X100/203

NATIONAL QUALIFICATIONS 2011

WEDNESDAY, 18 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.**

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.

FORMULAE LIST

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

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

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

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

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

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

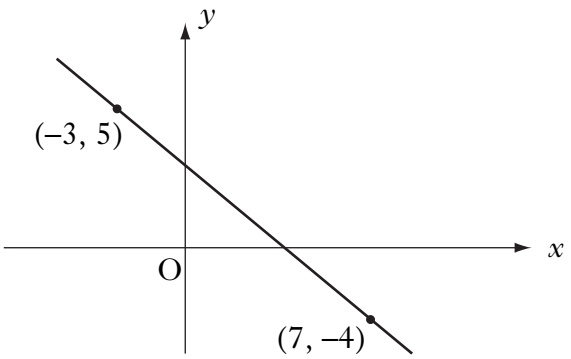
Volume of a cylinder: Volume $= \pi r^2 h$

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.

Marks

ALL questions should be attempted.

1.



Calculate the gradient of the straight line passing through the points (–3, 5) and (7, –4). **1**

2. It is estimated that house prices will increase at the rate of 3·15% per annum.

A house is valued at £134 750. If its value increases at the predicted rate, calculate its value after 3 years.

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

3. Change the subject of the formula

$$A = 4\pi r^2$$

to r. **2**

[Turn over

Marks

4. The Battle of Largs in 1263 is commemorated by a monument known as The Pencil.

This monument is in the shape of a cylinder with a cone on top.

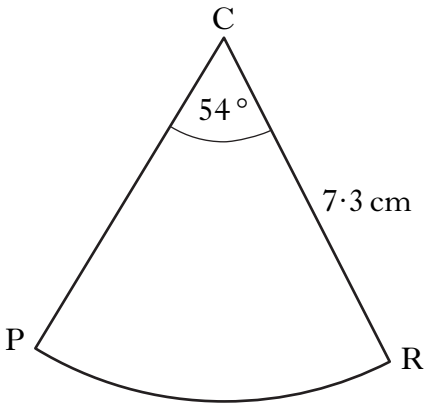
The cylinder part has diameter 3 metres and height 15 metres.

(*a*) Calculate the volume of the **cylinder** part of The Pencil. **2**

The volume of the **cone** part of The Pencil is 5·7 cubic metres.

(*b*) Calculate the **total** height of The Pencil. **3**

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

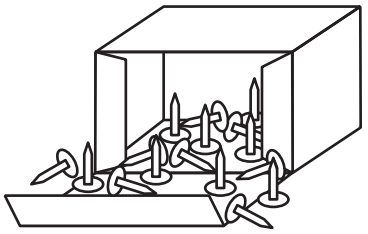


The radius of the circle is 7·3 centimetres and angle PCR is 54°.

Calculate the area of the sector PCR. **3**

Marks

6. A sample of six boxes contains the following numbers of pins per box.



43 39 41 40 39 44

(*a*) For the above data, calculate:

(i) the mean; **1**

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

The company which produces the pins claims that "the mean number of pins per box is 40 ± 2 and the standard deviation is less than 3".

(*b*) Does the data in part (*a*) support the claim made by the company?

Give reasons for your answer. **2**

7. Alan is taking part in a quiz. He is awarded x points for each correct answer and y points for each wrong answer. During the quiz, Alan gets 24 questions correct and 6 wrong. He scores 60 points.

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

Helen also takes part in the quiz. She gets 20 questions correct and 10 wrong. She scores 40 points.

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

(*c*) Calculate the score for David who gets 17 correct and 13 wrong. **4**

8. Simplify

$$\frac{3x-15}{(x-5)^2}.$$ **2**

9. Express

$$\frac{3}{x}-\frac{4}{x+1}, \qquad x \neq 0, \quad x \neq -1$$

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

Marks

10. Solve the equation

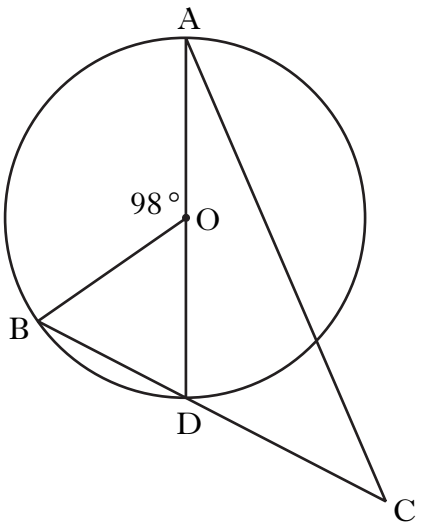
$$2 \tan x° - 3 = 5, \qquad 0 \leq x \leq 360.$$ **3**

11. Solve the equation

$$4x^2 - 7x + 1 = 0,$$

giving the roots correct to 1 decimal place. **4**

12.

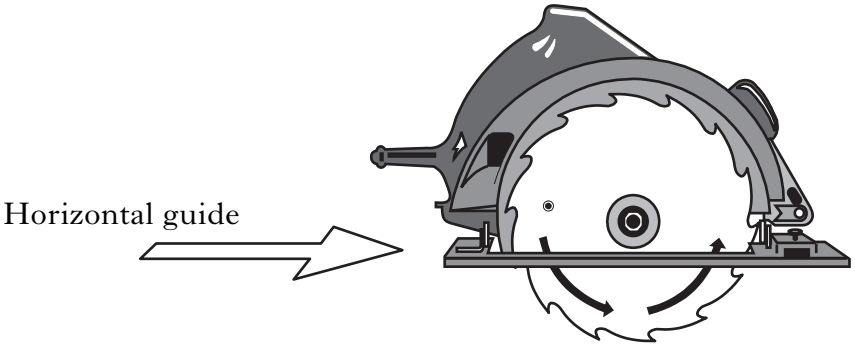


AD is a diameter of a circle, centre O.
B is a point on the circumference of the circle.
The chord BD is extended to a point C, outside the circle.
Angle BOA = 98°.
DC = 9 centimetres. The radius of the circle is 7 centimetres.

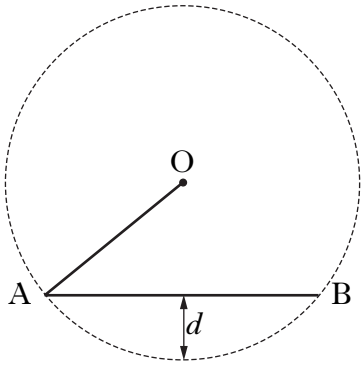
Calculate the length of AC. **5**

Marks

13. A circular saw can be adjusted to change the depth of blade that is exposed below the horizontal guide.



The circle, centre O, below represents the blade and the line AB represents part of the horizontal guide.



This blade has a radius of 110 millimetres.

If AB has length 140 millimetres, calculate the depth, d millimetres, of saw exposed. **4**

14. Prove that $\dfrac{\sin^2 A}{1-\sin^2 A} = \tan^2 A.$ **2**

[*END OF QUESTION PAPER*]