

X100/201

NATIONAL
QUALIFICATIONS
2006

FRIDAY, 19 MAY
1.00 PM – 1.45 PM

MATHEMATICS
INTERMEDIATE 2
Units 1, 2 and 3
Paper 1
(Non-calculator)

Read carefully

- 1 You may **NOT** use a calculator.
- 2 Full credit will be given only where the solution contains appropriate working.
- 3 Square-ruled paper is provided.



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

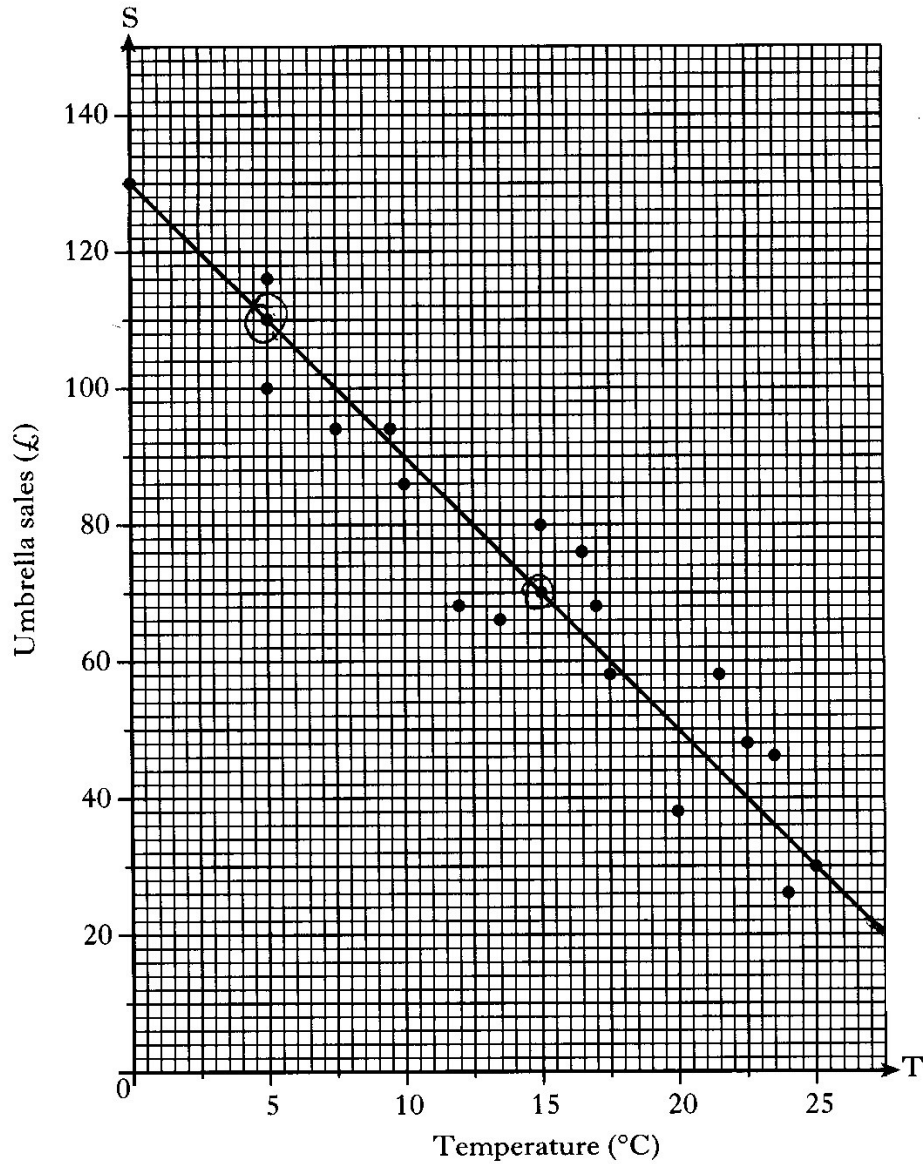
Volume of a cone: $\text{Volume} = \frac{1}{3}\pi r^2 h$

Volume of a cylinder: $\text{Volume} = \pi r^2 h$

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. The temperature, in degrees Celsius, at mid-day in a seaside town and the sales, in pounds, of umbrellas are shown in the scattergraph below.
A line of best fit has been drawn.



- (a) Find the equation of the line of best fit. 3
- (b) Use your answer to part (a) to predict the sales for a day when the temperature is 30 degrees Celsius. 1

[Turn over

2. Multiply out the brackets and collect like terms.

$$(2y - 3)(y^2 + 4y - 1)$$

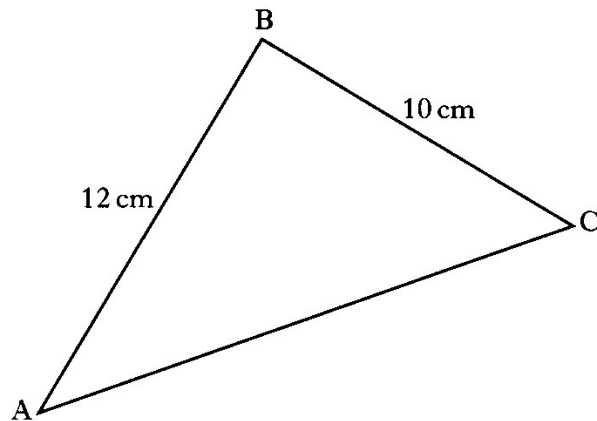
3

3. In a factory, the number of workers absent each day is recorded for 21 days. The results are listed below.

| | | | | | | |
|----|----|----|----|----|----|----|
| 19 | 22 | 19 | 22 | 20 | 21 | 17 |
| 19 | 21 | 16 | 20 | 19 | 18 | 18 |
| 20 | 20 | 23 | 19 | 18 | 17 | 19 |

- (a) Construct a dotplot for this data. 2
- (b) Find:
- (i) the median; 1
 - (ii) the lower quartile; 1
 - (iii) the upper quartile. 1
- (c) What is the probability that, on a day chosen at random from this sample, more than 18 workers were absent? 1

4.



Calculate the area of triangle ABC if $\sin B = \frac{2}{3}$.

2

5. A straight line is represented by the equation $2y + x = 6$.

(a) Find the gradient of this line.

2

(b) This line crosses the y -axis at $(0, c)$.
Find the value of c .

1

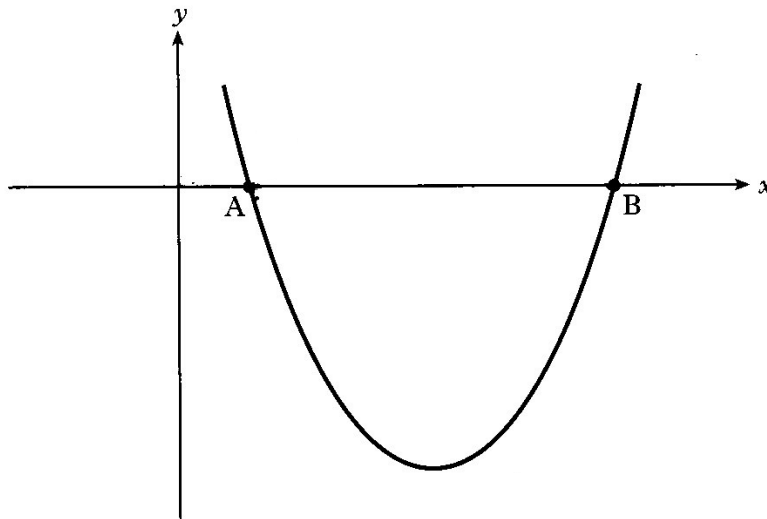
6. Write the following in order of size, **starting with the smallest**.

$\sin 0^\circ$ $\sin 30^\circ$ $\sin 200^\circ$

Give a reason for your answer.

2

7.



The equation of the parabola in the above diagram is

$$y = (x - 3)^2 - 4.$$

(a) State the coordinates of the minimum turning point of the parabola.

2

(b) State the equation of the axis of symmetry of the parabola.

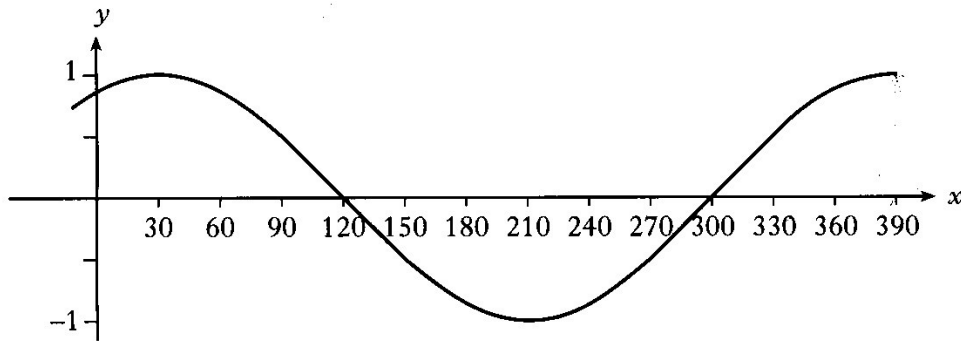
1

(c) A is the point $(1, 0)$. State the coordinates of B.

1

[Turn over for Questions 8 to 10 on Page six

8. The graph shown below has an equation of the form $y = \cos(x - a)^\circ$.



Write down the value of a .

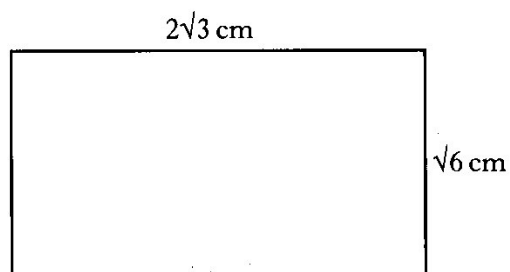
1

9. Evaluate

$$16^{\frac{3}{4}}$$

2

- 10.



The rectangle above has length $2\sqrt{3}$ centimetres and breadth $\sqrt{6}$ centimetres.

Calculate the area of the rectangle.

Express your answer as a surd in its simplest form.

3

[END OF QUESTION PAPER]

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FRIDAY, 19 MAY
2.05 PM – 3.35 PM

MATHEMATICS
INTERMEDIATE 2
Units 1, 2 and 3
Paper 2

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FORMULAE LIST

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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

1. The value of a boat decreased from £35 000 to £32 200 in one year.

(a) What was the percentage decrease?

1

(b) If the value of the boat continued to fall at this rate, what would its value be after a **further** 3 years?

Give your answer to the nearest hundred pounds.

3

2. Solve algebraically the system of equations

$$4x + 2y = 13$$

$$5x + 3y = 17.$$

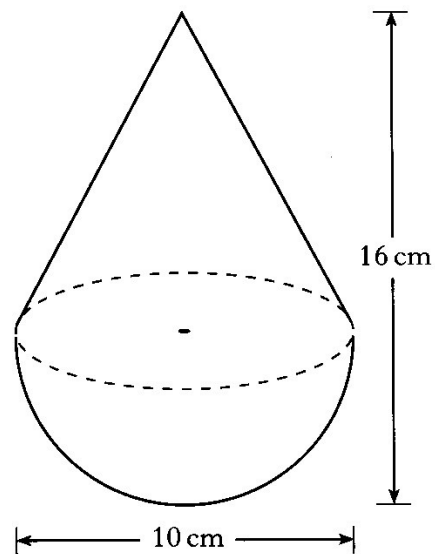
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3. A child's toy is in the shape of a hemisphere with a cone on top, as shown in the diagram.

The toy is 10 centimetres wide and 16 centimetres high.

Calculate the volume of the toy.

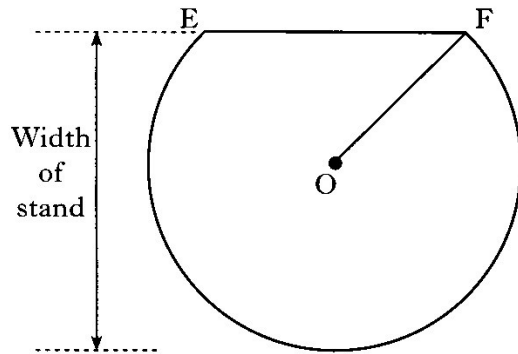
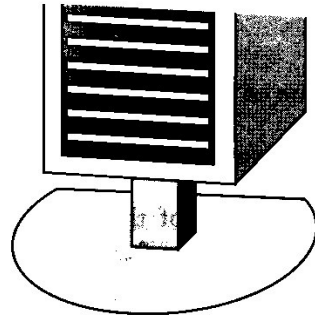
Give your answer correct to 2 significant figures.



5

[Turn over

4. The diagram shows the base of a compact disc stand which has the shape of part of a circle.



- The centre of the circle is O.
- EF is a chord of the circle.
- EF is 18 centimetres.
- The radius, OF, of the circle is 15 centimetres.

Find the width of the stand.

4

5. A new central heating system is installed in a house.
Sample temperatures, in degrees Celsius, are recorded below.

19 21 23 21 19 20

(a) For this sample data, calculate:

(i) the mean;

1

(ii) the standard deviation.

3

Show clearly all your working.

The target temperature for this house is 20 °Celsius. The system is judged to be operating effectively if the mean temperature is within 0.6 °Celsius of the target temperature **and** the standard deviation is less than 2 °Celsius.

(b) Is the system operating effectively?

Give reasons for your answer.

2

6. Factorise

$$4p^2 - 49.$$

2

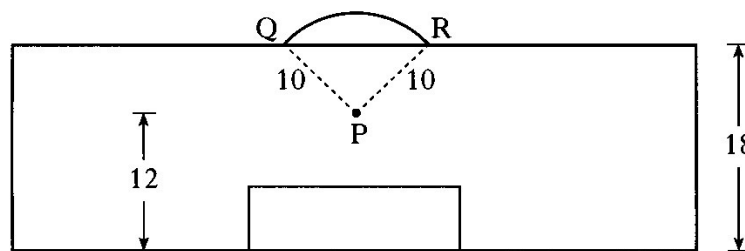
7. Express

$$\frac{3}{(x+1)} - \frac{1}{(x-2)}, \quad x \neq -1, \quad x \neq 2$$

as a single fraction in its simplest form.

3

8. The diagram shows the penalty area in a football pitch.
All measurements are given in yards.



The penalty spot is marked at point P.

QR is an arc of a circle, centre P, radius 10 yards.

The width of the penalty area is 18 yards and the distance of the penalty spot from the goal line is 12 yards, as shown.

(a) Calculate the size of angle QPR.

3

(b) Calculate the length of arc QR.

2

9. Change the subject of the formula

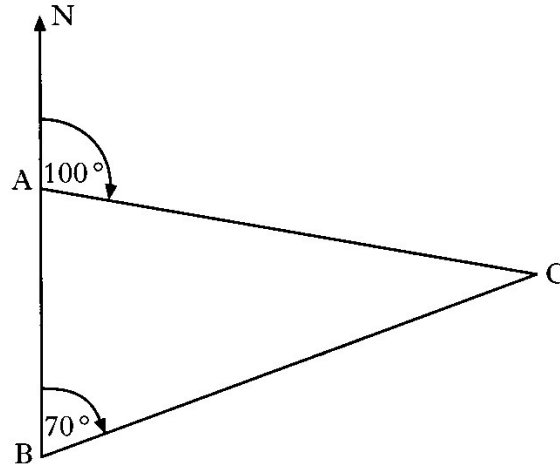
$$\frac{x}{c} + a = b$$

to x .

2

[Turn over

10. The diagram below shows the position of three campsites A, B and C.



Alan sets off from campsite A on a bearing of 100° at an average speed of 5.6 kilometres per hour.

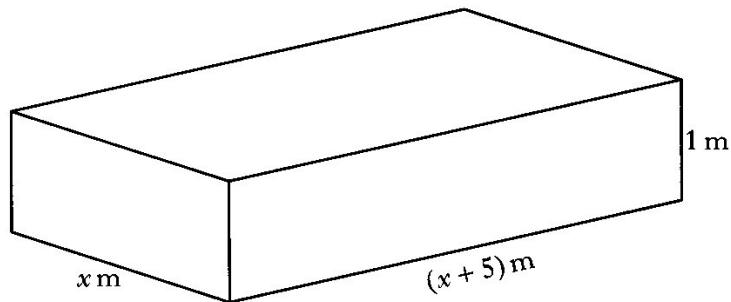
At the same time Bob sets off from campsite B on a bearing of 070° .

After 3 hours they both arrive at campsite C.

Who has the faster average speed and by how much?

5

11. A cuboid is shown below.



It has length $(x + 5)$ metres, breadth x metres, height 1 metre and volume 24 cubic metres.

- (a) Show that

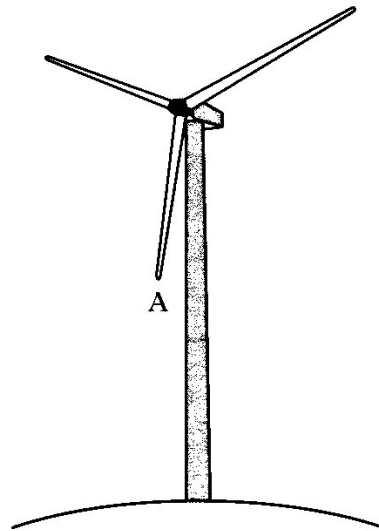
$$x^2 + 5x - 24 = 0.$$

2

- (b) Using the equation in part (a), find the breadth of the cuboid.

3

12. The arms on a wind turbine rotate at a steady rate.



The height, h metres, of a point A above the ground at time t seconds is given by the equation

$$h = 8 + 4 \sin t^\circ.$$

- (a) Calculate the height of point A at time 30 seconds. 2
- (b) Find the **two** times during the first turn of the arms when point A is at a height of 10.5 metres. 4

[END OF QUESTION PAPER]