X100/201

NATIONAL QUALIFICATIONS 2008

TUESDAY, 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.

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: 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. A straight line has equation $y = 4x + 5$.
State the gradient of this line. **1**

2. Multiply out the brackets and collect like terms.

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

3. The stem and leaf diagram shows the number of points gained by the football teams in the Premiership League in a season.

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

n = 20 4 | 1 represents 41 points

(*a*) Arsenal finished 1st in the Premiership with 90 points.
In what position did Southampton finish if they gained 47 points? **1**

(*b*) What is the probability that a team chosen at random scored less than 44 points? **1**

4. (*a*) Factorise

$$x^2 - y^2.$$ **1**

(*b*) Hence, or otherwise, find the value of

$$9{\cdot}3^2 - 0{\cdot}7^2.$$ **2**

[Turn over

Marks

5. In a survey, the number of books carried by each girl in a group of students was recorded.

The results are shown in the frequency table below.

Number of books	*Frequency*
0	1
1	2
2	3
3	5
4	5
5	6
6	2
7	1

(*a*) Copy this frequency table and add a cumulative frequency column. **1**

(*b*) For this data, find:

(i) the median; **1**

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

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

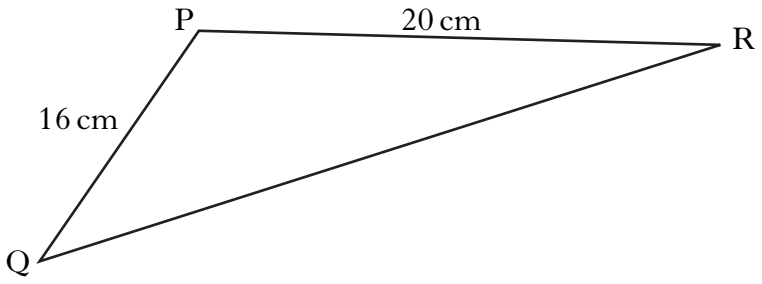
(*c*) Calculate the semi-interquartile range. **1**

(*d*) In the same survey, the number of books carried by each boy was also recorded.

The semi-interquartile range was 0·75.

Make an appropriate comment comparing the distribution of data for the girls and the boys. **1**

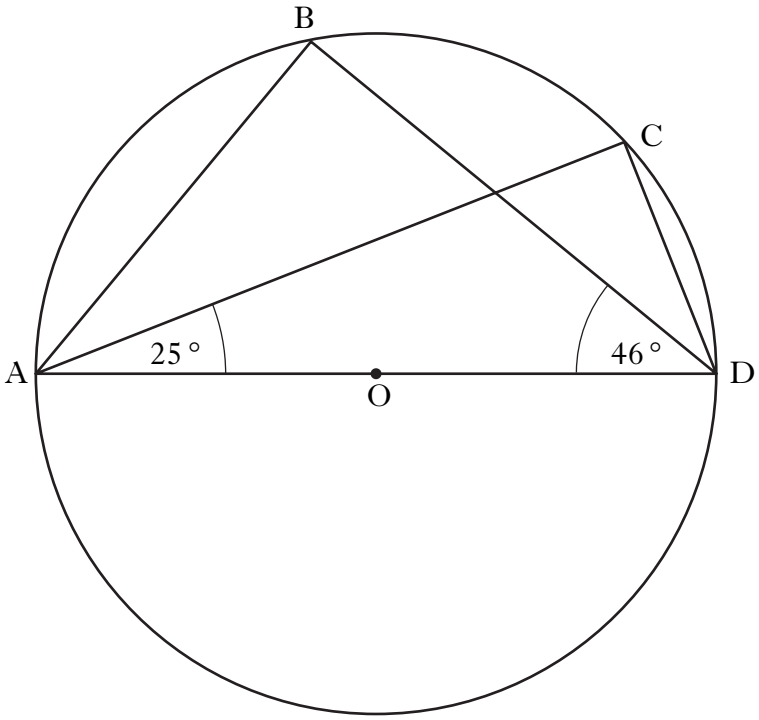
6. Triangle PQR is shown below.



If sin P = $\frac{1}{4}$, calculate the area of triangle PQR. **2**

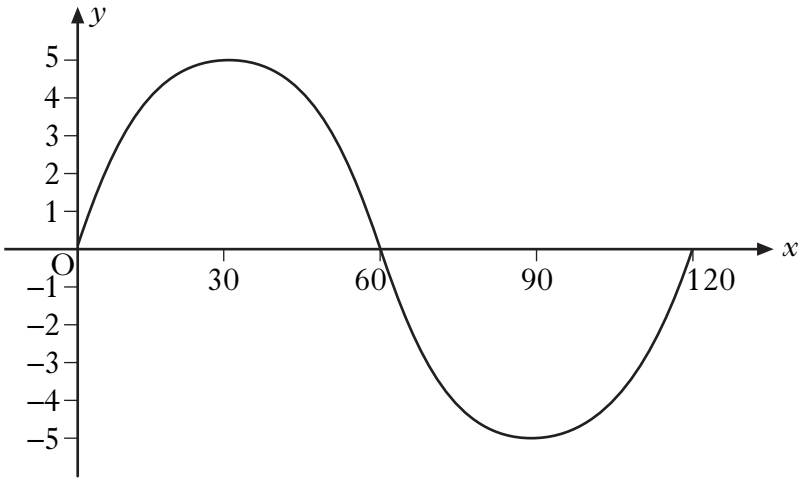
Marks

7.



AD is a diameter of a circle, centre O.
B and C are points on the circumference of the circle.
Angle CAD = 25 °.
Angle BDA = 46 °.
Calculate the size of angle BAC. **3**

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



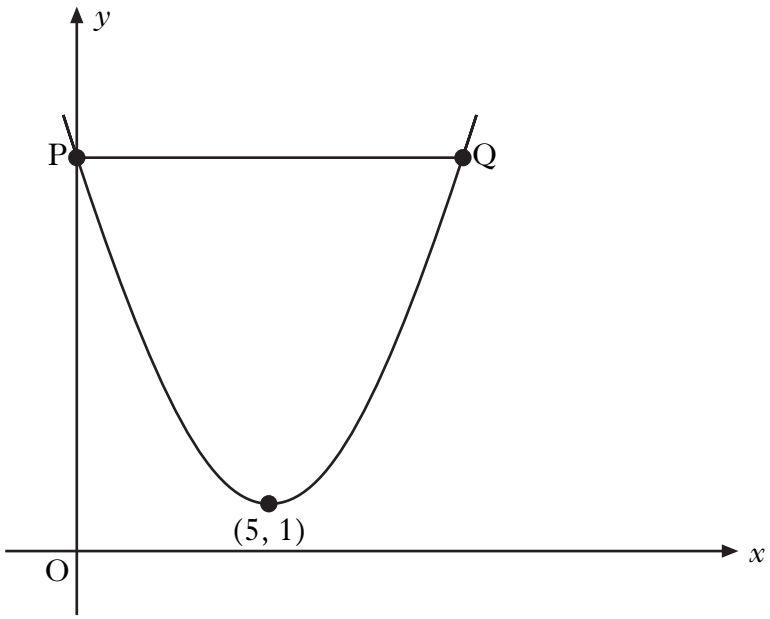
State the values of a and b. **2**

[Turn over for Questions 9 and 10 on *Page six*

Marks

9. The graph below shows part of a parabola with equation of the form

$$y = (x + a)^2 + b.$$



(*a*) State the values of *a* and *b*. **2**

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

(*c*) The line PQ is parallel to the *x*-axis.
Find the coordinates of points P and Q. **3**

10. If $\sin x° = \frac{4}{5}$ and $\cos x° = \frac{3}{5}$, calculate the value of $\tan x°$. **2**

[*END OF QUESTION PAPER*]

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X100/203

NATIONAL QUALIFICATIONS 2008

TUESDAY, 20 MAY
2.05 PM – 3.35 PM

MATHEMATICS
INTERMEDIATE 2
Units 1, 2 and 3
Paper 2

Read carefully

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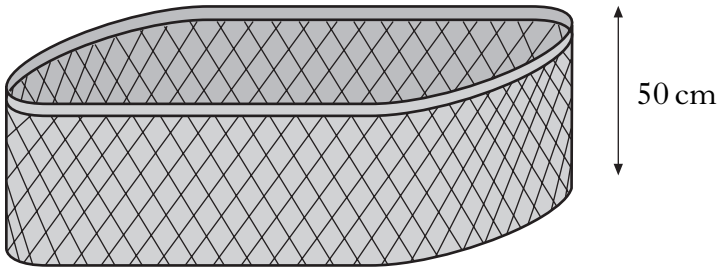
ALL questions should be attempted.

Marks

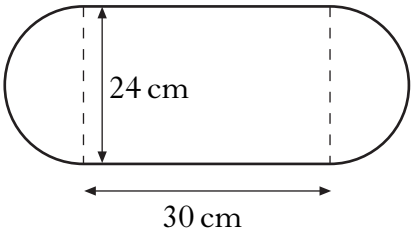
1. Calculate the **compound interest** earned when £50 000 is invested for 4 years at 4·5% per annum.
Give your answer to the nearest penny. **4**

2. Jim Reid keeps his washing in a basket. The basket is in the shape of a prism.



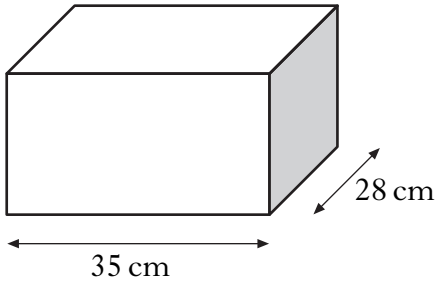
The height of the basket is 50 centimetres.

The cross section of the basket consists of a rectangle and two semi-circles with measurements as shown.



(*a*) Find the volume of the basket in cubic centimetres.
Give your answer correct to three significant figures. **4**

Jim keeps his ironing in a storage box which has a volume **half** that of the basket.



The storage box is in the shape of a cuboid, 35 centimetres long and 28 centimetres broad.

(*b*) Find the height of the storage box. **3**

Marks

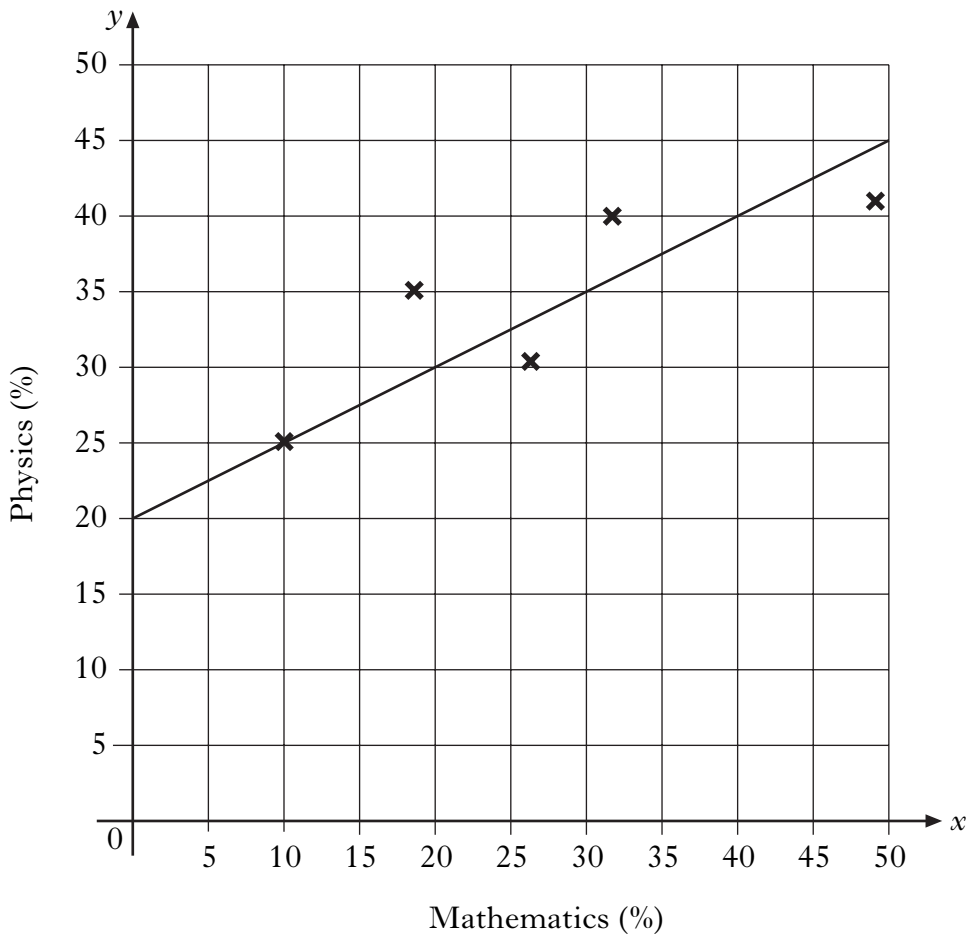
3. The results for a group of students who sat tests in mathematics and physics are shown below.

Mathematics (%)	10	18	26	32	49
Physics (%)	25	35	30	40	41

(*a*) Calculate the standard deviation for the mathematics test. **4**

(*b*) The standard deviation for physics was 6·8.
Make an appropriate comment on the distribution of marks in the two tests. **1**

These marks are shown on the scattergraph below.
A line of best fit has been drawn.



(*c*) Find the equation of the line of best fit. **3**

(*d*) Another pupil scored 76% in the mathematics test but was absent from the physics test.
Use your answer to part (*c*) to predict his physics mark. **1**

Marks

4. Suzie has a new mobile phone. She is charged x pence per minute for calls and y pence for each text she sends. During the first month her calls last a total of 280 minutes and she sends 70 texts. Her bill is £52·50.

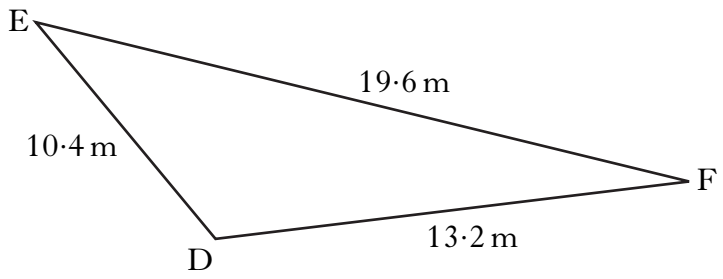
(*a*) Write down an equation in x and y which satisfies the above condition. **1**

The next month she reduces her bill. She restricts her calls to 210 minutes and sends 40 texts. Her bill is £38·00.

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

(*c*) Calculate the price per minute for a call and the price for each text sent. **4**

5. Triangle DEF is shown below.



It has sides of length 10·4 metres, 13·2 metres and 19·6 metres.
Calculate the size of angle EDF.
Do not use a scale drawing. **3**

6. Solve the equation

$$5x^2 + 4x - 2 = 0,$$

giving the roots correct to 2 decimal places. **4**

[Turn over

Marks

7. (*a*) Simplify

$$\frac{m^5}{m^3}.$$ **1**

(*b*) Express

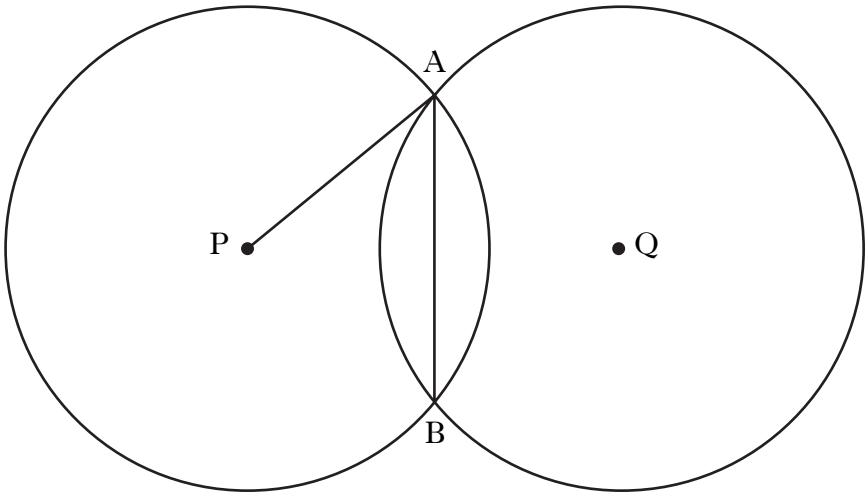
$$2\sqrt{5} + \sqrt{20} - \sqrt{45}$$

as a surd in its simplest form. **3**

8. Solve the equation

$$4\cos x° + 3 = 0, \qquad 0 \leq x \leq 360.$$ **3**

9. Two identical circles, with centres P and Q, intersect at A and B as shown in the diagram.



The radius of each circle is 10 centimetres.
The length of the common chord, AB, is 12 centimetres.

Calculate PQ, the distance between the centres of the two circles. **5**

Marks

10. Change the subject of the formula

$$p = q + \sqrt{a}$$

to a. **2**

11. Express

$$\frac{2}{a} - \frac{3}{(a+4)}, \qquad a \neq 0,\ a \neq -4,$$

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

[*END OF QUESTION PAPER*]

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