

# X100/11/01

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NATIONAL  
QUALIFICATIONS 2013

WEDNESDAY, 22 MAY  
9.00 AM – 9.45 AM

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. 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  $ax^2 + bx + c = 0$  are  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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

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

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:  $\text{Volume} = \pi r^2 h$

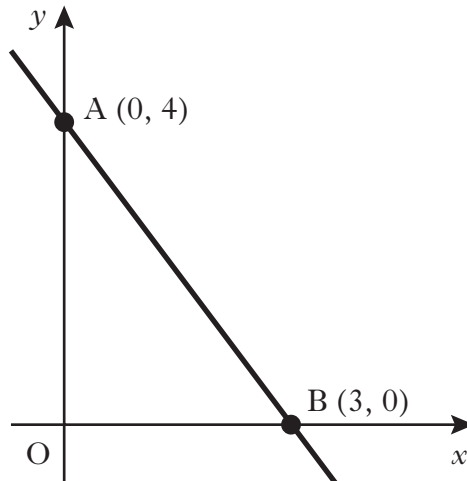
Standard deviation:  $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n-1}}$ , where  $n$  is the sample size.

1. Factorise

$$6ab - 7bc.$$

1

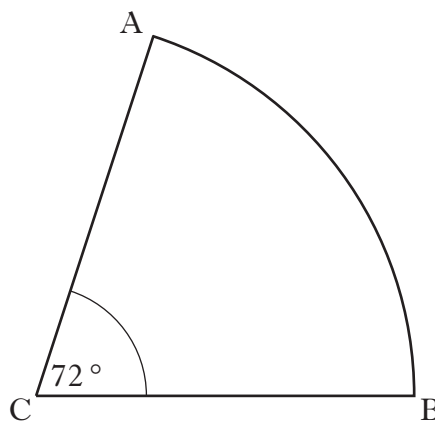
- 2.



Find the equation of the straight line AB.

3

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



The radius of the circle is 5 centimetres and angle ACB is  $72^\circ$ .

Calculate the length of arc AB.

Take  $\pi = 3.14$ .

3

[Turn over

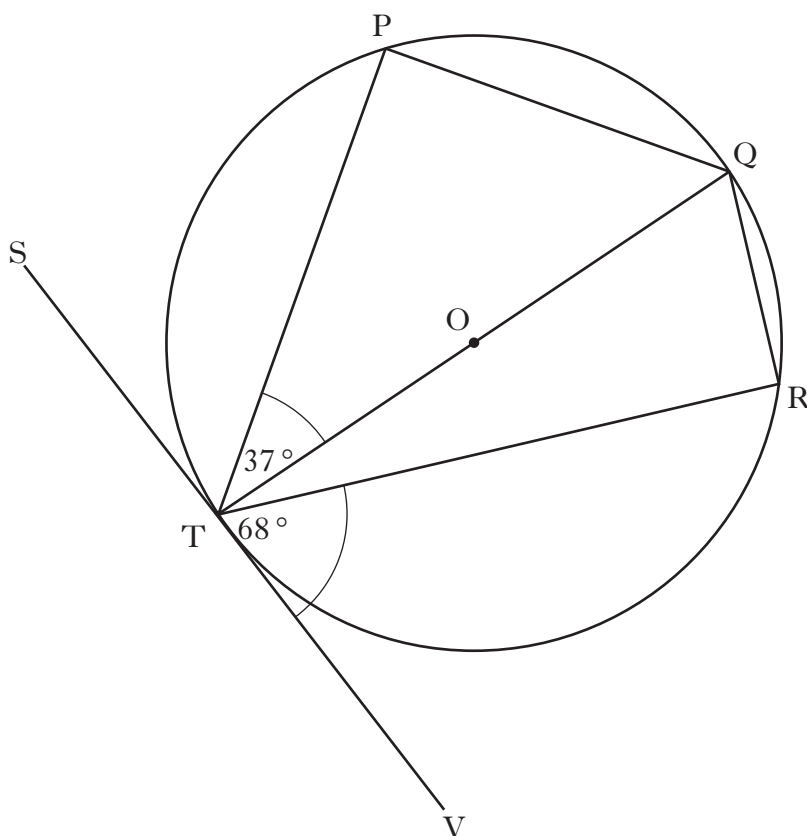
4. Solve algebraically the system of equations

$$2x - y = 10$$

$$4x + 5y = 6.$$

3

5.



The tangent SV touches the circle, centre O, at T.

Angle PTQ is  $37^\circ$  and angle VTR is  $68^\circ$ .

Calculate the size of angle PQR.

3

6. The stem and leaf diagram shows the number of minutes on average spent on homework per night by a group of first year pupils.

1	0 5 5 5
2	0 1 2 2 3 5 5 8 9
3	0 5 5 6 6 7 8 9 9 9
4	2 4 4 5 6 7
5	0

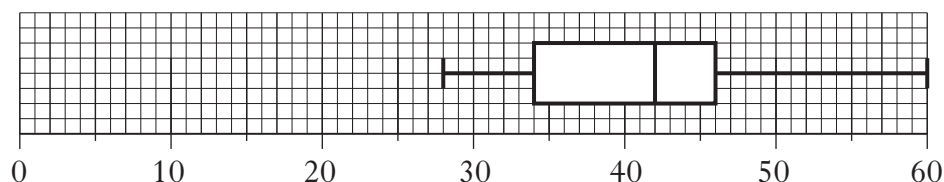
n = 30            1 | 0 represents 10 minutes

(a) Using the above data find:

- (i) the median; 1
- (ii) the lower quartile; 1
- (iii) the upper quartile. 1

(b) Draw a boxplot to illustrate this data. 2

(c) A group of fourth year pupils was surveyed to find out how many minutes on average they spent on homework per night. The boxplot below was drawn for this data.



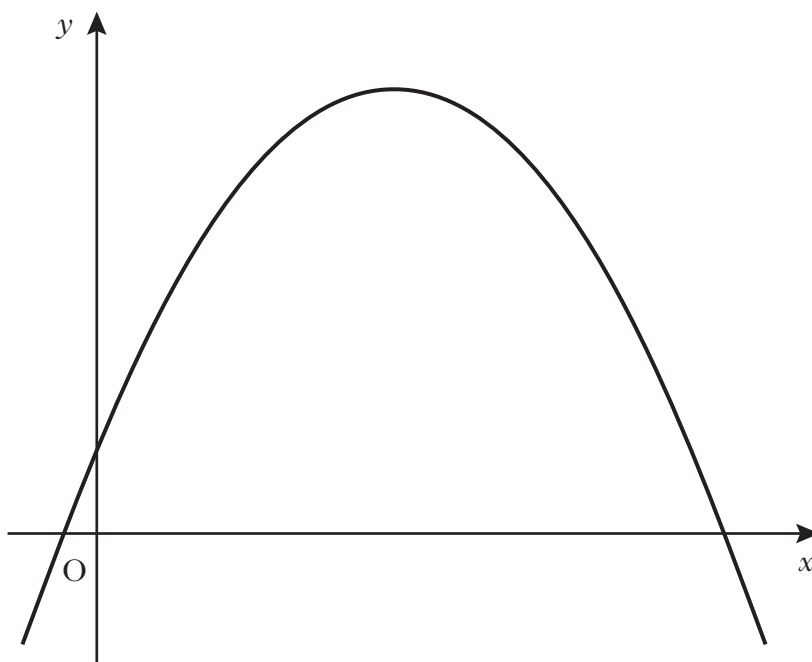
Compare the two boxplots and comment. 2

7. Simplify  $\frac{(x+4)^2}{x^2-x-20}$ . 3

8. State the period of  $y = \sin 2x^\circ$ . 1

**[Turn over**

9. The diagram below shows part of the graph of  $y = 20 - (x - 4)^2$ .



- (a) State the coordinates of the maximum turning point. 2
- (b) State the equation of the axis of symmetry. 1
10. Sketch the graph of  $y = \sin(x - 90)^\circ$ ,  $0 \leq x \leq 360$ . 3

[END OF QUESTION PAPER]

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# X100/11/02

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NATIONAL  
QUALIFICATIONS  
2013

WEDNESDAY, 22 MAY  
10.05 AM – 11.35 AM

MATHEMATICS  
INTERMEDIATE 2  
Units 1, 2 and 3  
Paper 2

**Read carefully**

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## FORMULAE LIST

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

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.

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

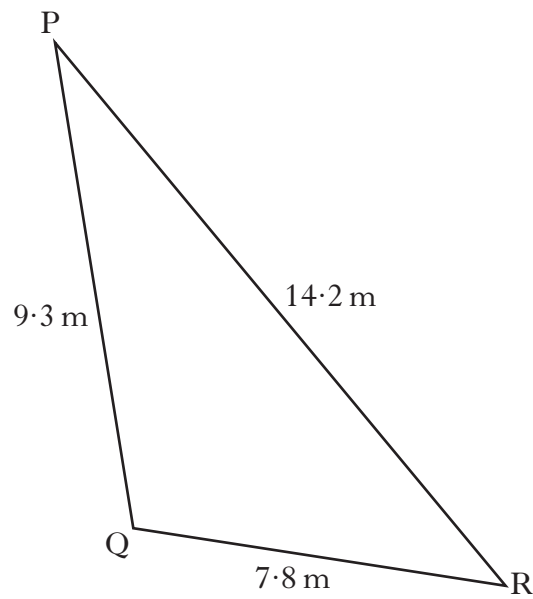
Construct a pie chart to illustrate this information.

**Show all of your working.**

**3**

**[Turn over**

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

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;  
(ii) the standard deviation.

**Show clearly all your working.**



1  
3

- (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

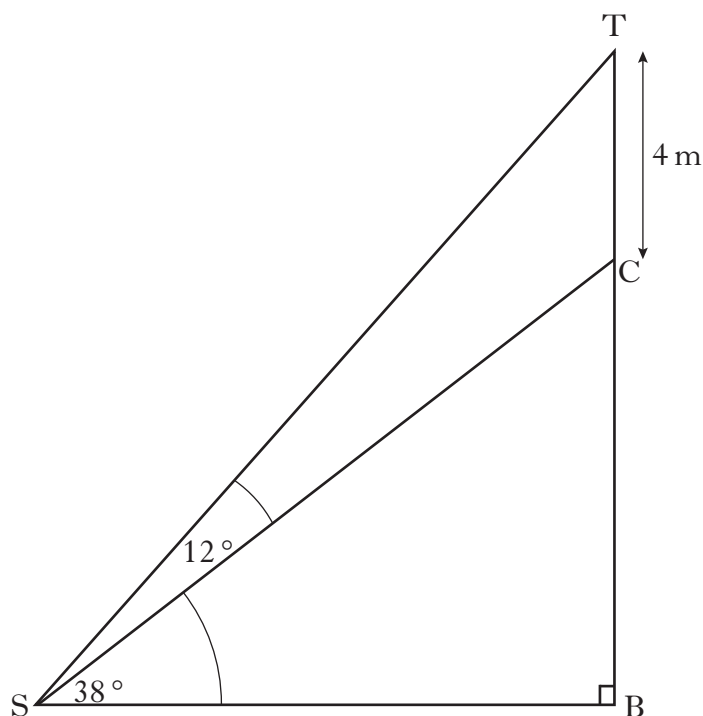
9. Simplify  $\frac{x^6}{y^2} \times \frac{y^3}{x^3}$ .

2

**[Turn over**

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 =  $12^\circ$  and angle BSC =  $38^\circ$ .

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

**Do not use a scale drawing.**

5

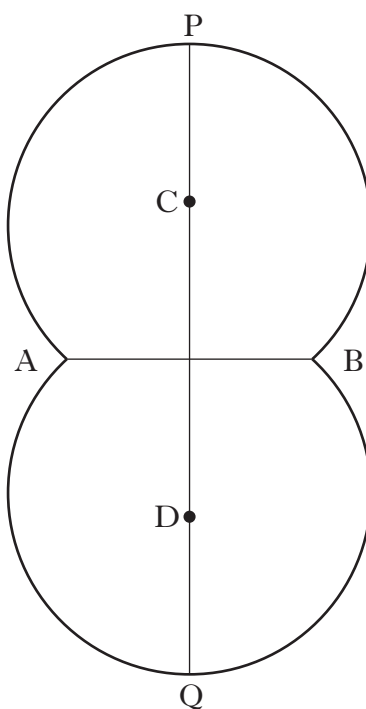
11. Express

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

as a single fraction in its simplest form.

3

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***

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

$$h = 7 + 5\sin t^\circ.$$

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]