt{\frac{3Q}{P}}$ 3 marks <ul style="list-style-type: none"> •¹ cross multiplies •² divides both sides by P •³ takes square root 	<ul style="list-style-type: none"> •¹ $PR^2 = 3Q$ •² $R^2 = \frac{3Q}{P}$ •³ $R = \sqrt{\frac{3Q}{P}}$

Qu	Give one mark for each •	Illustrations for awarding mark
12	ans: 45° 4 marks <ul style="list-style-type: none"> •¹ uses correct diameter •² finds circumference of circle •³ knows how to find angle •⁴ answer 	<ul style="list-style-type: none"> •¹ $d = 16$ [may be formula] •² $C = \pi \times 16 = 16\pi$ •³ $x^\circ = \frac{2\pi}{16\pi} \times 360$ •⁴ 45°
13	ans: $\sin x^\circ$ 2 marks <ul style="list-style-type: none"> •¹ substitutes for $\tan x^\circ$ •² simplifies 	<ul style="list-style-type: none"> •¹ $\cos x^\circ \times \frac{\sin x^\circ}{\cos x^\circ}$ •² $\sin x^\circ$
		Total 37 marks