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.

LI X100/201 6/21370

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{\left(b^2 - 4ac\right)}}{2a}$

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: Area $= \frac{1}{2}ab \sin C$

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

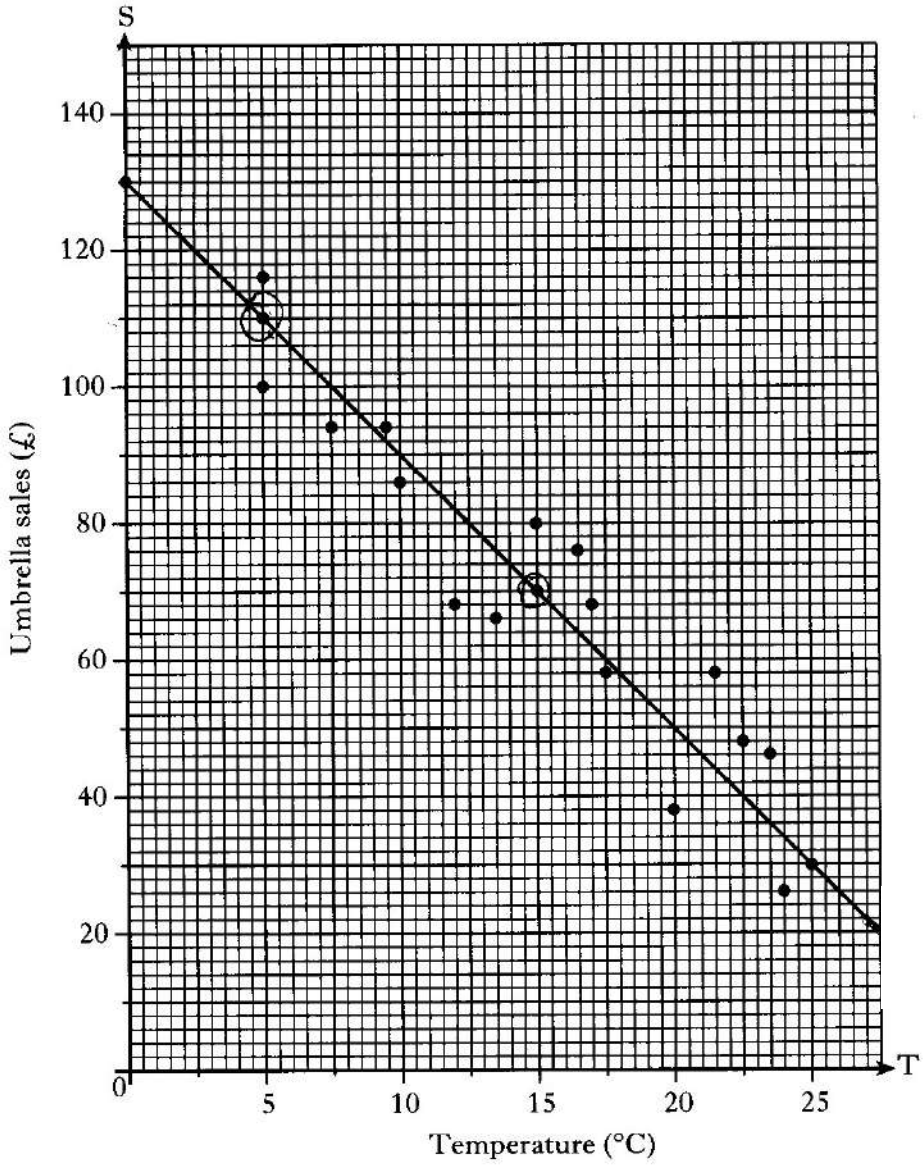
Volume of a cone: Volume $= \frac{1}{3}\pi r^2 h$

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

Standard deviation: $s = \sqrt{\dfrac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\sum x^2 - (\sum x)^2 / n}{n-1}}$, 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

Marks

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:

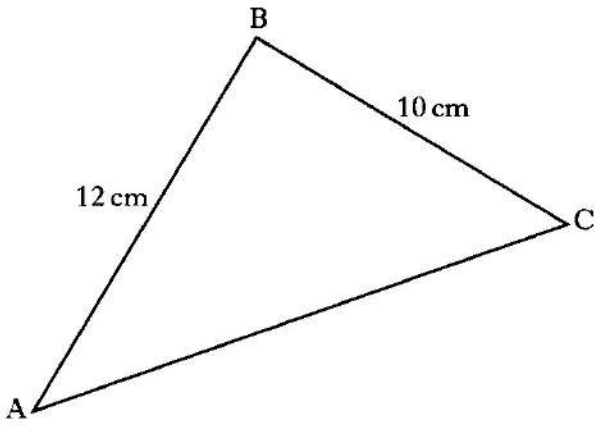
(i) the median; **1**

(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**

Marks

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

(*a*) Find the gradient of this line. **2**

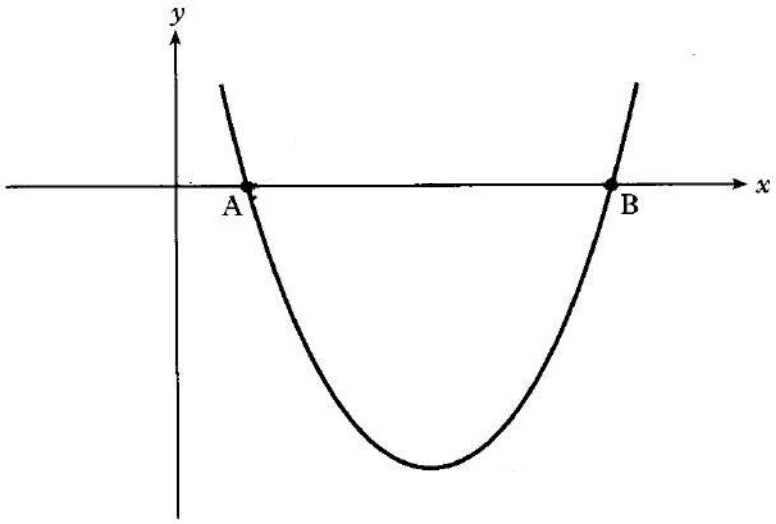
(*b*) This line crosses the y-axis at $(0, c)$.
Find the value of c. **1**

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

$\sin 0°$ $\sin 30°$ $\sin 200°$

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**

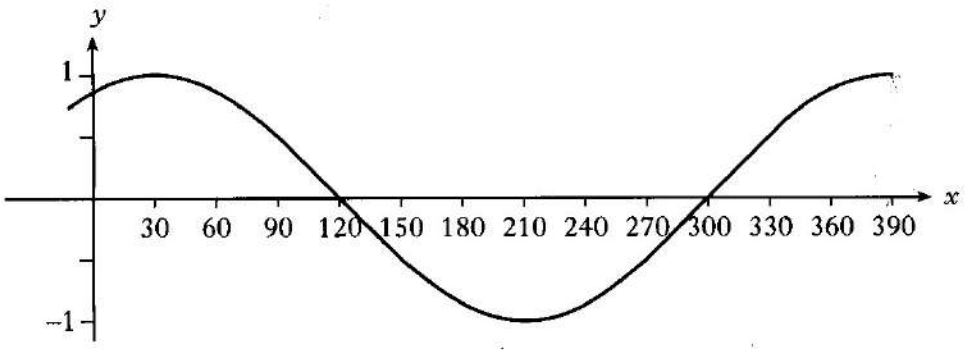
(*b*) State the equation of the axis of symmetry of the parabola. **1**

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

[Turn over for Questions 8 to 10 on *Page six*

Marks

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

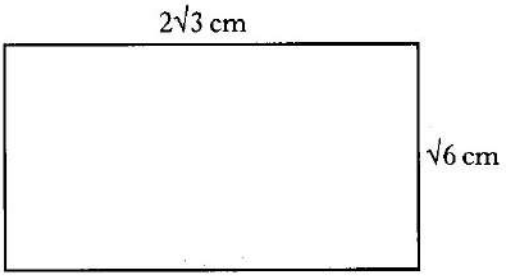


Write down the value of a. **1**

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]

X100/203

NATIONAL QUALIFICATIONS 2006

FRIDAY, 19 MAY
2.05 PM – 3.35 PM

MATHEMATICS
INTERMEDIATE 2
Units 1, 2 and 3
Paper 2

Read carefully

1 **Calculators may be used in this paper.**

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LI X100/203 6/21370

SCOTTISH QUALIFICATIONS AUTHORITY

FORMULAE LIST

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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**

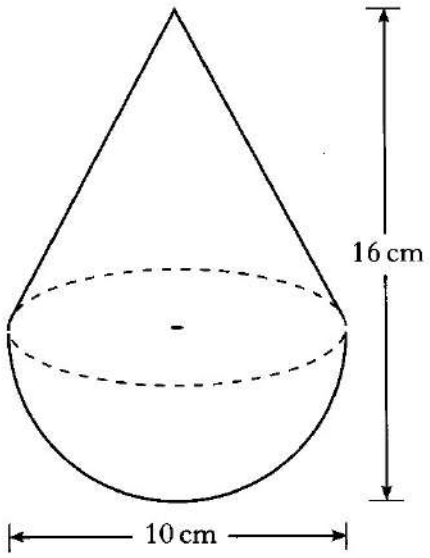
(*b*) If the value of the boat continued to fall at this rate, what would its value be after a **further** 3 years?
Give your answer to the nearest hundred pounds. **3**

2. Solve algebraically the system of equations

$$4x + 2y = 13$$

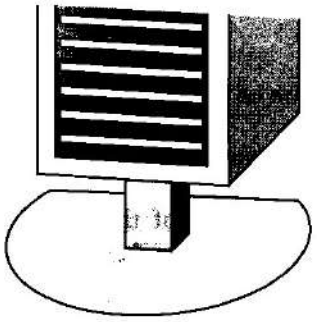
$$5x + 3y = 17.$$ **3**

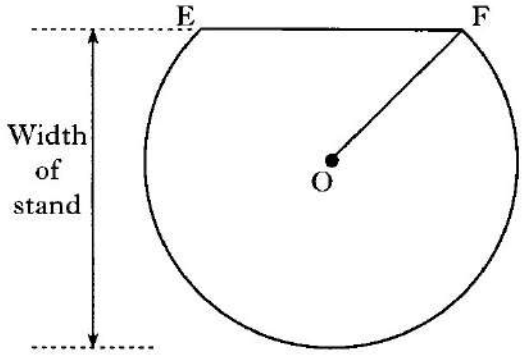
3. A child's toy is in the shape of a hemisphere with a cone on top, as shown in the diagram.
The toy is 10 centimetres wide and 16 centimetres high.
Calculate the volume of the toy.
Give your answer correct to 2 significant figures. **5**



[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**

Marks

6. Factorise

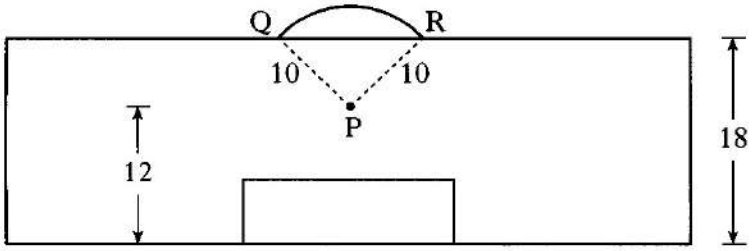
$$4p^2 - 49.$$ **2**

7. Express

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

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

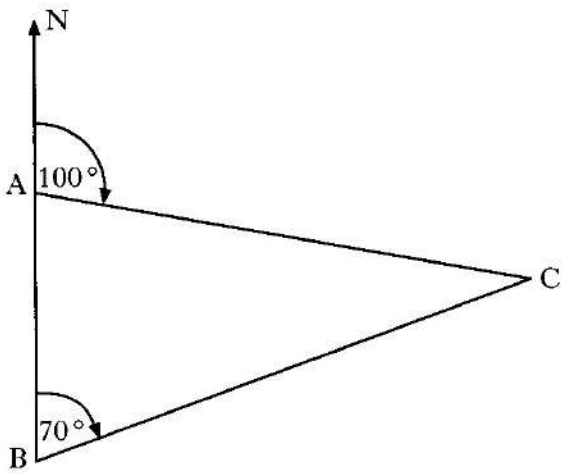
$$\frac{x}{c} + a = b$$

to x. **2**

[Turn over

Marks

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



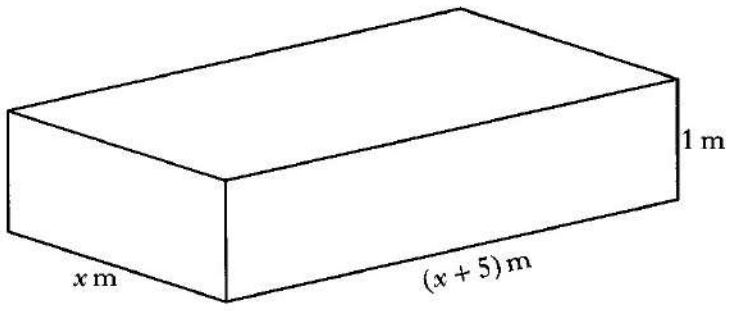
Alan sets off from campsite A on a bearing of 100° at an average speed of 5·6 kilometres per hour.

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.

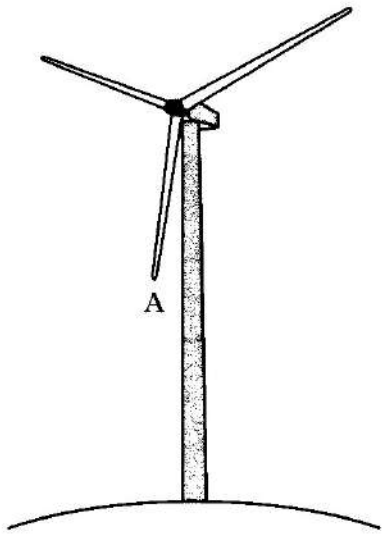
(*a*) Show that

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

(*b*) Using the equation in part (*a*), find the breadth of the cuboid. **3**

Marks

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

$$h = 8 + 4 \sin t°.$$

(*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]