X100/201

NATIONAL QUALIFICATIONS 2005

FRIDAY, 20 MAY
1.00 PM – 1.45 PM

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.

LIB X100/201 6/16370

FORMULAE LIST

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

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

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.

Marks

ALL questions should be attempted.

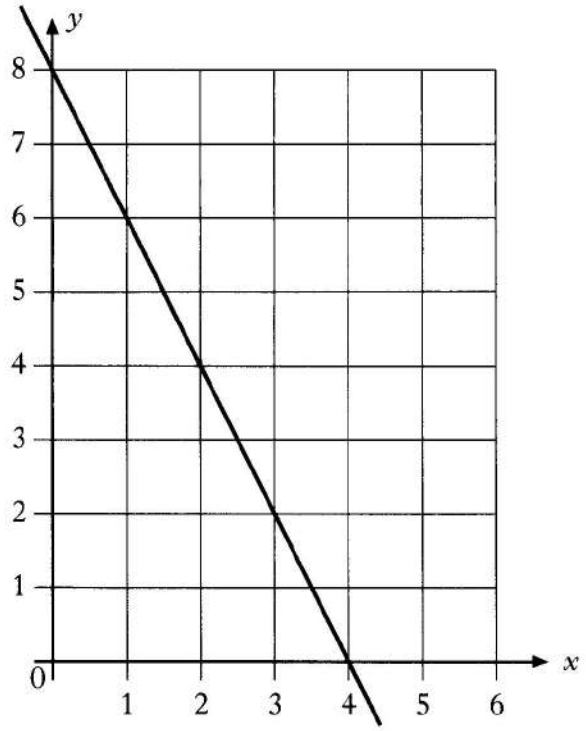
1. The stem and leaf diagram below shows the heights of a group of children.

12	1	2	4	5	9	
13	0	0	1	5	7	8
14	0	2	8	9		
15	1	1	2			

n = 18 12 | 1 represents 121 centimetres

What is the probability that a child chosen at random from this group has a height less than 130 centimetres? **1**

2.



(*a*) Find the equation of the straight line shown in the diagram. **3**

(*b*) Find the coordinates of the point where the line $y = 2x$ meets this line. **2**

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

$$(4x + 2)(x - 5) + 3x$$ **3**

(*b*) Factorise

$$2p^2 - 5p - 12.$$ **2**

Marks

4. For a group of freezers in a shop, the volume, in litres, of each one is listed below.

78 81 91 75 85 83 84 78

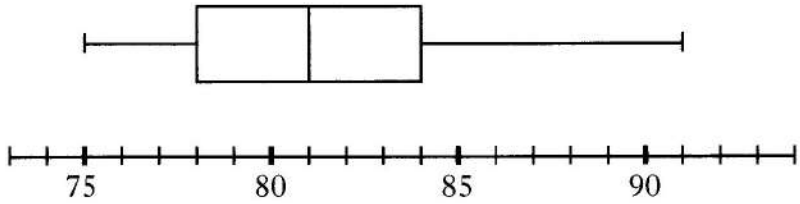
(*a*) For the given data, calculate:

(i) the median; **1**

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

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

One of the numbers from the above list was accidentally missed out. A boxplot was then drawn and is shown below.



(*b*) Which number was missed out?
Give a reason for your answer. **2**

5. Simplify

$k^8 \times (k^2)^{-3}$. **2**

6. Given that

$\tan 45° = 1$,

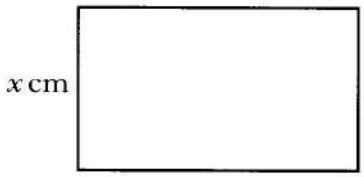
what is the value of $\tan 135°$? **1**

7. Sketch the graph of

$y = \sin 2x°, \quad 0 \leq x \leq 360$. **3**

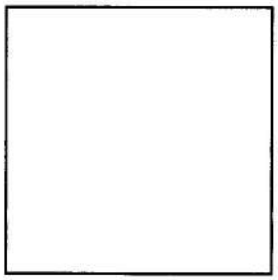
Marks

8. A rectangle has length $(x + 2)$ centimetres and breadth x centimetres.



(*a*) Write down an expression for the area of the rectangle. **1**

A square has length $(x + 1)$ centimetres.

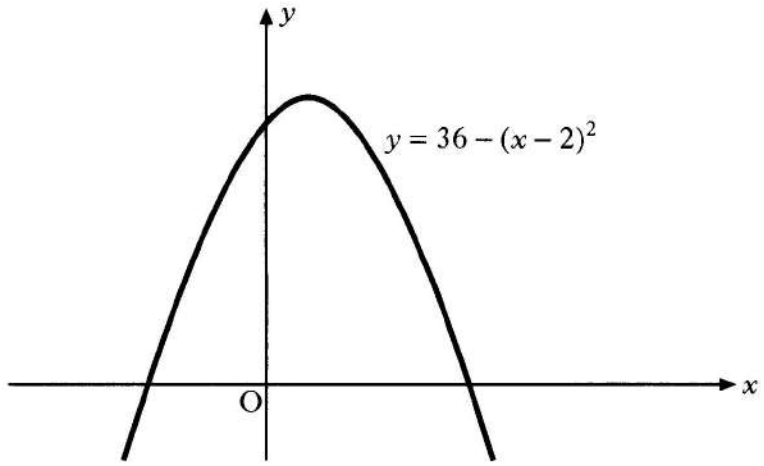


(*b*) The area of the square above is greater than the area of the rectangle. By how much is it greater? **2**

[Turn over for Question 9 on *Page six*

Marks

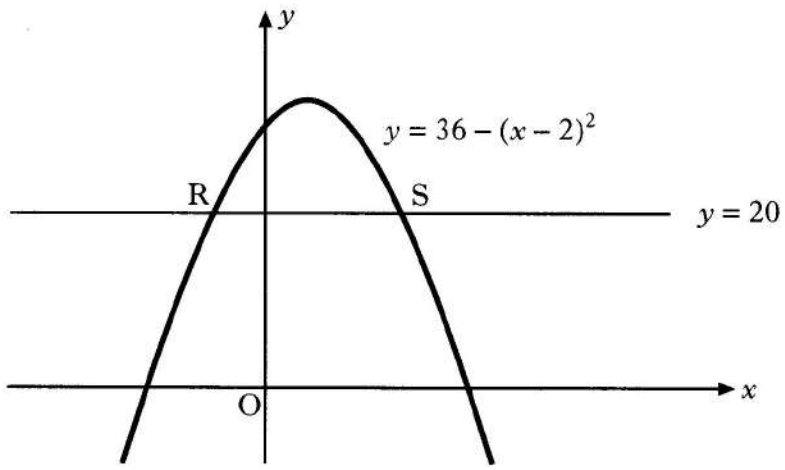
9. The diagram below shows part of the graph of $y = 36 - (x - 2)^2$.



(*a*) State the coordinates of the maximum turning point. **2**

(*b*) State the equation of the axis of symmetry. **1**

The line $y = 20$ is drawn.
It cuts the graph of $y = 36 - (x - 2)^2$ at R and S as shown below.



(*c*) S is the point (6, 20). Find the coordinates of R. **2**

[END OF QUESTION PAPER]

X100/203

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FRIDAY, 20 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.**

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LIB X100/203 6/16370

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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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. In the evening, the temperature in a greenhouse drops by 4% per hour.
At 8 pm the temperature is 28 ° Celsius.
What will the temperature be at 11 pm? **3**

2. In a bakery, a sample of six fruit loaves is selected and the weights, in grams, are recorded.

395 400 408 390 405 402

For the above data the mean is found to be 400 grams.

(*a*) Calculate the standard deviation.
Show clearly all your working. **3**

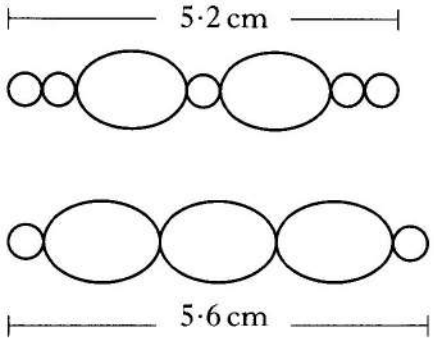
(*b*) New methods are introduced to ensure more consistent weights.
Another sample is then taken and the mean and standard deviation found to be 400 grams and 5·8 grams respectively.
Are the new methods successful?
Give a reason for your answer. **1**

3. A straight line has equation $3y = 12 - 4x$.
Find the coordinates of the point where it crosses the x-axis. **2**

[Turn over

Marks

4. A jeweller uses two different arrangements of beads and pearls.

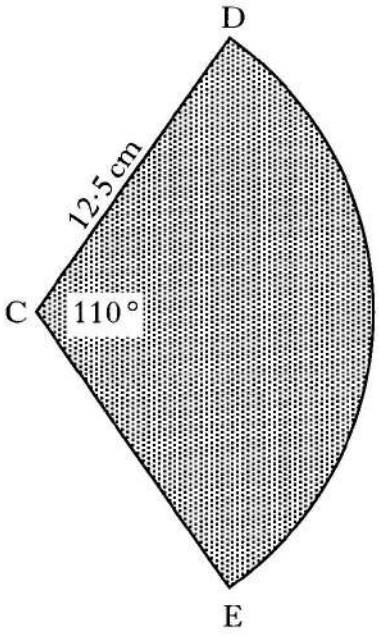


The first arrangement consists of 2 beads and 5 pearls and has an overall length of 5·2 centimetres.

The second arrangement consists of 3 beads and 2 pearls and has an overall length of 5·6 centimetres.

Find the length of **one** bead and the length of **one** pearl. **6**

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

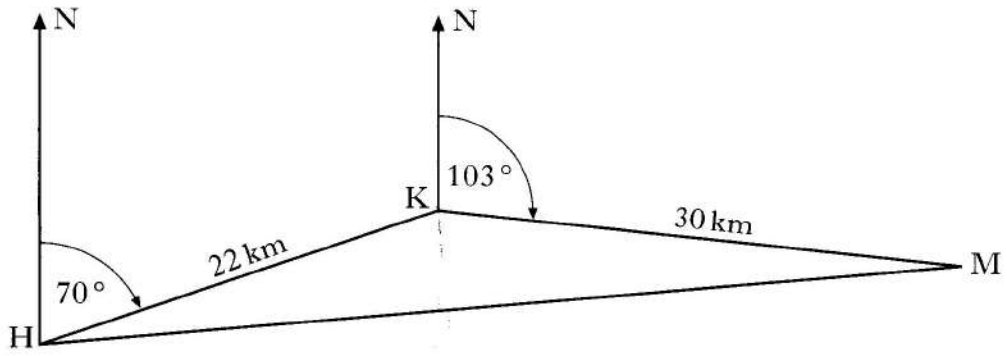


The radius of the circle is 12·5 centimetres and angle DCE is 110°.

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

Marks

6. In the diagram below three towns, Holton, Kilter and Malbrigg are represented by the points H, K and M respectively.



A helicopter flies from Holton for 22 kilometres on a bearing of 070° to Kilter. It then flies from Kilter for 30 kilometres on a bearing of 103° to Malbrigg. The helicopter then returns directly to Holton.

(*a*) (i) Calculate the size of angle HKM. **1**

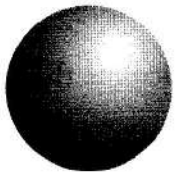
(ii) Calculate the total distance travelled by the helicopter. **3**

Do not use a scale drawing.

(*b*) A climber is reported missing somewhere in the triangle represented by HKM in the diagram.

Calculate the area of this triangle. **2**

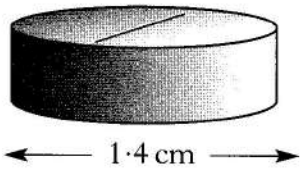
7. A pharmaceutical company makes vitamin pills in the shape of spheres of radius 0·5 centimetres.



(*a*) Calculate the volume of **one** pill.

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

The company decides to change the shape of each pill to a cylinder.



(*b*) The new pill has the **same** volume as the original and its diameter is 1·4 centimetres.

Calculate the height of the new pill. **3**

[Turn over

Marks

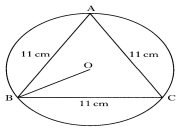
8. Solve the equation

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

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

9. Points A, B and C lie on the circumference of a circle, centre O.

11. Points A, B and C lie on the circumference of a circle, centre O. *Marks*



Triangle ABC is equilateral with sides of length 11 centimetres as shown in the diagram.

(*a*) Write down the size of angle OBC. 1

(*b*) Calculate the length of the radius OB. 3

Triangle ABC is equilateral with sides of length 11 centimetres as shown in the diagram.

(*a*) Write down the size of angle OBC. **1**

(*b*) Calculate the length of the radius OB. **3**

Marks

10. (*a*) Express $\frac{7}{\sqrt{2}}$ as a fraction with a rational denominator. **2**

(*b*) Express $\frac{a}{b} \times \frac{3b}{a^2}$ as a fraction in its simplest form. **2**

(*c*) Change the subject of the formula

$$p = q + 2r^2 \quad \text{to } r.$$ **3**

11. (*a*) Solve the equation

$$7\cos x° - 5 = 0, \qquad 0 \leq x < 360.$$ **3**

(*b*) Simplify

$$\tan x° \cos x°.$$ **2**

[END OF QUESTION PAPER]