X101/202

NATIONAL QUALIFICATIONS 2010

FRIDAY, 21 MAY
1.00 PM – 1.45 PM

MATHEMATICS INTERMEDIATE 2

Units 1, 2 and Applications of Mathematics
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

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

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

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

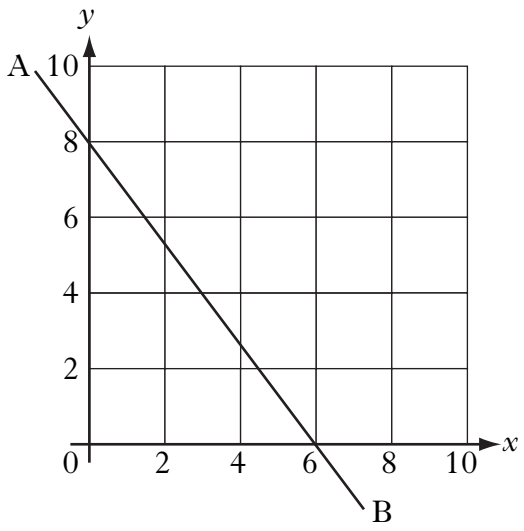
Volume of a cylinder: Volume $= \pi r^2 h$

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

Marks

ALL questions should be attempted.

1.



Find the equation of the straight line AB shown in the diagram. **3**

2. The pupils in a primary class record their shoe sizes as shown below.

8	7	6	5	6
5	7	11	7	7
7	8	7	9	6
8	6	5	9	7

(*a*) Construct a frequency table from the above data and add a cumulative frequency column. **2**

(*b*) For this data, find:

(i) the median; **1**

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

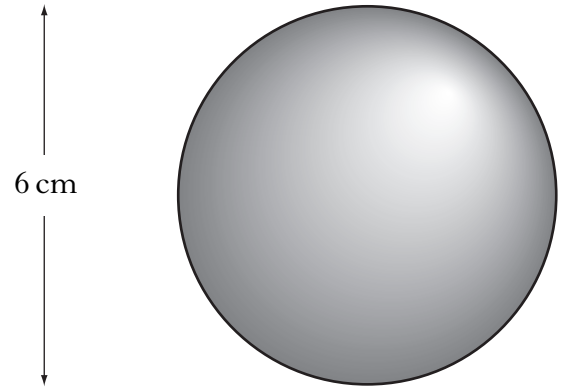
(iii) the upper quartile. **1**

(*c*) Construct a boxplot for this data. **2**

[Turn over

Marks

3. The diagram below represents a sphere.



The sphere has a diameter of 6 centimetres.

Calculate its volume.

Take $\pi = 3{\cdot}14$. **2**

4. (*a*) Factorise

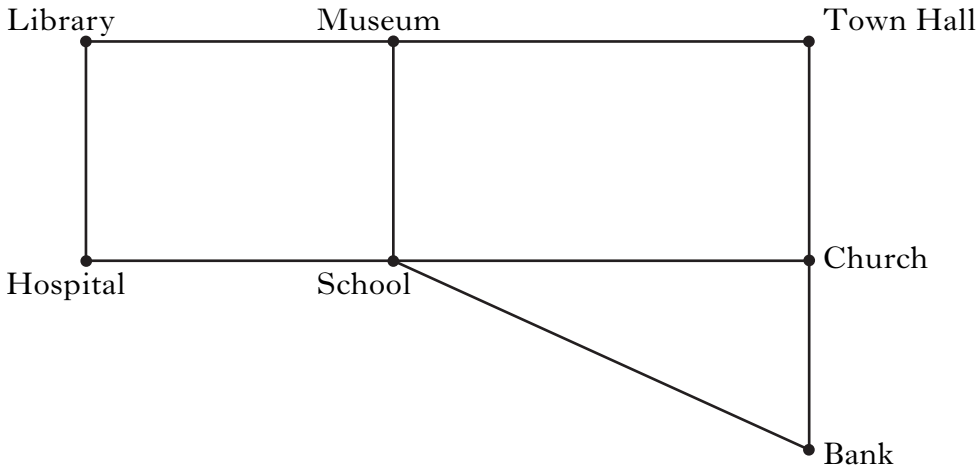
$$x^2 + x - 6.$$ **2**

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

$$(3x + 2)(x^2 + 5x - 1)$$ **3**

Marks

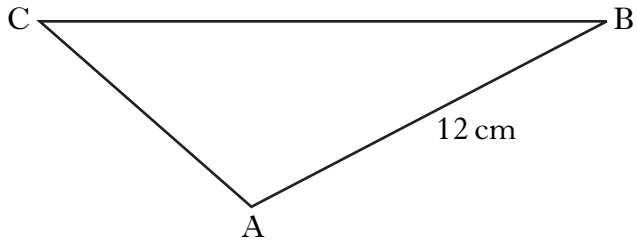
5. The diagram shows a network of streets connecting certain landmarks in a town centre.



A bin lorry has to collect rubbish along every street shown.

Is it possible to do this without travelling any street more than once? Explain your answer. **2**

6.



In triangle ABC, AB = 12 centimetres, $\sin C = \frac{1}{2}$ and $\sin B = \frac{1}{3}$.

Find the length of side AC. **3**

[Turn over for Questions 7 and 8 on *Page six*

Marks

7. The size of each angle, $a°$, in a regular polygon is given by the formula

$$a = 180 - \frac{360}{n},$$

where n is the number of sides in the regular polygon.

(*a*) Calculate a when $n = 10$. **2**

(*b*) Calculate n when $a = 140$. **3**

8. The table below shows the monthly repayments to be made when money is borrowed from the Bank of Caledonia.

Repayments can be made with or without loan protection.

	Monthly repayments: Bank of Caledonia					
	24 months		**36 months**		**48 months**	
Loan Amount	**With Loan Protection**	**Without Loan Protection**	**With Loan Protection**	**Without Loan Protection**	**With Loan Protection**	**Without Loan Protection**
£10 000	£495	£445	£343	£305	£277	£237
£8000	£395	£356	£275	£244	£222	£190
£5000	£247	£223	£172	£153	£139	£119
£4000	£198	£179	£138	£123	£111	£95

Jeremy borrows £8000 over 36 months **without** loan protection.

After 28 months, he is made redundant and is unable to pay the remainder of the loan.

His brother, Peter, agrees to make the remaining payments.

How much does Peter pay in total? **3**

[*END OF QUESTION PAPER*]

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X101/204

NATIONAL QUALIFICATIONS 2010

FRIDAY, 21 MAY 2.05 PM – 3.35 AM

MATHEMATICS INTERMEDIATE 2

Units 1, 2 and Applications of Mathematics 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.

FORMULAE LIST

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

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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.

Marks

ALL questions should be attempted.

1. An industrial machine costs £176 500.

Its value depreciates by 4·25% each year.

How much is it worth after 3 years?

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

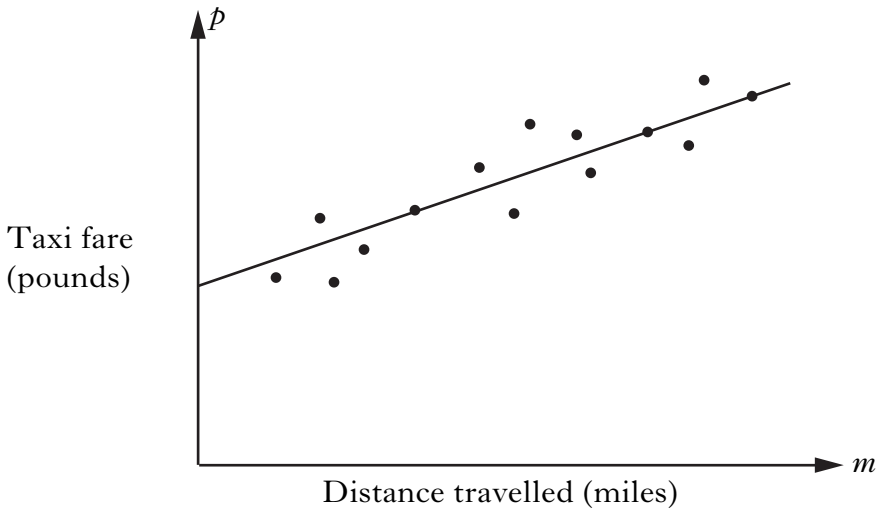
2. Paul conducts a survey to find the most popular school lunch.

- 30 pupils vote for Pasta
- 40 pupils vote for Baked Potato
- 2 pupils vote for Salad

Paul wishes to draw a pie chart to illustrate his data. How many degrees must he use for each sector in his pie chart?

Do <u>not</u> draw the pie chart. **2**

3. The scattergraph shows the taxi fare, p pounds, plotted against the distance travelled, m miles. A line of best fit has been drawn.



The equation of the line of best fit is $p = 2 + 1{\cdot}5\,m$.

Use this equation to predict the taxi fare for a journey of 6 miles. **1**

[Turn over

Marks

4. A rugby team scored the following points in a series of matches.

13 7 0 9 7 8 5

(*a*) For this sample, calculate:

(i) the mean; **1**

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

Show clearly all your working.

The following season, the team appoints a new coach.

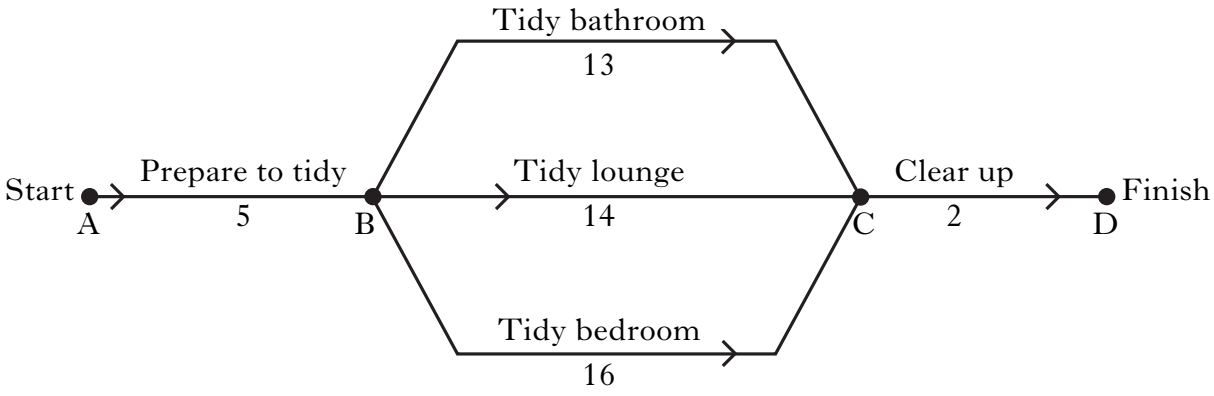
A similar series of matches produces a mean of 27 and a standard deviation of 3·25.

(*b*) Make two valid comparisons about the performance of the team under the new coach. **2**

5. Solve algebraically the system of equations

$$2x - 5y = 24$$
$$7x + 8y = 33.$$ **3**

6. The network diagram below shows the time it takes **three** friends to tidy a flat. All times are in minutes.



Guests are due to arrive in 20 minutes.

Will the flat be tidy on time?

Give a reason for your answer. **1**

Marks

7. Sam sells used cars. She keeps a record of her profits on a spreadsheet.

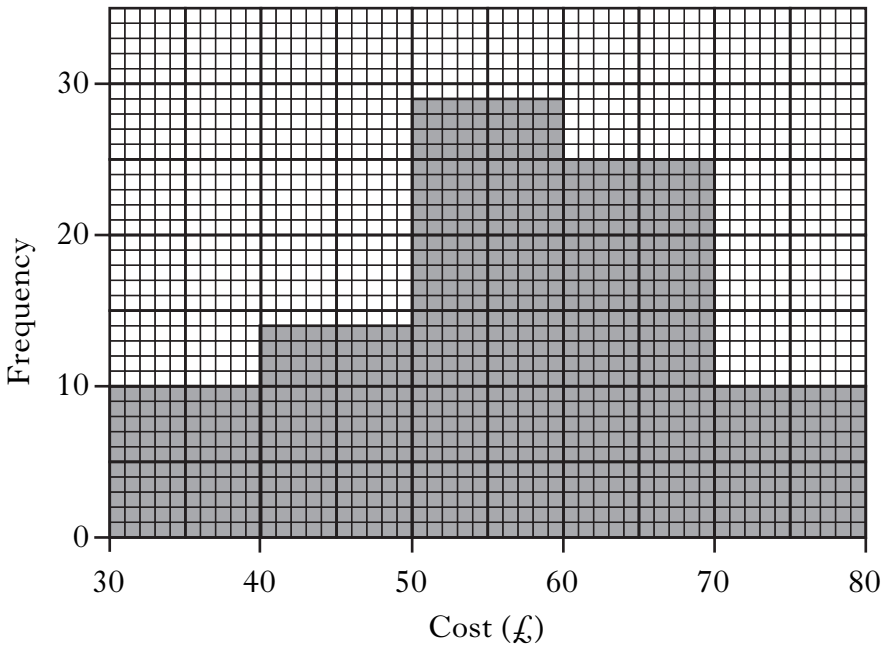
	A	B	C	D	E
1	**Make of Car**	**Cost Price**	**Selling Price**	**Profit**	**Profit (%)**
2					
3	**Sultan**	£2500	£3800	£1300	52
4	**Astral 4**	£3600	£4800		
5	**Ventra**	£2000	£3000		
6	**Satellite 5**	£7250	£8120		
7	**Phoenix**	£2800	£3080		

(*a*) What formula would be used to enter the profit in cell D6? **1**

(*b*) The result of the formula =D6/B6*100 is to appear in cell E6.
What value will appear in cell E6? **3**

8. The cost of electricity per quarter to a sample of homes in Bellrock Avenue was recorded.

The results are shown in the histogram below.



Estimate the value of the mode. **1**

[Turn over

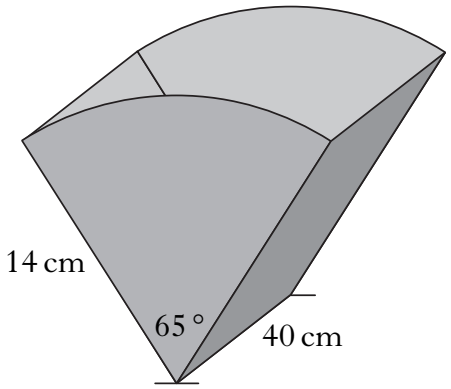
Marks

9. The ends of a magazine rack are identical.

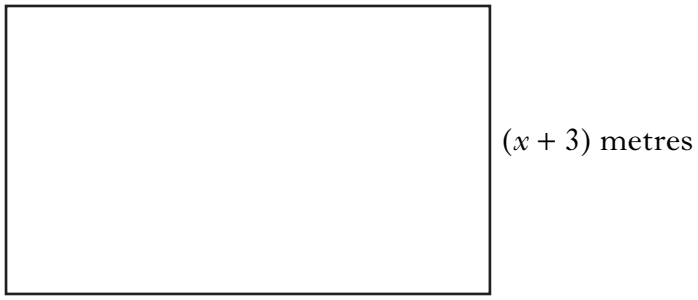
Each end is a sector of a circle with radius 14 centimetres.
The angle in each sector is 65 °.

The sectors are joined by two rectangles, each with length 40 centimetres.

The exterior is covered by material.
What area of material is required? **4**



10. The diagram below represents a rectangular garden with length $(x + 7)$ metres and breadth $(x + 3)$ metres.



Show that the area, A square metres, of the garden is given by

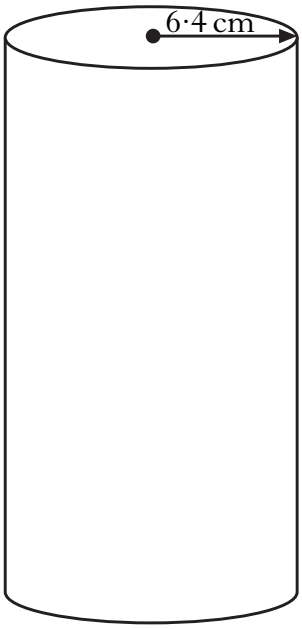
$$A = x^2 + 10x + 21.$$ **2**

Marks

11. A cylindrical container has a volume of 3260 cubic centimetres.

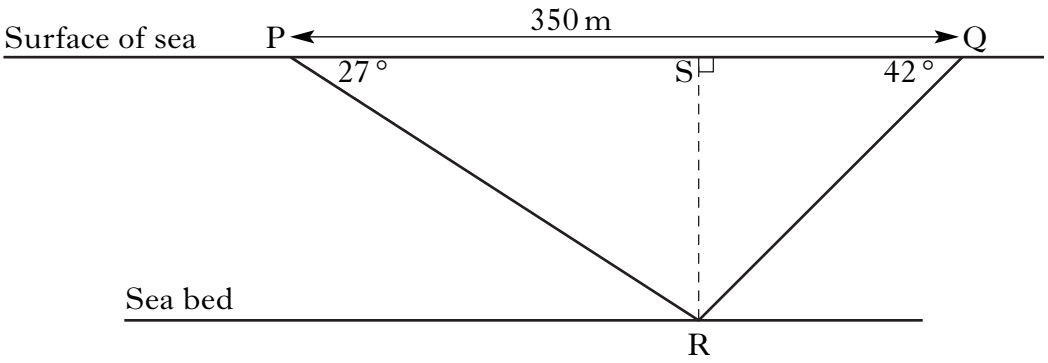
The radius of the cross section is 6·4 centimetres.

Calculate the height of the cylinder. **3**



12. Two ships have located a wreck on the sea bed.

In the diagram below, the points P and Q represent the two ships and the point R represents the wreck.



The angle of depression of R from P is 27°.
The angle of depression of R from Q is 42°.
The distance PQ is 350 metres.

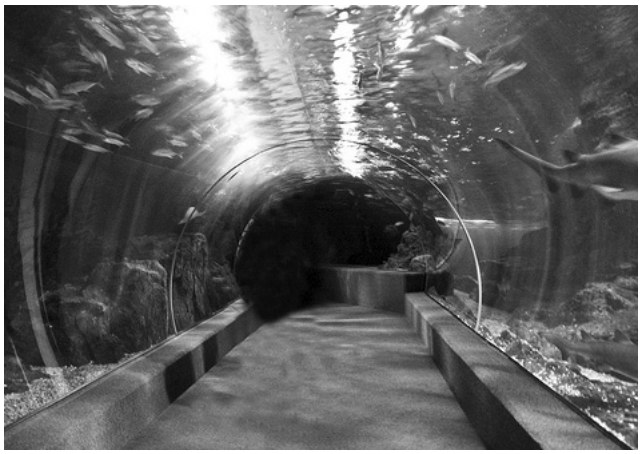
Calculate QS, the distance ship Q has to travel to be directly above the wreck.

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

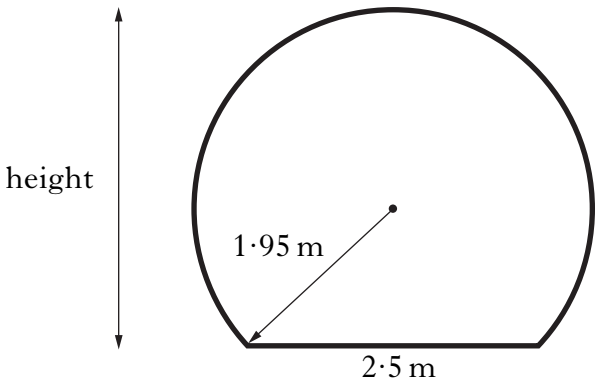
[Turn over

Marks

13. Ocean World has an underwater viewing tunnel.



The diagram below shows the cross-section of the tunnel. It consists of part of a circle with a horizontal base.



The radius of the circle is 1·95 metres and the width of the base is 2·5 metres.

Calculate the height of the tunnel. **4**

Marks

14. Shaheen works in a call centre. Her basic rate of pay is £6·40 per hour.

She is paid time and a half for working overtime in the evening and double time for working overtime at the weekend.

One week she works 35 hours at the basic rate and 6 hours overtime in the evening. She also works overtime at the weekend.

Shaheen's gross pay for the week is £320.

How many hours does she work at the weekend? **4**

15. The marks of a group of students in their Intermediate 2 Mathematics examination were recorded.

The cumulative frequency results are shown below.

Marks (m)	*Cumulative Frequency*
$0 \leq m < 10$	1
$10 \leq m < 20$	5
$20 \leq m < 30$	12
$30 \leq m < 40$	30
$40 \leq m < 50$	48
$50 \leq m < 60$	55
$60 \leq m < 70$	59
$70 \leq m < 80$	60

(*a*) Using squared paper, draw a cumulative frequency diagram for this data. **3**

(*b*) From your diagram, estimate:

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

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

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

[*END OF QUESTION PAPER*]

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