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.

SQA

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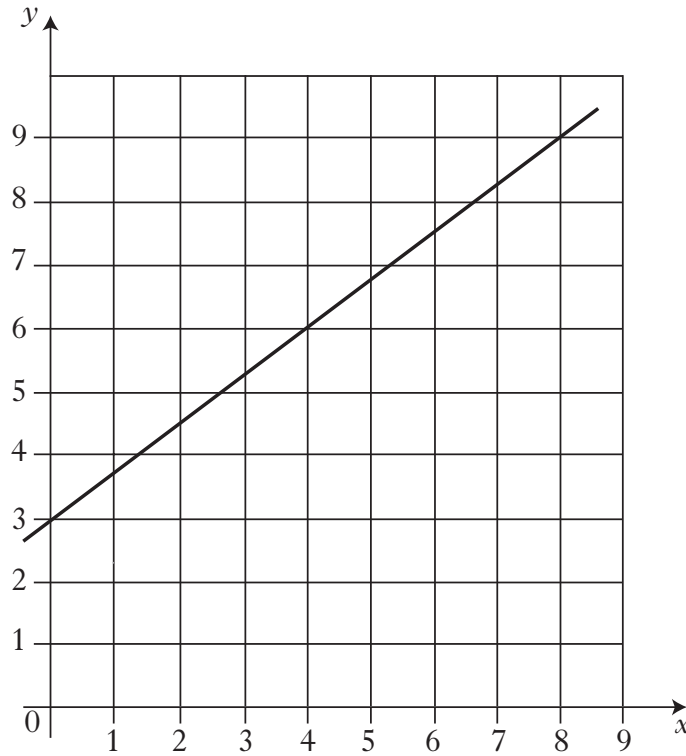
Volume of a cone: Volume $= \frac{1}{3} \pi r^2 h$

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

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

1.

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

2. Multiply out the brackets and collect like terms.

$$(3x + 2)(x - 5) + 8x$$ **3**

[Turn over

3.

P

5cm

Q

7 cm

R
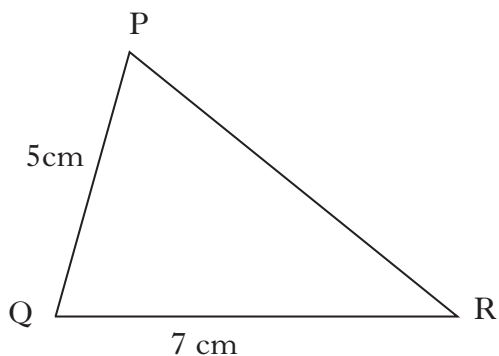
In triangle PQR, PQ = 5 centimetres, QR = 7 centimetres and $\cos Q = \dfrac{1}{5}$.

Calculate the length of side PR.

Give your answer in the form $\sqrt{a}$. **3**

4. At a ski resort the temperature, in degrees Celsius, was recorded each day at noon for the first fortnight in February 2013.

$$0 \quad -1 \quad 2 \quad -5 \quad 4 \quad 2 \quad -3 \quad 1 \quad -4 \quad 8 \quad -6 \quad 4 \quad -2 \quad 1$$

(*a*) Calculate:

   (i) the median temperature; **1**

   (ii) the lower quartile; **1**
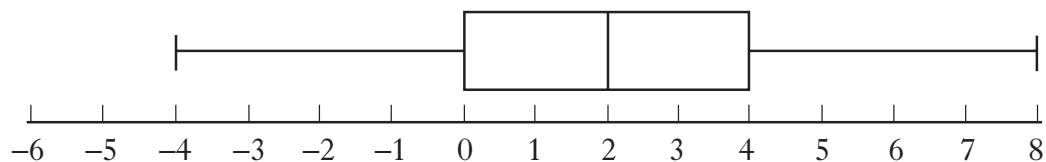
   (iii) the upper quartile. **1**

(*b*) Use the above data to construct a boxplot. **2**

(*c*) The temperature, in degrees Celsius, was recorded at the same ski resort each day at noon for the first fortnight in February 2014.

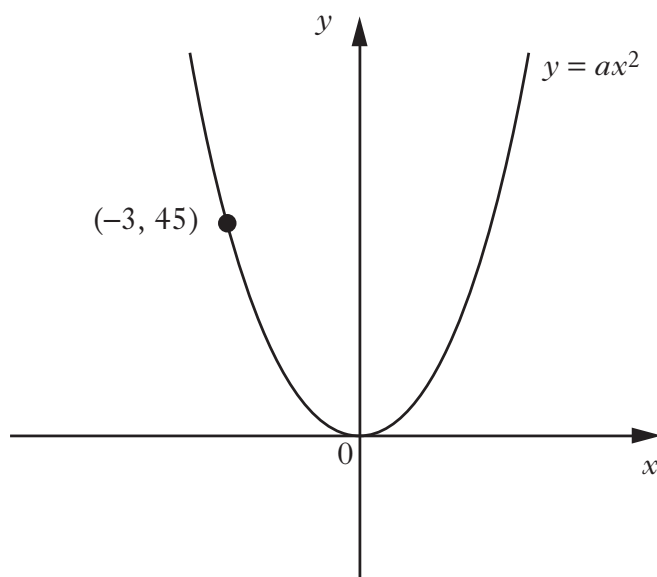The following boxplot was constructed.

Compare the two boxplots and comment. **2**

5. Express $\sqrt{40} + 4\sqrt{10} + \sqrt{90}$ as a surd in its simplest form.

3

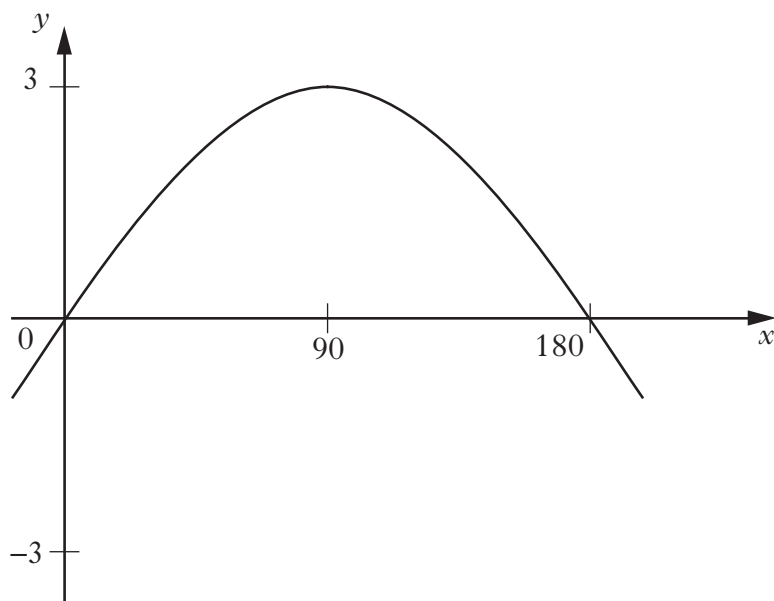**6.** The diagram below shows part of the graph of $y = ax^2$.

Find the value of a.

2

[Turn over

7.

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

State the values of a and b. **2**
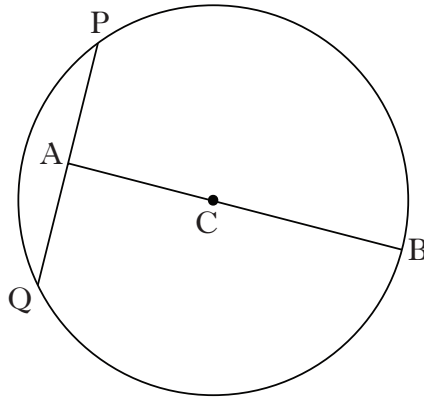
8. A parabola has equation $y = (x - 2)^2 - 5$.

(*a*) Write down the coordinates of the turning point of the parabola. **2**

(*b*) Does this parabola have a maximum or a minimum turning point? **1**

9. The diagram below shows a circle, centre C.

The radius of the circle is 15 centimetres.

A is the mid-point of chord PQ.

The length of AB is 27 centimetres.

Calculate the length of PQ. **4**

[END OF QUESTION PAPER]

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X100/11/02

MATHEMATICS INTERMEDIATE 2 Units 1, 2 and 3 Paper 2

Read carefully

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LI

FORMULAE LIST

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

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

Cosine rule: $\quad a^2 = b^2 + c^2 - 2bc \cos A \ \text{ or } \ \cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

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

Volume of a sphere: $\qquad \text{Volume} = \tfrac{4}{3} \pi r^3$

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

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

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.
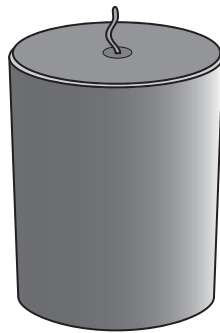
1. There are 964 pupils on the roll of Aberleven High School.

It is forecast that the roll will decrease by 15% per year.

What will be the expected roll after 3 years?

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

2. (*a*) A candle is in the shape of a cylinder with diameter 10 centimetres and height 15 centimetres.
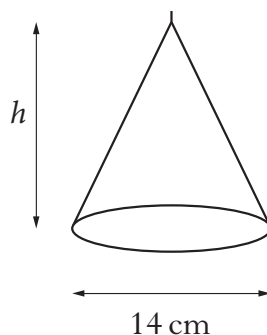

Calculate the volume of the candle.

Give your answer correct to 3 significant figures. **3**

(*b*) A second candle is in the shape of a cone with a circular base of diameter 14 centimetres and height *h* centimetres.

14 cm

It has the same volume as the first candle.

Calculate *h*. **3**

[Turn over

3. Factorise **fully**

$$3x^2 + 9x - 12.$$

4. Mr Smith and Mrs Curran both shop at the same store.

(*a*) Mr Smith bought 3 loaves and 2 packets of butter. The total cost was £4·73.

Let x pounds be the cost of a loaf and y pounds be the cost of a packet of butter.

Write down an equation in x and y which satisfies the above condition. **1**

(*b*) Mrs Curran bought 5 loaves and 3 packets of butter. The total cost was £7·52.

Write down a second equation in x and y which satisfies this condition. **1**

(*c*) Use the equations in parts (*a*) and (*b*) to find the cost of a loaf and the cost of a packet of butter. **4**

5. A runner has recorded her times, in seconds, for six different laps of the running track.

53   57   58   60   55   56

(*a*) Calculate:

 (i) the mean; **1**
(ii) the standard deviation; **3**

of these lap times.

Show clearly all your working.

(*b*) She changes her training routine hoping to improve her consistency. After this change, she records her times for another six laps.

The mean is 55 seconds and the standard deviation 3·2 seconds.

Has the new training routine improved her consistency?

Explain clearly your answer. **1**

6. Solve the equation

$$2x^2 - 7x + 1 = 0,$$

giving the answers correct to two decimal places. **4**

7. Change the subject of the formula

$$p = \frac{qr^2}{3} \quad \text{to } r.$$ **3**

8. Simplify $\dfrac{8p^6}{2p^3 \times p}$. **3**

9. Express

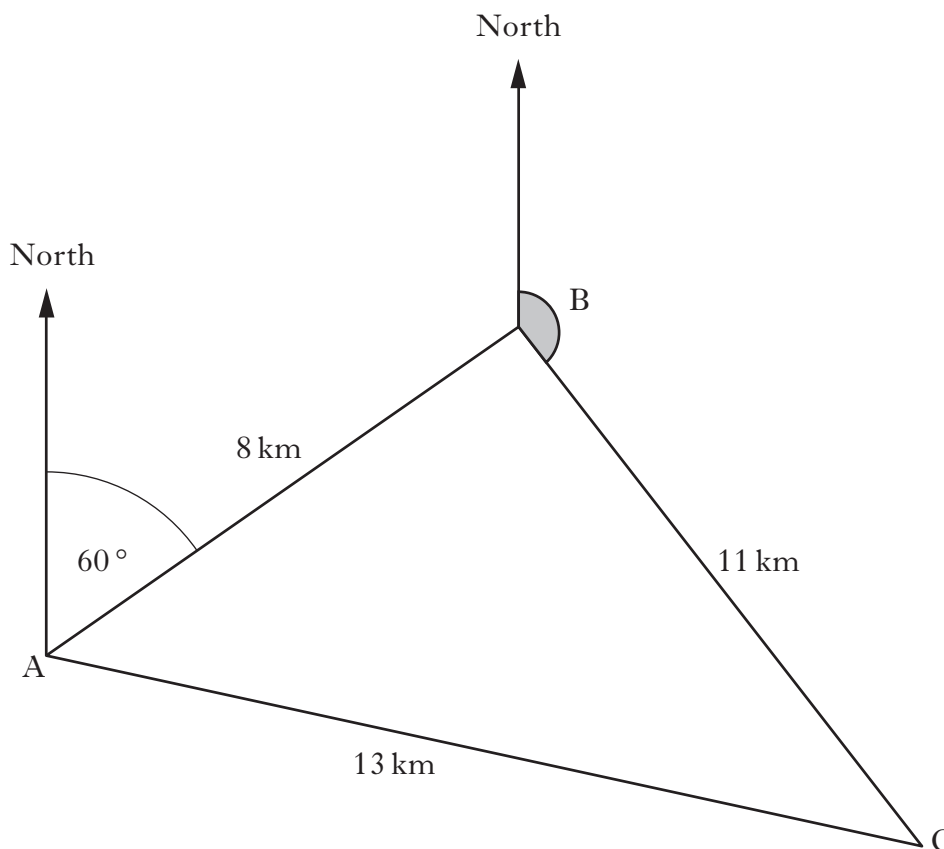$$\frac{2}{(x-4)} + \frac{5}{x}, \qquad x \neq 0, \ x \neq 4,$$

as a single fraction in its simplest form. **3**

[Turn over

10. Gerry saves 2 pence, 5 pence and 10 pence coins in a jar.

He thinks the probability of picking a 5 pence coin at random from the jar is $\frac{25}{20}$.

Why is he wrong?   **1**

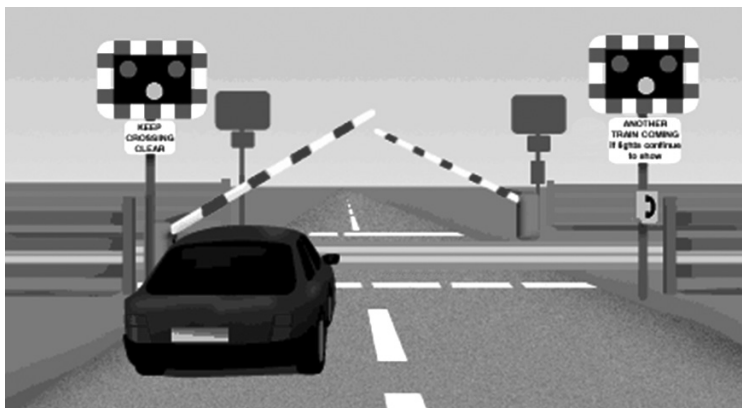**11.** In a race, boats sail round three buoys represented by A, B and C in the diagram below.

North

B is 8 kilometres from A on a bearing of 060°.

C is 11 kilometres from B.

A is 13 kilometres from C.

(*a*) Calculate the size of angle ABC.   **3**

(*b*) Hence find the size of the shaded angle.   **2**

12. The barrier at a level crossing is raised after a train has passed.

The height, *h* centimetres, of the end of the barrier can be calculated using the formula below
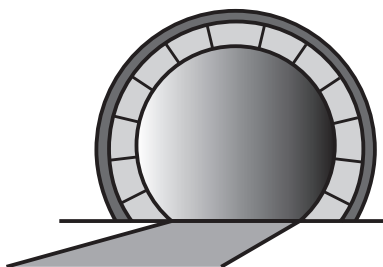
$$h = 320 \sin x° + 150, \qquad 0 \le x \le 90,$$

where $x°$ is the size of the angle between the barrier and the horizontal.

Calculate the size of the angle between the barrier and the horizontal when the height of the end of the barrier is 458 centimetres. **3**
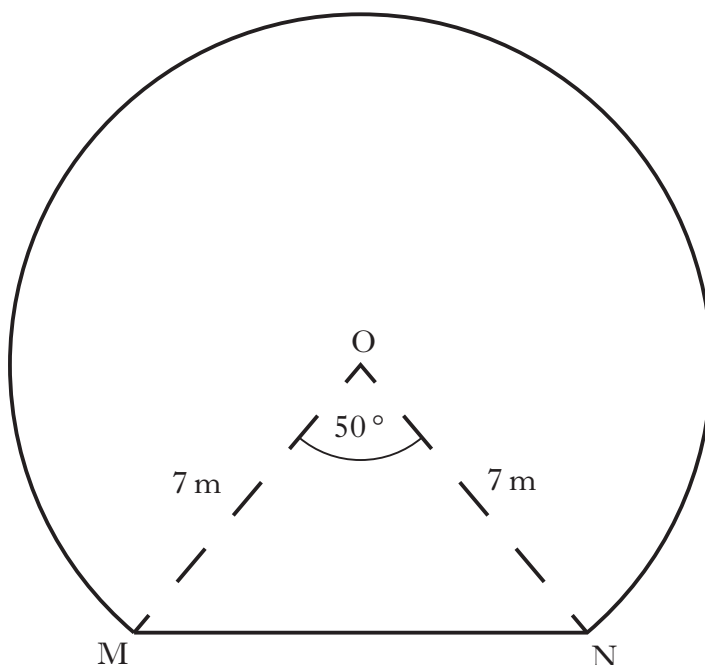
[Turn over for Question 13 on *Page eight*

13. The picture shows the entrance to a tunnel which is in the shape of part of a circle.

The diagram below represents the cross-section of the tunnel.

O

50°

7 m   7 m

M   N

- The centre of the circle is O.
- MN is a chord of the circle.
- Angle MON is 50°.
- The radius of the circle is 7 metres.

Calculate the area of the cross-section of the tunnel.   **5**

[END OF QUESTION PAPER]

ACKNOWLEDGEMENT