X100/11/02

NATIONAL QUALIFICATIONS 2013

WEDNESDAY, 22 MAY
10.05 AM – 11.35 AM

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.

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FORMULAE LIST

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

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

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

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.

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

2. A company buys machinery worth £750 000.

The value of the machinery depreciates by 20% per annum.

The machinery will be replaced at the end of the year in which its value falls below half of its original value.

After how many years should the machinery be replaced?

You must explain your answer. **4**

3. A sample of voters was asked how they intended to vote at the next election. The responses are shown below.

Party	*Percentage*
Scottish National Party (SNP)	35%
Labour (Lab)	30%
Liberal Democrat (Lib Dem)	15%
Conservative (Con)	10%
Others	10%

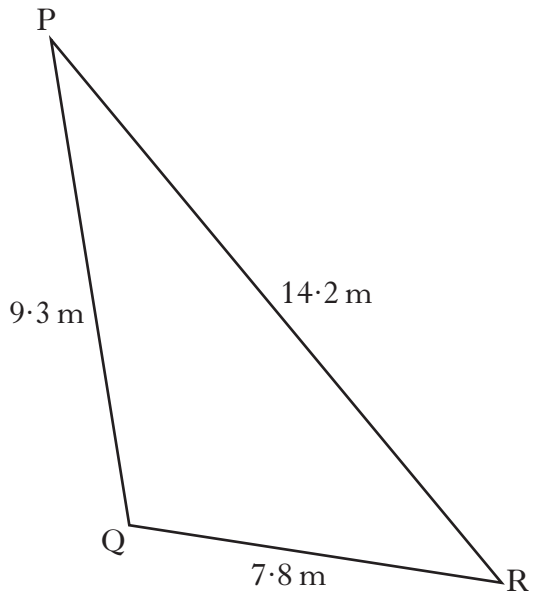
Construct a pie chart to illustrate this information.

Show all of your working. **3**

[Turn over

Marks

4. Triangle PQR is shown below.



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

5. Solve the equation

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

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

Marks

6. Harry often plays golf and the scores for some of his games are recorded below.

84 78 87 80 81

(*a*) For this sample calculate:

(i) the mean; **1**

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

Show clearly all your working.

(*b*) His partner for these games is Tony, whose scores are listed below.

104 98 107 100 101

Write down the mean and standard deviation of Tony's scores. **2**

7. A lead **cube**, of side 10 centimetres, is melted down.
During this process 8% of the metal is lost.
The remaining metal is then made into a **cone**, with radius 8 centimetres.
Calculate the height of this cone.
Give your answer correct to 2 significant figures. **5**

8. Change the subject of the formula

$$a = 3b^2 + c$$

to b. **3**

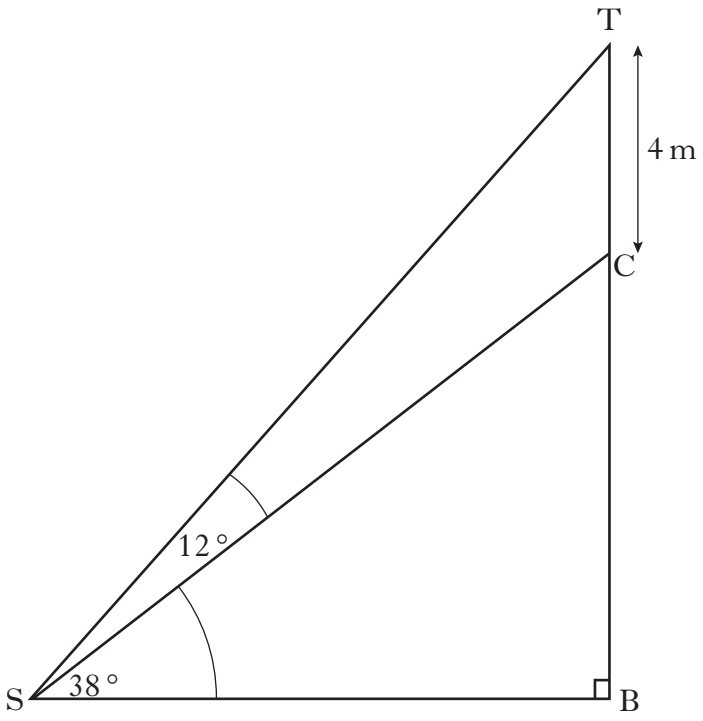
9. Simplify $\frac{x^6}{y^2} \times \frac{y^3}{x^3}$. **2**

[Turn over

Marks

10. A tree surgeon is asked to reduce the height of a tree.

In the diagram below TB represents the original height of the tree and C is the point where the cut is to be made.



The tree surgeon will reduce the height of the tree by 4 metres.

Angle TSC = 12 ° and angle BSC = 38 °.

Calculate the height of the tree after it has been cut.

Do not use a scale drawing. **5**

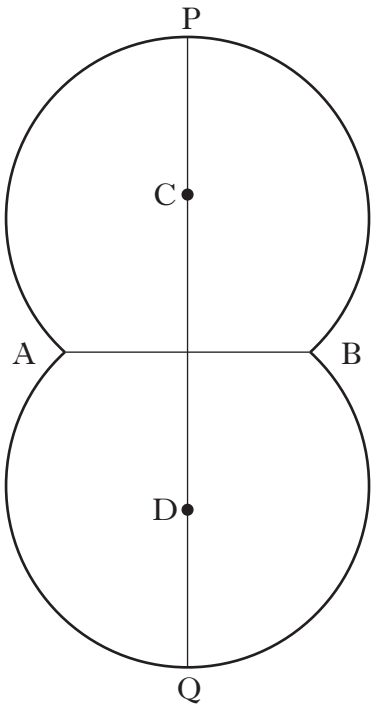
11. Express

$$\frac{3}{x+2}+\frac{5}{x-1} \qquad x \neq -2, \quad x \neq 1$$

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

Marks

12. The shape below is used as a logo in an advertising campaign. It is made up from segments of two identical circles.



The points C and D are the centres of the circles and each circle has a radius of 24 centimetres.

AB is a common chord of length 30 centimetres.

Calculate the height of the logo, represented by the line PQ. **5**

[Turn over for Question 13 on *Page eight*

Marks

13.

A Ferris wheel is turning at a steady rate.

The height, h metres, of one of the cars above the ground at a time t seconds is given by the formula

$$h = 7 + 5\sin t°.$$

Find **two** times during the first turn when the car is at a height of 10·8 metres above the ground. **4**

[*END OF QUESTION PAPER*]