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

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

Volume of a sphere: Volume $= \frac{4}{3} \pi r^3$
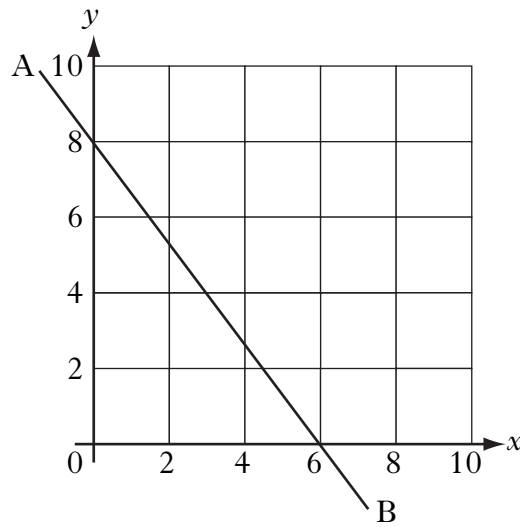
Volume of a cone: Volume $= \frac{1}{3} \pi r^2 h$

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.

Find the equation of the straight line AB shown in the diagram. **3**

2. The pupils in a primary class record their shoe sizes as shown below.

8	7	6	5	6
5	7	11	7	7
7	8	7	9	6
8	6	5	9	7

(*a*) Construct a frequency table from the above data and add a cumulative frequency column. **2**

(*b*) For this data, find:

  (i) the median; **1**

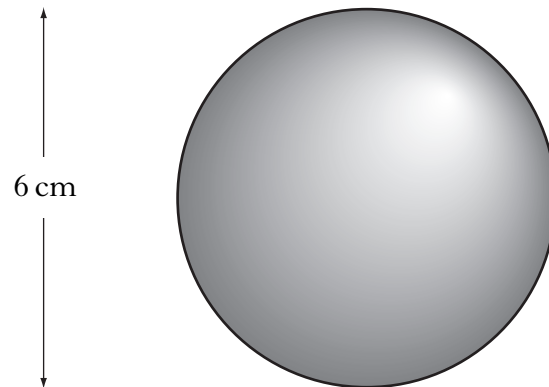 (ii) the lower quartile; **1**

  (iii) the upper quartile. **1**

(*c*) Construct a boxplot for this data. **2**

[Turn over

3. The diagram below represents a sphere.

6 cm

The sphere has a diameter of 6 centimetres.

Calculate its volume.

Take π = 3·14. **2**

4. (*a*) Factorise
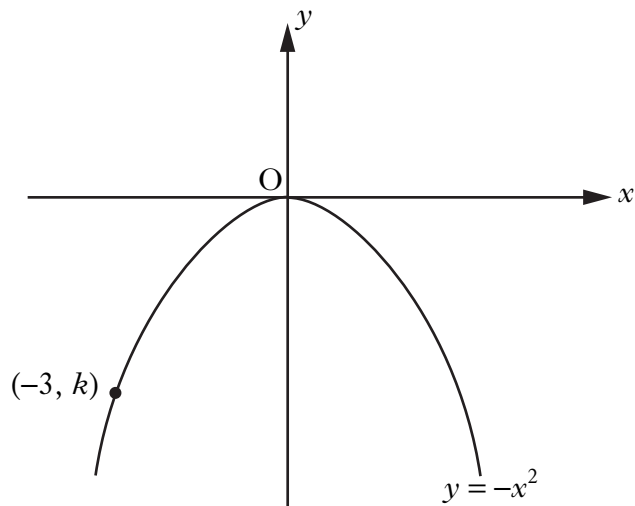
$$x^2 + x - 6.$$ **2**

(*b*) Multiply out the brackets and collect like terms.

$$(3x + 2)(x^2 + 5x - 1)$$ **3**

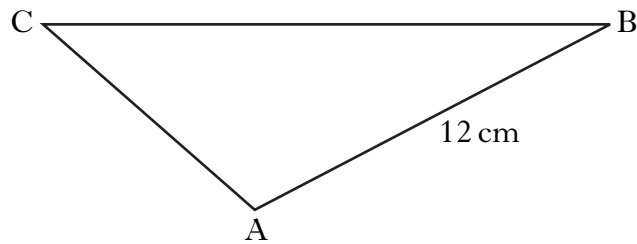**5.** The diagram below shows the graph of $y = -x^2$.

The point $(-3, k)$ lies on the graph.

Find the value of k.

6.

In triangle ABC, AB = 12 centimetres, $\sin C = \frac{1}{2}$ and $\sin B = \frac{1}{3}$.

Find the length of side AC.

[Turn over

7. Express

$$p^3(p^2 - p^{-3})$$

in its simplest form. **2**

8. Maria has been asked to find the roots of the equation

$$x^2 + 3x + 5 = 0.$$

She decides to use the quadratic formula

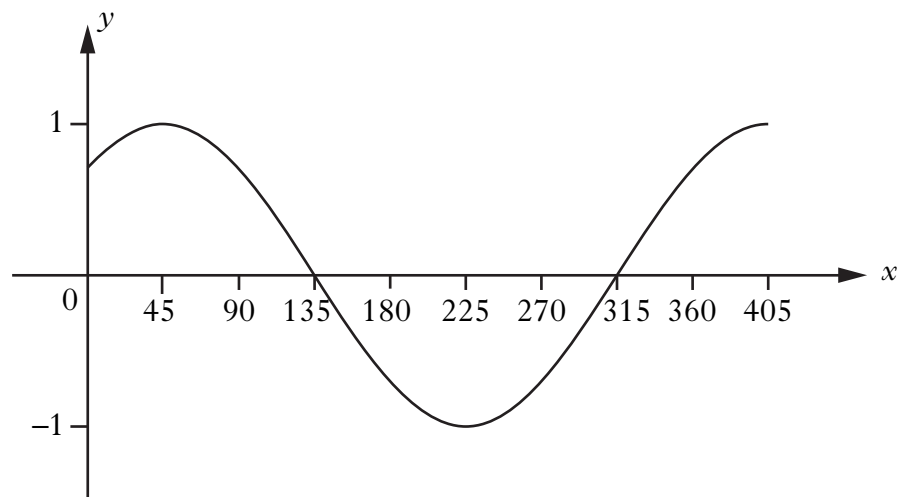$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}.$$

(*a*) Calculate the value of $b^2 - 4ac$. **1**
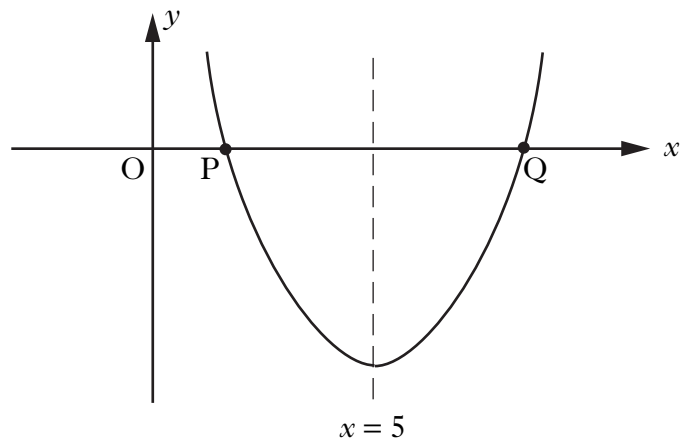
(*b*) Now explain why Maria cannot find the roots. **1**

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

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

10. The graph below shows part of a parabola with equation of the form $y = (x + a)^2 + b$.

The equation of the axis of symmetry of the parabola is $x = 5$.

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

(*b*)   P is the point (2, 0). State the coordinates of Q.   **1**

(*c*)   Calculate the value of *b*.   **2**

[END OF QUESTION PAPER]

X100/203

MATHEMATICS
INTERMEDIATE 2
Units 1, 2 and 3
Paper 2

Read carefully

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

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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: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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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. An industrial machine costs £176 500.

   Its value depreciates by 4·25% each year.

   How much is it worth after 3 years?

   Give your answer correct to **three** significant figures. **4**

2. Paul conducts a survey to find the most popular school lunch.

   - 30 pupils vote for Pasta
   - 40 pupils vote for Baked Potato
   - 2 pupils vote for Salad

   Paul wishes to draw a pie chart to illustrate his data. How many degrees must he use for each sector in his pie chart?

   Do not draw the pie chart. **2**

3. The scattergraph shows the taxi fare, p pounds, plotted against the distance travelled, m miles. A line of best fit has been drawn.

   Taxi fare (pounds)

   Distance travelled (miles)
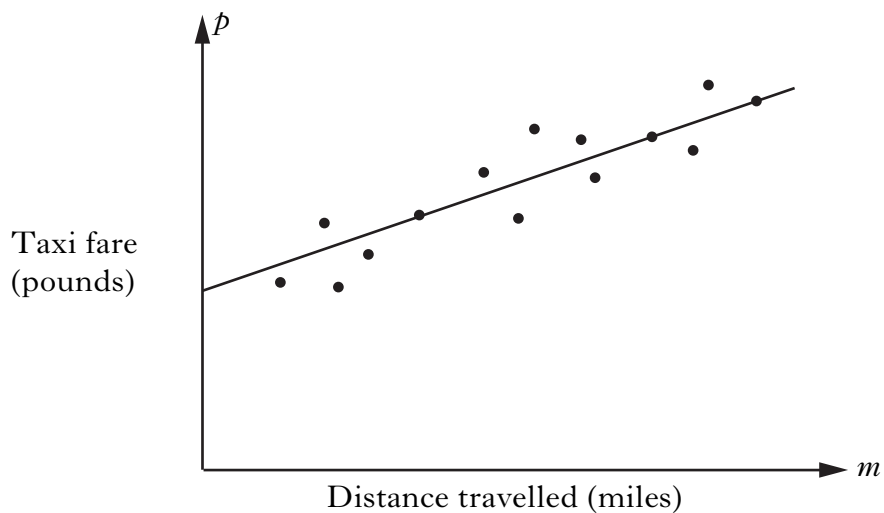
   The equation of the line of best fit is $p = 2 + 1·5\,m$.

   Use this equation to predict the taxi fare for a journey of 6 miles. **1**

   [Turn over

4. A rugby team scored the following points in a series of matches.

$$13 \quad 7 \quad 0 \quad 9 \quad 7 \quad 8 \quad 5$$

    (*a*)   For this sample, calculate:

       (i) the mean;   **1**

      (ii) the standard deviation.   **3**

    Show clearly all your working.

The following season, the team appoints a new coach.

A similar series of matches produces a mean of 27 and a standard deviation of 3·25.

    (*b*)   Make two valid comparisons about the performance of the team under the new coach.   **2**

5. Solve algebraically the system of equations

$$2x - 5y = 24$$
$$7x + 8y = 33.$$

        3

6. Express

$$\frac{s^2}{t} \times \frac{3t}{2s}$$

as a fraction in its simplest form.   **2**

7. Change the subject of the formula

$$P = 2(L + B)$$

to L.   **2**

8. Express

$$\sqrt{63} + \sqrt{28} - \sqrt{7}$$
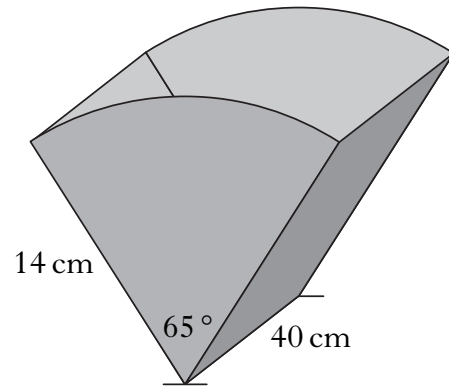
as a surd in its simplest form. **3**

9. The ends of a magazine rack are identical.

Each end is a sector of a circle with radius 14 centimetres.
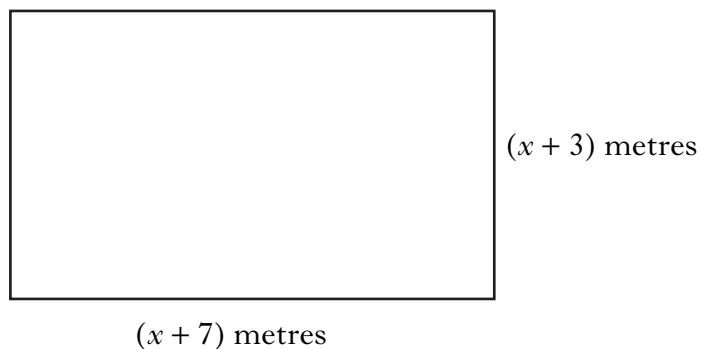The angle in each sector is 65 °.

The sectors are joined by two rectangles, each with length 40 centimetres.

The exterior is covered by material.
What area of material is required? **4**

14 cm

65 °

40 cm

10. The diagram below represents a rectangular garden with length $(x + 7)$ metres and breadth $(x + 3)$ metres.

$(x + 3)$ metres

$(x + 7)$ metres

(*a*) Show that the area, A square metres, of the garden is given by
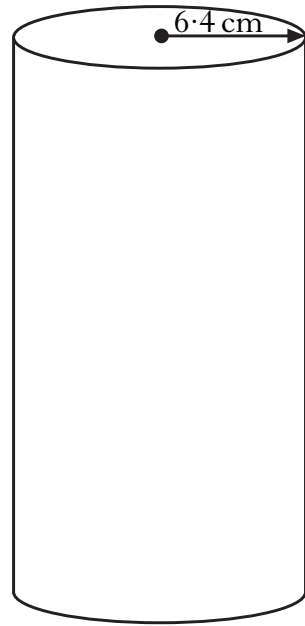
$$A = x^2 + 10x + 21.$$ **2**

(*b*) The area of the garden is 45 square metres. Find x.

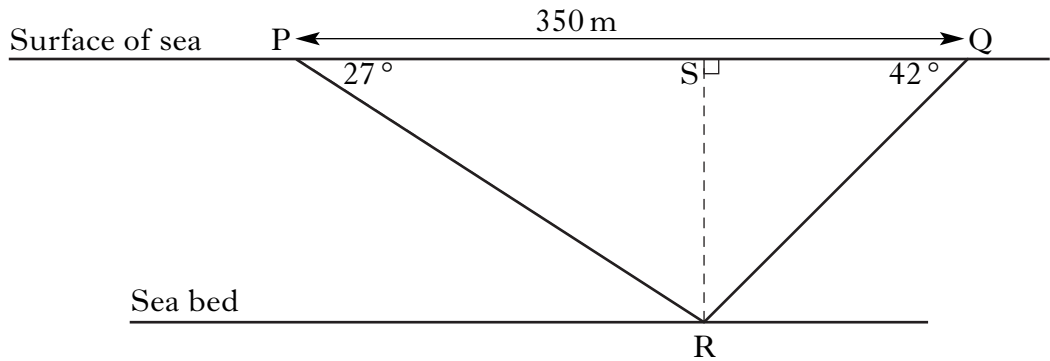**Show clearly all your working.** **4**

11. A cylindrical container has a volume of 3260 cubic centimetres.

The radius of the cross section is 6·4 centimetres.

Calculate the height of the cylinder.

12. Two ships have located a wreck on the sea bed.

In the diagram below, the points P and Q represent the two ships and the point R represents the wreck.
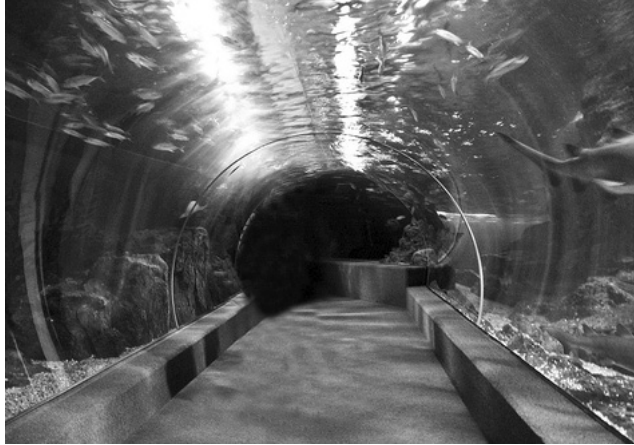
The angle of depression of R from P is 27°.
The angle of depression of R from Q is 42°.
The distance PQ is 350 metres.

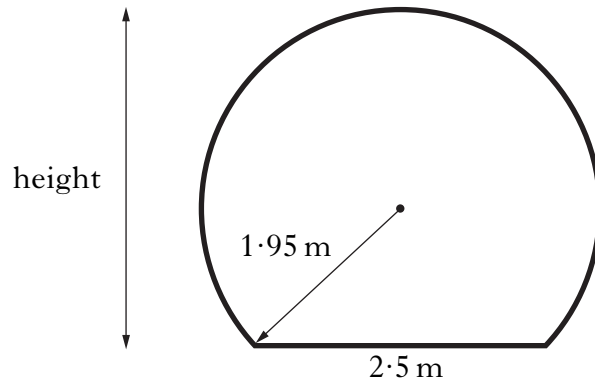Calculate QS, the distance ship Q has to travel to be directly above the wreck.

Do not use a scale drawing.

13. Ocean World has an underwater viewing tunnel.

The diagram below shows the cross-section of the tunnel. It consists of part of a circle with a horizontal base.

The radius of the circle is 1·95 metres and the width of the base is 2·5 metres.
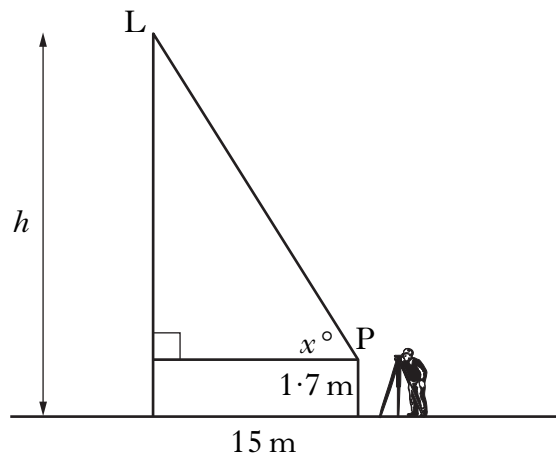
Calculate the height of the tunnel. **4**

[Turn over for Question 14 on *Page eight*

14. A surveyor views a lift as it travels up the outside of a building.

In the diagram below, the point L represents the lift.

The height, *h* metres, of the lift above the ground is given by the formula

$$h = 15 \tan x° + 1·7,$$

where $x°$ is the angle of elevation of the lift from the surveyor at point P.

(*a*) What is the height of the lift above the ground when the angle of elevation from P is 25 °? **2**

(*b*) What is the angle of elevation at point P when the height of the lift above the ground is 18·4 metres? **3**

[*END OF QUESTION PAPER*]