X100/11/01

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

Read carefully

1 **You may <u>NOT</u> use a calculator.**

2 Full credit will be given only where the solution contains appropriate working.

3 Square-ruled paper is provided. If you make use of this, you should write your name on it clearly and put it inside your answer booklet.

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FORMULAE LIST

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

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 $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

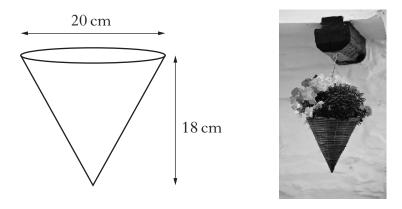Area of a triangle: $\text{Area} = \frac{1}{2}ab \sin C$

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. *Marks*

1. Multiply out the brackets and collect like terms.

$$(2x + 6)(5x - 3) + 9x$$ **3**

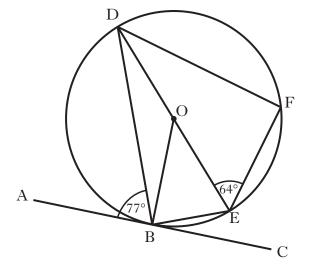**2.** A hanging basket is in the shape of a cone.

20 cm

18 cm

The diameter is 20 centimetres and the height is 18 centimetres.

Calculate the volume of the hanging basket.
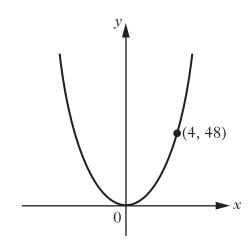
Take π = 3·14. **2**

[Turn over

3.

AC is a tangent to the circle, centre O, with point of contact B.

DE is a diameter of the circle and F is a point on the circumference.

Angle ABD is 77° and angle DEF is 64°.

Calculate the size of angle BDF. **3**

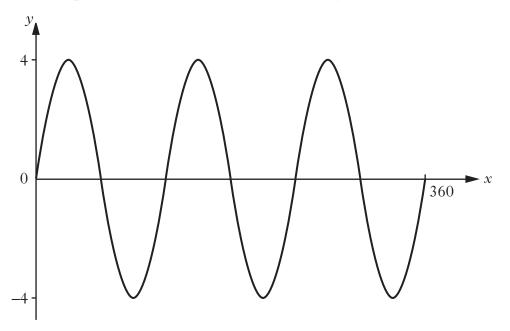**4.** The diagram below shows the graph with equation $y = kx^2$ passing through the point (4, 48).

Find the value of k. **2**

5. The standard deviation of 1, 2, 2, 2, 8 is equal to $\sqrt{a}$.
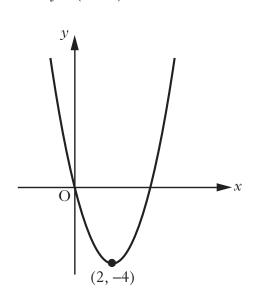
Find the value of a. **3**

6. Part of the graph of $y = a \sin bx°$ is shown in the diagram.

State the values of *a* and *b*.

2

7. The graph below shows part of the parabola with equation of the form

$$y = (x + a)^2 + b.$$

(2, −4)

The minimum turning point (2, −4) is shown in the diagram.

(*a*) State the values of:

    (i) *a*

1

    (ii) *b*.

1

(*b*) Write down the equation of the axis of symmetry of the graph.

1

8. Using **graphical** means, solve the system of equations:

$$y = 2x + 5$$

$$y = 3x + 6.$$

Use the squared paper provided. **3**

9. Write the following in order of size starting with the smallest.

cos 90°   cos 100°   cos 300°

Justify your answer. **2**

10. Express $\sqrt{45} + 6\sqrt{5} - \sqrt{20}$ as a surd in its simplest form. **3**

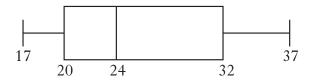**11**. A straight line is represented by the equation $y = mx + c$.

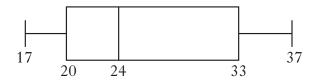Sketch a possible straight line graph to illustrate this equation when $m < 0$ and $c > 0$. **2**

12. A book club has **seven** members.

The ages of the members have been used to construct the following boxplot.

After an **eighth** member joins the club, a new boxplot is drawn.

This boxplot is shown below.

What age is the eighth member? **2**

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ACKNOWLEDGEMENT

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MATHEMATICS
INTERMEDIATE 2
Units 1, 2 and 3
Paper 2

Read carefully

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FORMULAE LIST

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

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

1. A house is valued at £240 000. Its value is predicted to rise by 2·8% per annum.

   Calculate its predicted value after 2 years.　　**3**

2. The number of visitors to **Farrhill Museum** is recorded daily over a three week period. The results are shown in the stem and leaf diagram below.

3	2	7				
4	3	6	6	7		
5	0	4	5	8	8	9
6	2	5	7	8		
7	0	2	2	5		
8	5					

   $n = 21$　　4|3 represents 43 visitors.

   (a) What is the probability that on any given day in this three week period there were more than 70 visitors to Farrhill Museum?　　**1**

   (b) For the given data, calculate:

   　(i)　the median;　　**1**

   　(ii)　the lower quartile;　　**1**

   　(iii)　the upper quartile.　　**1**

   In the same three week period, the number of visitors to **Farrhill Castle** is recorded daily. For this data the semi-interquartile range is found to be 5.
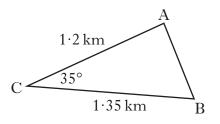
   (c) Make an appropriate comment comparing the distribution of visitors to the museum and the castle.　　**2**
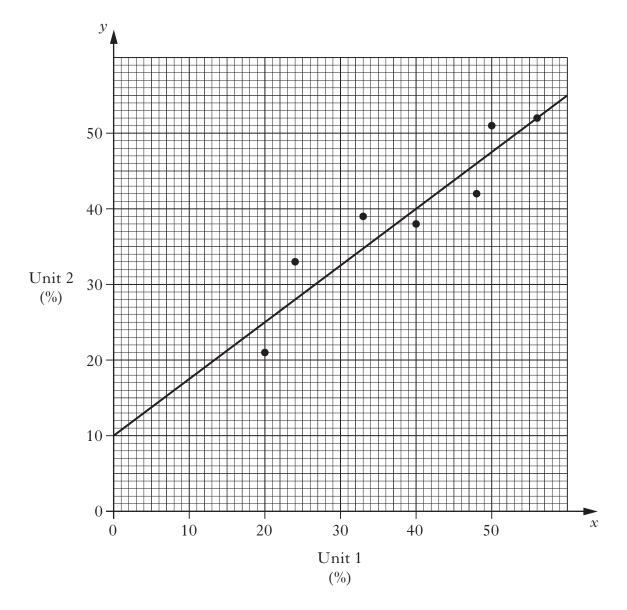
   [Turn over

3. Triangle ABC is shown below. *Marks*

Calculate the length of AB. **3**

4. The marks of a group of students in the Unit 1 and Unit 2 tests of their Intermediate 2 Mathematics course are shown in the scattergraph below.
A line of best fit has been drawn.

(*a*) Find the equation of this line of best fit. **3**

(*b*) Another student scored 80% in the Unit 1 test.
Use your answer to part (*a*) to predict her mark in the Unit 2 test. **1**

5. Express
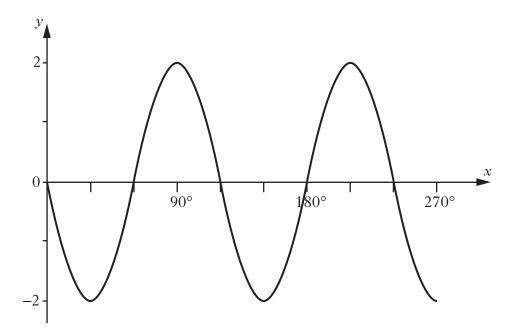
$$\frac{5t}{s} \div \frac{t}{2s^2}$$

in its simplest form. **3**

6. Change the subject of the formula

$$A = \tfrac{1}{2}(b+c)d \quad \text{to } b.$$

3

7. Simplify $\dfrac{5p^7 \times 4p^{-2}}{2p}$. **3**

8. Part of the graph of a trigonometric function is shown below.

State the period, in degrees, of this function. **1**

[Turn over

9. Solve the equation
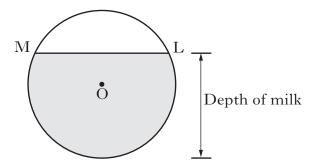
$$3 \tan x° - 2 = 4, \quad 0 \le x < 360.$$ **3**

10. A mug in the shape of a cylinder has a volume of 400 cubic centimetres.

Its diameter is 7·6 centimetres.

Calculate the height of the mug, giving your answer correct to one decimal place. **3**

11. A straight line has equation $2y + 3x = 12$.

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

(*b*) The line crosses the *y*-axis at $(0, c)$.

Find the value of *c*. **1**

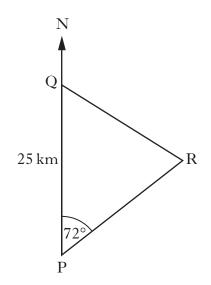12. The diagram below shows the circular cross-section of a milk tank.

The radius of the circle, centre O, is 1·2 metres.

The width of the surface of the milk in the tank, represented by ML in the diagram, is 1·8 metres.

Calculate the depth of the milk in the tank. **4**

13. In the diagram below P, Q and R represent the positions of Portlee, Queenstown and Rushton respectively.

Portlee is 25 kilometres due South of Queenstown.

From Portlee, the bearing of Rushton is 072°.

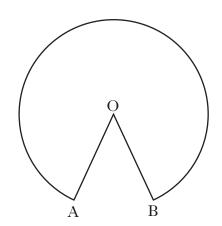From Queenstown, the bearing of Rushton is 128°.

Calculate the distance between Portlee and Rushton.

Do not use a scale drawing.　　　　　　　　　　　　　　　　　　**4**

14. Find the roots of the equation

$$2x^2 + 9x - 5 = 0.$$　　　　　　　　　　**3**

15. The diagram below shows part of a circle, centre O.

The radius of the circle is 6·4 centimetres.

Major arc AB has length 34·6 centimetres.

Calculate the size of reflex angle AOB.　　　　　　　　　　**4**

[*END OF QUESTION PAPER*]

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