

N5

Prelim Examination

MATHEMATICS

National Qualifications - National 5

Paper 2 (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 - 44

- You may use a calculator.**
- Use **blue** or **black** ink. Pencil may be used for graphs and diagrams only.
- Write your working and answers in the spaces provided. Additional space for answers
If you use this space, write clearly the number of the question you are attempting.
is provided at the end of the booklet.
- Square ruled paper is provided.
- Full credit will be given only where the solution contains appropriate working.
- State the units for your answer where appropriate.
- 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: $\text{Volume} = \frac{1}{3} Ah$

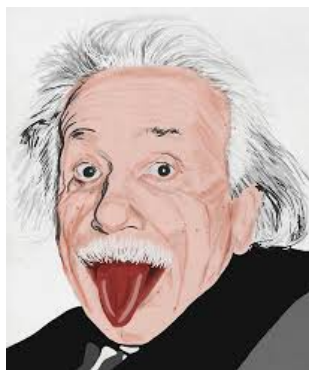
Standard deviation: $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n-1}}$, where n is the sample size.

All questions should be attempted

Marks

Do not
write in
this
margin.

1. A painting was valued at £40 000 in 2012. Rosso, the owner, plans to sell it in 2015 and hopes that it will be worth £50 000.



If the painting increases in value at the rate of 8% per annum, will Rosso's picture be worth £50 000 in 2015?

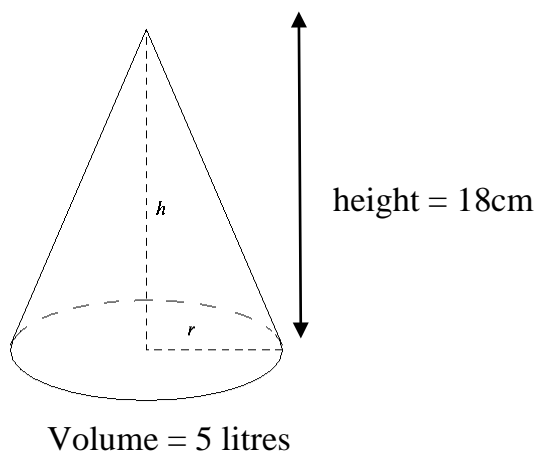
You must show all your working and give a reason for your answer.

3

2. Write as a single fraction in its simplest form: $\frac{4b}{7x} \div \frac{b}{x^3}$

3

3. A conical container has a volume of 5 litres and height 18 cm. Calculate its radius.

3

4. Solve the equation $5 \cos x^\circ + 4 = 5$ for $0 < x < 360$.

3

Marks

5. Oliver and Penelope each book in at the Aberdour Sea View Hotel.

a. Oliver stays for 3 nights and has breakfast on 2 mornings. His bill is £145.
Write down an algebraic equation to illustrate this

1

b. Penelope stays for 5 nights and has breakfast on 3 mornings. Her bill is £240.
Write down an algebraic expression to illustrate this.

1

c. Calculate the cost of one breakfast

3

6. The pulse rates, in beats per minute, of 6 adults in a hospital waiting area are:

68 73 86 72 82 78

(a) Calculate the mean and standard deviation of this data.

3

(b) 6 children in the same waiting have a mean pulse rate of 89.6 beats per minute and a standard deviation of 5.4.

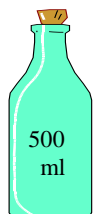
Make *two valid* comparisons between the children's pulse rates and those of the adults.

2

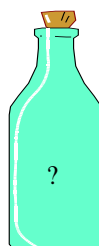
7. Two bottles shown below are mathematically similar. The smaller bottle has a base of diameter of 6cm and holds 500ml. Calculate the volume of the large bottle which has a base diameter of 9cm

Marks

3



6cm



9cm

8. Solve $3x^2 + 2x - 3 = 0$ giving your answer correct to **1 decimal place**

4

9. The diagram below shows the cross section of a cylindrical tank with radius 18cm.

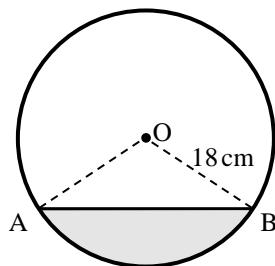


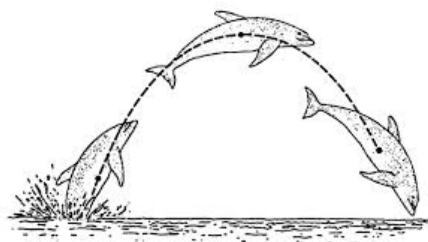
Diagram 2 shows the cross-sectional view of the tank. There is liquid in the tank and its surface, AB, measures 27cm.

It is thought that angle AOB is 90° .

Without using trigonometry, decide whether or not this is the case.
[Show working to justify your answer]

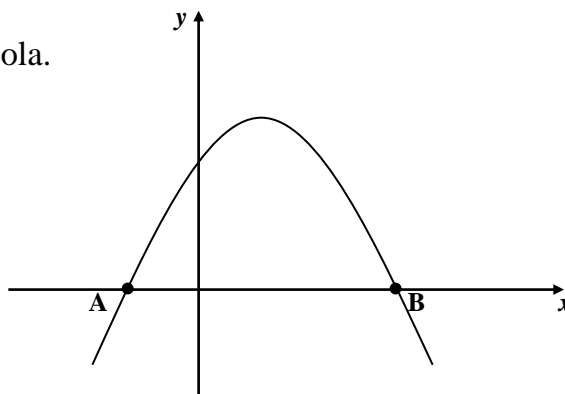
4

10. When a fish 'leaps' from the water its path is in the shape of a parabola.



The parabola can be represented by the equation $y = 5 + 4x - x^2$.

This cartesian diagram shows the parabola.



- (a) If one unit on the graph represents a distance of 20cm, calculate how far the fish travels horizontally during one 'leap'.

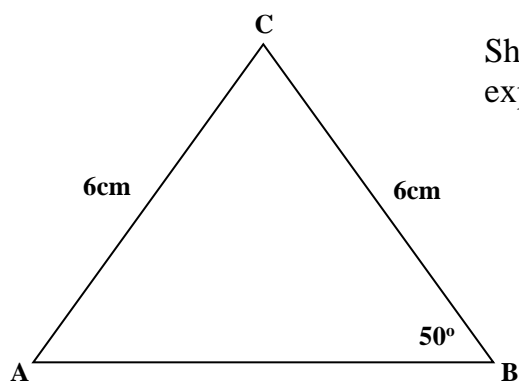
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- (b) Does the fish reach a height of 1.75 metres on this leap?
You must show all your working to justify your answer.

4

11. Isosceles triangle **ABC** is shown below.

Marks



Show that the length of **AB** can be given by the expression

$$AB = \sqrt{72(1 - \cos 80^\circ)} \text{ cm.}$$

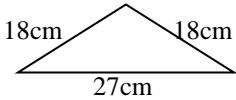
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End of Question Paper

National 5 All units Paper 2

Marking Scheme

Qu	Give one mark for each •	Illustrations for awarding mark
1	ans: yes with reason 3 marks <ul style="list-style-type: none"> •¹ correct multiplier •² correct method •³ conclusion 	<ul style="list-style-type: none"> •¹ 1.08 •² $40\,000 \times 1.08^3 = \text{£}50\,388.48$ •³ yes since $\text{£}50\,388.48 > \text{£}50\,000$
2	ans : $\frac{4x^2}{7}$ 3 marks <ul style="list-style-type: none"> •¹ inverts divisor and multiplies •² multiplies •³ simplifies 	<ul style="list-style-type: none"> •¹ $\times \frac{x^3}{b}$ •² $\frac{4bx^3}{7xb}$ •³ $\frac{4x^2}{7}$
3	ans : 16.3cm 3 marks <ul style="list-style-type: none"> •¹ changes to cm³ and subs into formula •² starts to solve for r •³ finds r 	<ul style="list-style-type: none"> •¹ $5000 = \frac{1}{3} \times \pi \times r^2 \times 18$ •² $r^2 = \frac{5000}{6\pi}$ •³ $r = \sqrt{\frac{5000}{6\pi}} = 16.3$
4	ans: 78.5°, 281.5° 3 marks <ul style="list-style-type: none"> •¹ solves for $\cos x^\circ$ •² finds one solution •³ finds second solution 	<ul style="list-style-type: none"> •¹ $\cos x^\circ = 0.2$ •² 78.5° •³ 281.5°
5	ans : 2 equations, £5 5 marks <ul style="list-style-type: none"> •¹ $3N + 2B = 145$ •² $5N + 3B = 240$ •³ evidence of scaling equations •⁴ Solves for B <ul style="list-style-type: none"> • States “Breakfast cost £5” 	<ul style="list-style-type: none"> •¹ •² •³ evidence of scaling equations •⁴ B = 5 <ul style="list-style-type: none"> • States “Breakfast cost £5”
6	ans: see below 5 marks <ul style="list-style-type: none"> •¹ Mean = 76.5 •² Correct numbers entered in SD formula <ul style="list-style-type: none"> • Correct SD calculated SD = 6.75 • Children’s pulse rates tend to be higher • And to vary less than adults pulse rates 	<ul style="list-style-type: none"> ¹ Mean = $459/6 = 76.5$ •² Correct numbers entered in SD formula $SD = \sqrt{\frac{227.5}{5}}$ <ul style="list-style-type: none"> • SD = 6.75 • Children’s pulse rates tend to be higher • And to vary less than adults pulse rates

Qu	Give one mark for each •	Illustrations for awarding mark
7	ans: 1687.5 ml 3 marks <ul style="list-style-type: none"> •¹ finds linear scale factor •² finds volume scale factor •³ finds volume of larger bottle 	<ul style="list-style-type: none"> •¹ $L.S.F. = \frac{9}{6} = \frac{3}{2}$ •² $V.S.F. = \left(\frac{3}{2}\right)^3$ [or equivalent] •³ $\left(\frac{3}{2}\right)^3 \times 500 = 1687.5 \text{ ml}$
8	ans : 0.7, -1.4 4 marks <ul style="list-style-type: none"> • finds a, b & c & subs into formula • calculates $b^2 - 4ac$ • finds roots • correct rounding 	<ul style="list-style-type: none"> • $a=3, b=2, c=-3$ • $\frac{-2 \pm \sqrt{40}}{2 \times 3}$ • 40 • 0.72, -1.38 • 0.7, -1.4
9	ans: angle not right with reason 4 marks <ul style="list-style-type: none"> •¹ assembles facts in triangle •² knows condition for right angle •³ tests both sides •⁴ valid conclusion 	 <ul style="list-style-type: none"> •¹ •² statement e.g. if $18^2 + 18^2 = 27^2$ angle is right •³ $18^2 + 18^2 = 648; 27^2 = 729$ •⁴ since $18^2 + 18^2 \neq 27^2$ angle is not right
10	ans : 120cm 3 marks <ul style="list-style-type: none"> •¹ sets equation = 0 •² solves quadratic equation •³ finds distance 	<ul style="list-style-type: none"> •¹ $5 + 4x - x^2 = 0$ •² $(5 - x)(1 + x) = 0; x = 5 \text{ or } -1$ •³ $6 \times 20\text{cm} = 120\text{cm}$ [or 1.2 m]
a		
b	ans: Yes since 180cm > 1.75m 4 mark <ul style="list-style-type: none"> •¹ knows to find maximum TP •² knowing to sub into equation/evaluates •³ uses scale •⁴ valid conclusion 	<ul style="list-style-type: none"> •¹ evidence of finding middle of 5 and -1 •² $y = 5 + 4(2) - (2)^2 = 9 \text{ units}$ •³ $9 \times 20 = 180\text{cm}$ •⁴ Yes since $180\text{cm} > 1.75\text{m}$
11	ans: proof 4 marks <ul style="list-style-type: none"> •¹ correct strategy •² uses Cosine Rule •³ evaluates side •⁴ simplifies answer 	<ul style="list-style-type: none"> •¹ angle ACB = 80° •² $AB^2 = 6^2 + 6^2 - 2 \times 6 \times 6 \times \cos 80^\circ$ •³ $AB^2 = 72 - 72 \cos 80^\circ$ •⁴ $AB = \sqrt{72(1 - \cos 80^\circ)}$
		Total 44 marks