X100/201

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 $x = \dfrac{-b \pm \sqrt{\left(b^2 - 4ac\right)}}{2a}$

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

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: $s = \sqrt{\dfrac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\sum x^2 - (\sum x)^2 / n}{n-1}}$, where n is the sample size.
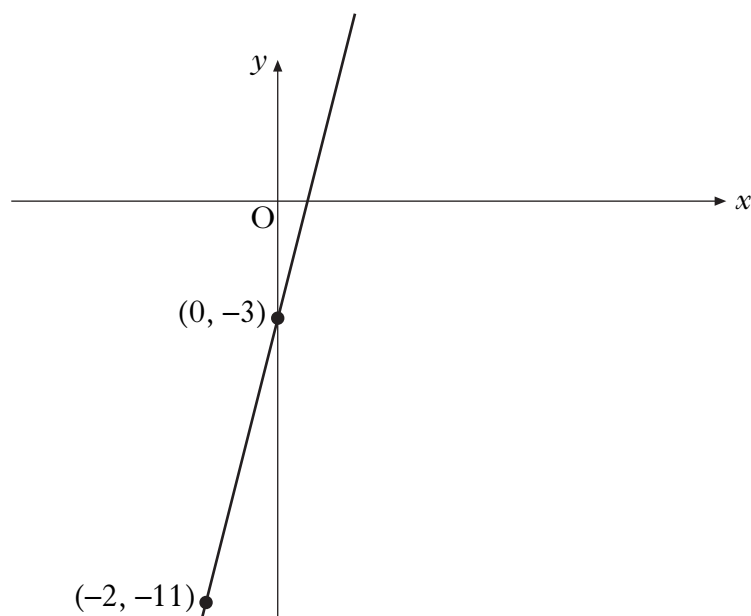
ALL questions should be attempted.

1. The table below shows the results of a survey of First Year pupils.

	Wearing a blazer	*Not wearing a blazer*
Boys	40	22
Girls	29	9

What is the probability that a pupil, chosen at random from this sample, will be a girl wearing a blazer? **1**
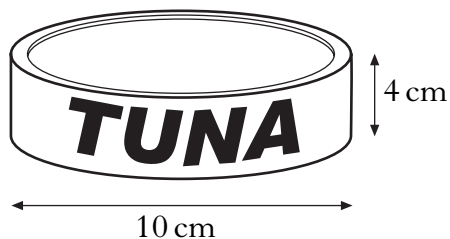
2.

Find the equation of the straight line passing through the points (0, −3) and (−2, −11). **3**

[Turn over

3. A tin of tuna is in the shape of a cylinder.

It has diameter 10 centimetres and height 4 centimetres.

Calculate its volume.

Take π = 3·14. **2**

4. Find the point of intersection of the straight lines with equations $x + 2y = -5$ and $3x - y = 13$. **4**

5. Multiply out the brackets and collect like terms.
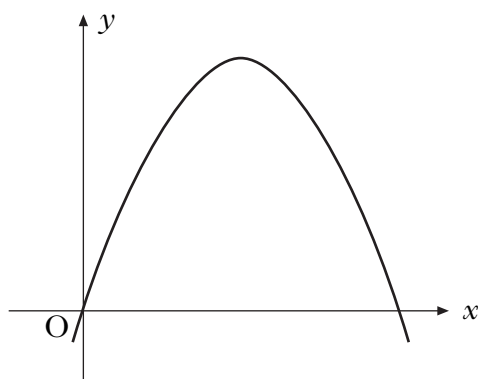
$$(x + 3)(x^2 + 4x - 12)$$ **3**

6. (*a*) Show that the standard deviation of 1, 1, 1, 2 and 5 is equal to $\sqrt{3}$. **3**

(*b*) **Write down** the standard deviation of 101, 101, 101, 102 and 105. **1**

7. The graph shown below is part of the parabola with equation $y = 8x - x^2$.

(*a*) By factorising $8x - x^2$, find the roots of the equation

$$8x - x^2 = 0.$$ **2**

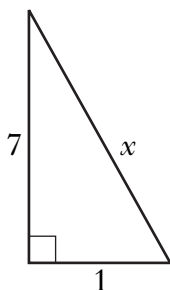(*b*) State the equation of the axis of symmetry of the parabola. **1**

(*c*) Find the coordinates of the turning point. **2**

8. Given that

$$\cos 60° = 0 \cdot 5,$$

what is the value of $\cos 240°$? **1**

9. A right-angled triangle is shown below.

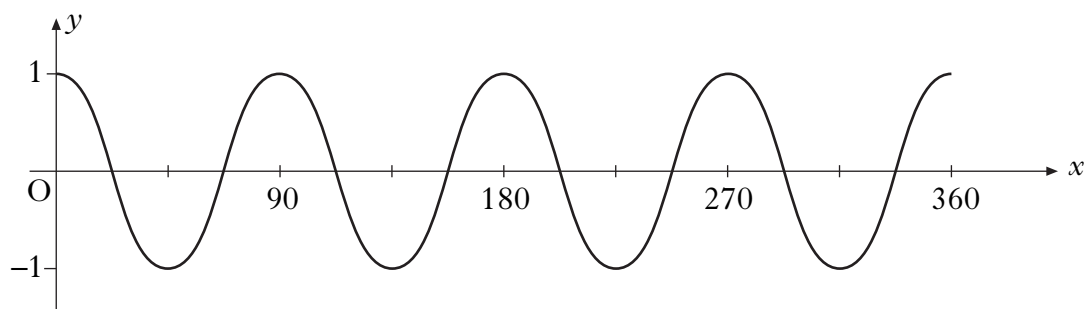
Using Pythagoras' Theorem, find x.
Express your answer as a surd in its simplest form. **3**
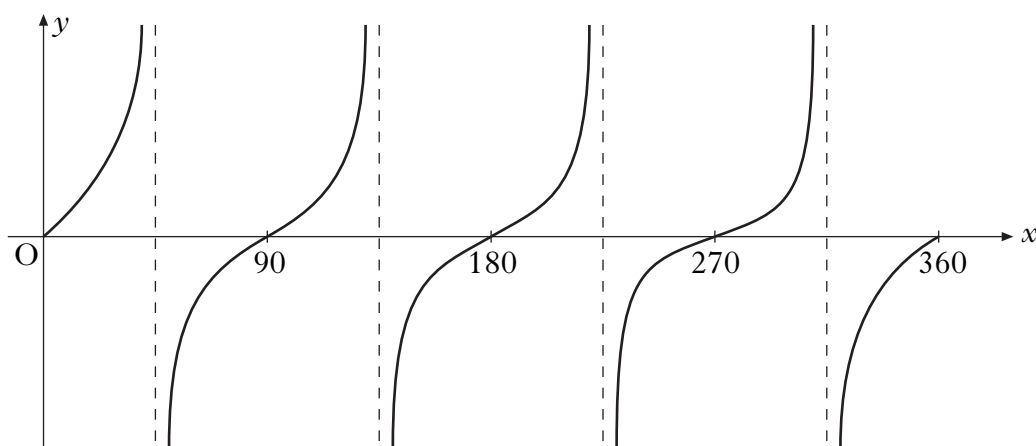
[Turn over for Questions 10 and 11 on *Page six*

10. (*a*) Part of the graph of $y = \cos ax°$ is shown below.

State the value of *a*. **1**

(*b*) Part of the graph of $y = \tan bx°$ is shown below.

State the value of *b*. **1**

11. A straight line is represented by the equation $y = ax + b$.

Sketch a possible straight line graph to illustrate this equation when $a = 0$ and $b > 0$. **2**

[*END OF QUESTION PAPER*]

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Read carefully

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FORMULAE LIST

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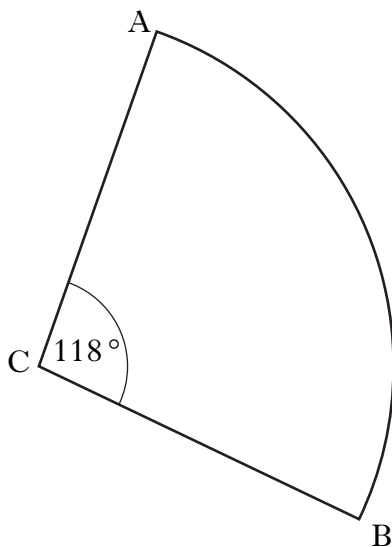
ALL questions should be attempted.

1. Ian's annual salary is £28 400. His boss tells him that his salary will increase by 2·3% per annum.

What will Ian's annual salary be after 3 years?

Give your answer to the nearest pound. **3**

2. The diagram below shows a sector of a circle, centre C.

The radius of the circle is 10·5 centimetres and angle ACB is 118°.

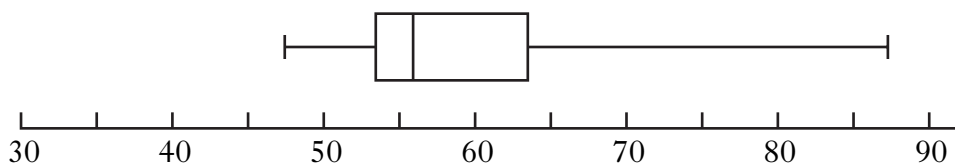Calculate the length of arc AB. **3**

[Turn over

3. This back-to-back stem and leaf diagram shows the results for a class in a recent mathematics examination.

Girls		Boys
1	3	
9	4	7 9
8 7 4 3 2 2	5	2 3 4 4 6 6 7 9
9 4	6	3
9 6 3	7	4 8
8 1	8	7

n = 15   n = 14

Key
3 | 7 | represents 73%
   | 8 | 7   represents 87%

(*a*) A boxplot is drawn to represent one set of data.

Does the boxplot above represent the girls' data or the boys' data?
Give a reason for your answer.   **1**

(*b*) For the **other** set of data, find:
 (i)   the median;   **1**
 (ii) the lower quartile;   **1**
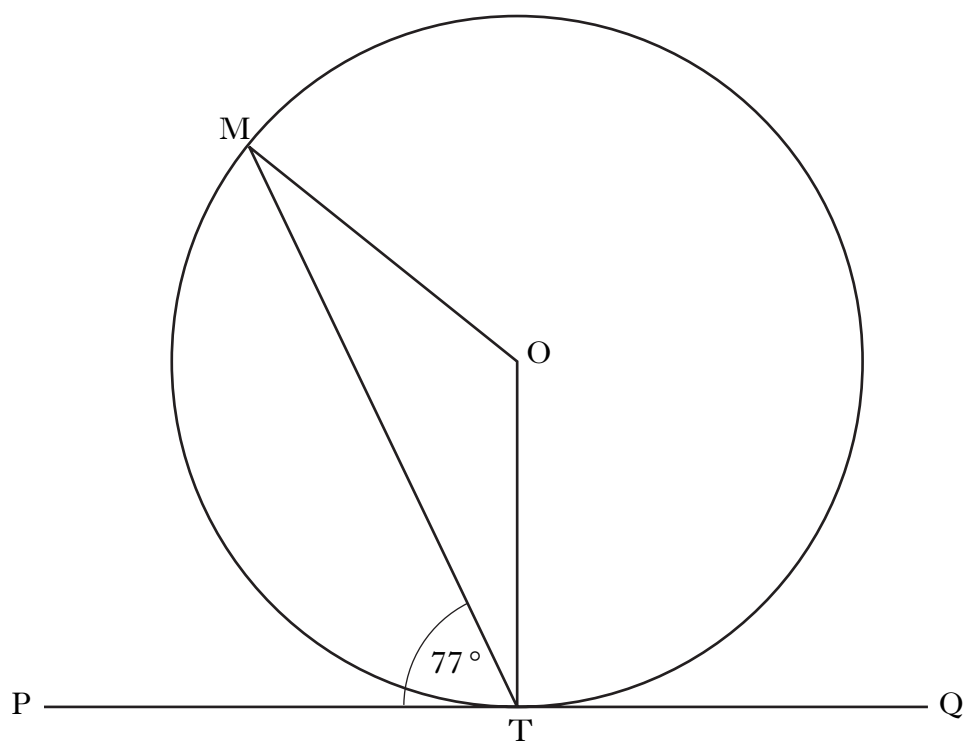 (iii) the upper quartile.   **1**

(*c*) Use the answers found in part (*b*) to construct a second boxplot.   **2**

(*d*) Make an appropriate comment about the distribution of data in the two sets.   **1**

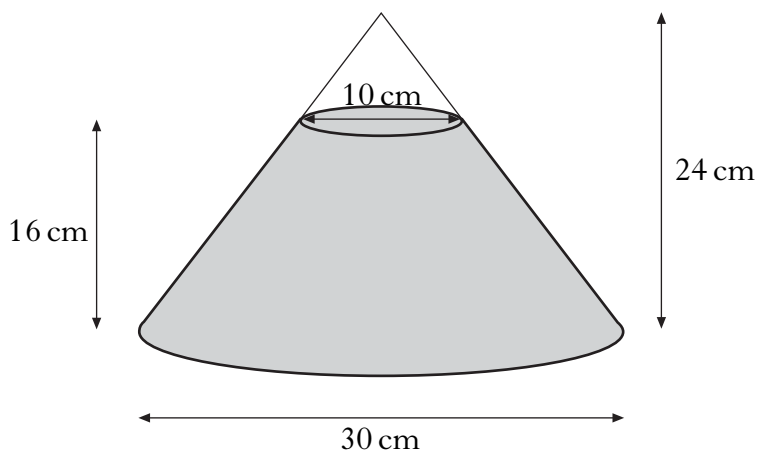**4.**

The tangent PQ touches the circle, centre O, at T.
Angle MTP is 77°.

(*a*) Calculate the size of angle MOT. **2**

(*b*) The radius of the circle is 8 centimetres.
Calculate the length of chord MT. **3**

[Turn over

5. A glass ornament in the shape of a cone is partly filled with coloured water.

The cone is 24 centimetres high and has a base of diameter 30 centimetres.

The water is 16 centimetres deep and measures 10 centimetres across the top.

What is the volume of the water?

Give your answer correct to 2 significant figures. **5**

6. Tasnim rolls a standard dice with faces numbered 1 to 6.

The probability that she gets a number less than 7 is

        A   0

        B $\frac{1}{7}$

        C $\frac{1}{6}$

        D   1.

Write down the letter that corresponds to the correct probability. **1**

7. (*a*) Factorise **fully**

$$2x^2 - 18.$$ **2**

(*b*) Simplify

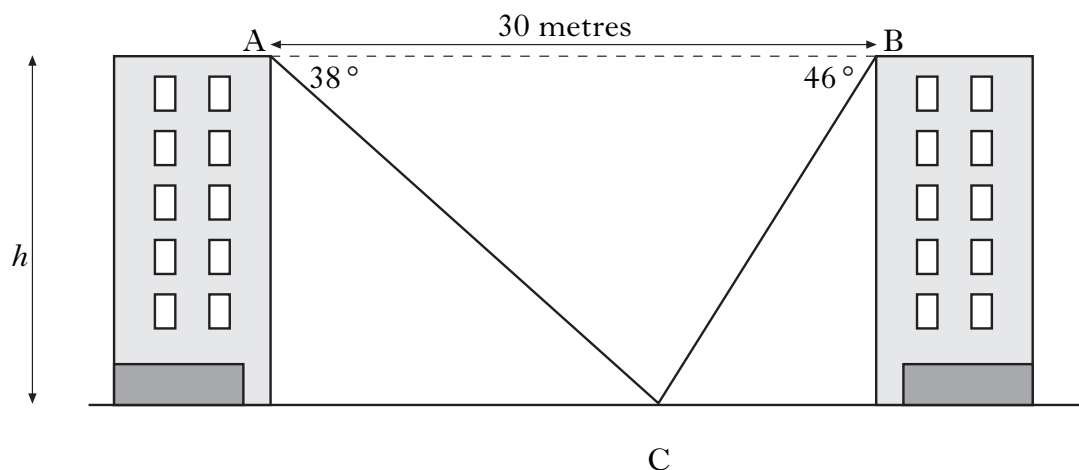$$\frac{(2x+5)^2}{(2x-1)(2x+5)}.$$

1

8. Solve the equation

$$2x^2 - 6x - 5 = 0,$$

giving the roots correct to one decimal place.

4

9. The diagram shows two blocks of flats of equal height.

A and B represent points on the top of the flats and C represents a point on the ground between them.

To calculate the height, h, of each block of flats, a surveyor measures the angles of depression from A and B to C.

From A, the angle of depression is $38°$.
From B, the angle of depression is $46°$.
The distance AB is 30 metres.

Calculate the height, h, in metres.

5

10. Express $\dfrac{5p^2}{8} \div \dfrac{p}{2}$ as a fraction in its simplest form.

3

11. Change the subject of the formula

$$K = \frac{m^2 n}{p}$$

to m.

3

[Turn over for Questions 12, 13 and 14 on *Page eight*

12. Simplify the expression below, giving your answer with a positive power.
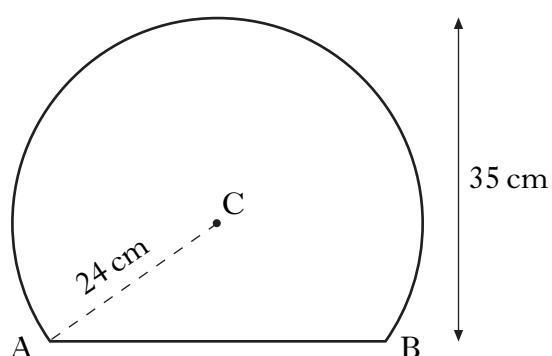
$$m^5 \times m^{-8}$$

2

13. Solve the equation

$$5 \tan x° - 6 = 2, \qquad 0 \le x < 360.$$

3

14. A mirror is shaped like part of a circle.

The radius of the circle, centre C, is 24 centimetres.
The height of the mirror is 35 centimetres.

Calculate the length of the base of the mirror, represented in the diagram by AB.

3

[*END OF QUESTION PAPER*]