

X100/201

NATIONAL
QUALIFICATIONS
2003

WEDNESDAY, 21 MAY
1.30 PM – 2.15 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 $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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.

ALL questions should be attempted.

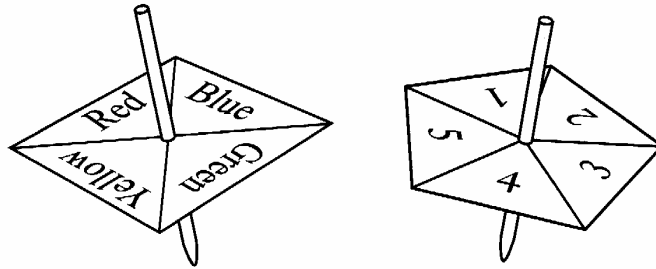
Marks

1. Multiply out the brackets and collect like terms.

$$(2a - b)(3a + 2b)$$

2

2. Two spinners are used in an experiment.



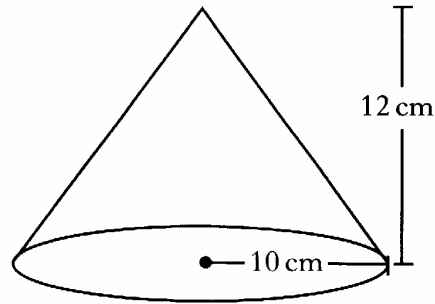
The table below shows some of the possible outcomes when both spinners are spun and allowed to come to rest.

	1	2	3	4	5
Red	R,1	R,2			
Yellow	Y,1				
Blue	B,1				
Green	G,1				

- (a) Copy and complete the table. 1
- (b) What is the probability that one spinner comes to rest on red and the other on an even number? 1

[Turn over

3. The diagram shows a cone.



The height is 12 centimetres and the radius of the base 10 centimetres.
Calculate the volume of the cone.

Take $\pi = 3.14$.

2

4. A hotel books taxis from a company called QUICKCARS.
The receptionist notes the waiting time for every taxi ordered over a period of two weeks.
The times are recorded in the stem and leaf diagram shown below.

Waiting time (minutes)

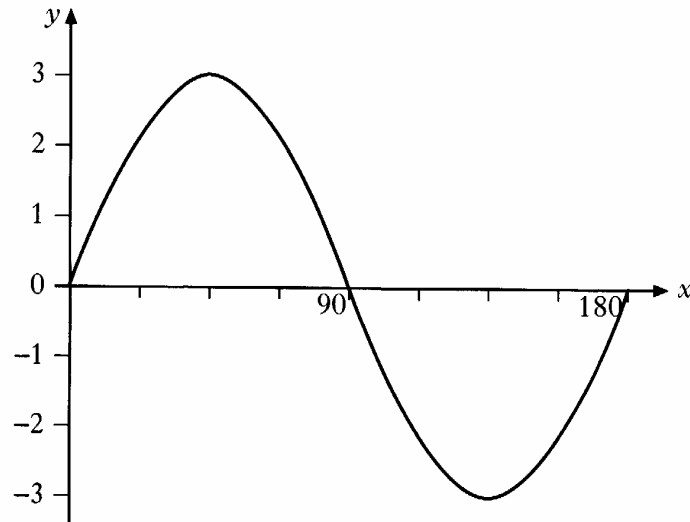
0	6 7
1	2 3 4
2	5 6 9 9
3	2 5 7
4	2 4

$n = 14$

1|3 represents 13 minutes

- (a) For the given data, calculate:
- (i) the median; 1
 - (ii) the lower quartile; 1
 - (iii) the upper quartile. 1
- (b) Calculate the semi-interquartile range. 1
- In another two week period, the hotel books taxis from a company called FASTCABS.
The semi-interquartile range for FASTCABS is found to be 2.5 minutes.
- (c) Which company provides the more consistent service? 1
Give a reason for your answer.

5. Part of the graph of $y = a \sin bx^\circ$ is shown in the diagram.



State the values of a and b .

2

6. (a) Express $\frac{\sqrt{40}}{\sqrt{2}}$ as a surd in its simplest form.

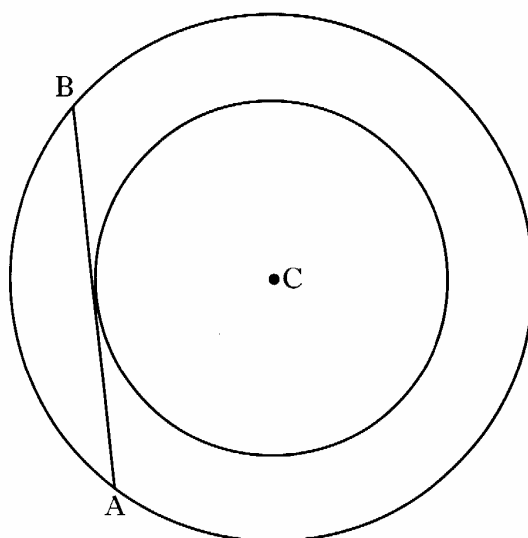
2

- (b) Simplify $\frac{2x+2}{(x+1)^2}$.

2

[Turn over for Questions 7 and 8 on Page six

7.



C is the centre of two concentric circles.

AB is a tangent to the smaller circle and a chord of the larger circle.

The radius of the smaller circle is 6 centimetres and the chord AB has length 16 centimetres.

Calculate the radius of the larger circle.

3

8. (a) Factorise $7 + 6x - x^2$.

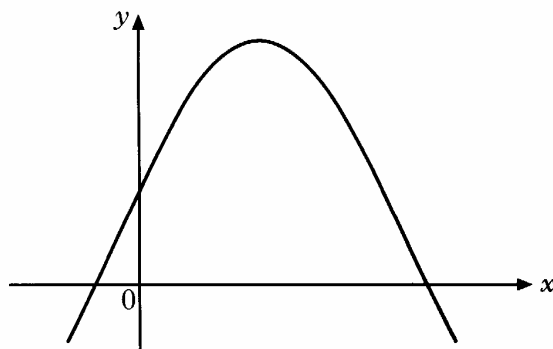
2

(b) Hence write down the roots of the equation

$$7 + 6x - x^2 = 0.$$

1

(c) The graph of $y = 7 + 6x - x^2$ is shown in the diagram.



Find the coordinates of the turning point.

3

[END OF QUESTION PAPER]

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MATHEMATICS
INTERMEDIATE 2
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Paper 2

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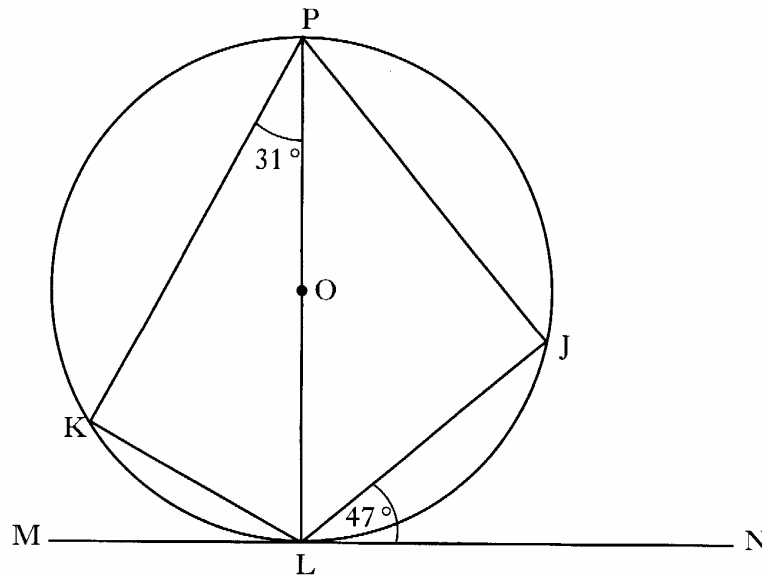
Volume of a cylinder: $\text{Volume} = \pi r^2 h$

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.

ALL questions should be attempted.

Marks

1.



The tangent, MN, touches the circle, centre O, at L.

Angle JLN = 47° .

Angle KPL = 31° .

Find the size of angle KLJ.

3

2. A sample of shoppers was asked which brand of washing powder they preferred.

The responses are shown below.

<i>Washing Powder</i>	<i>Frequency</i>
Dazzle	250
Cyclo	375
Surfer	125
Cleano	250

Construct a pie chart to illustrate this information.

Show all your working.

3

[Turn over

3. Seats on flights from London to Edinburgh are sold at two prices, £30 and £50.

On one flight a total of 130 seats was sold.

Let x be the number of seats sold at £30 and y be the number of seats sold at £50.

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

The sale of the seats on this flight totalled £6000.

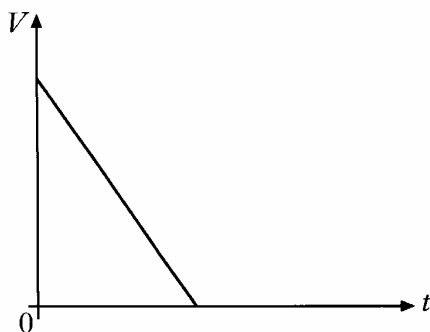
- (b) Write down a second equation in x and y which satisfies this condition. **1**

- (c) How many seats were sold at each price? **4**

4. A bath contains 150 litres of water.

Water is drained from the bath at a steady rate of 30 litres per minute.

The graph of the volume, V litres, of water in the bath against the time, t minutes, is shown below.



Write down an equation connecting V and t . **3**

5. A gardener grows tomatoes in his greenhouse.

The temperature of the greenhouse, in degrees Celsius, is recorded every day at noon for one week.

17 22 25 16 21 16 16

- (a) For the given temperatures, calculate:

(i) the mean;

1

(ii) the standard deviation.

3

Show clearly all your working.

For best growth, the mean temperature should be $(20 \pm 5)^{\circ}\text{C}$ and the standard deviation should be less than 5°C .

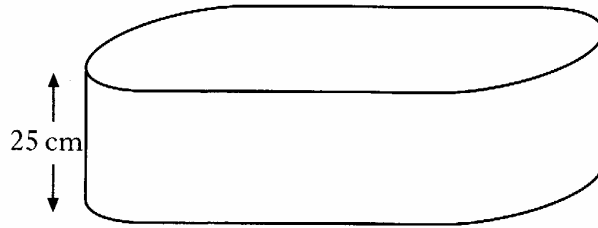
- (b) Are the conditions in the greenhouse likely to result in best growth?

Explain clearly your answer.

2

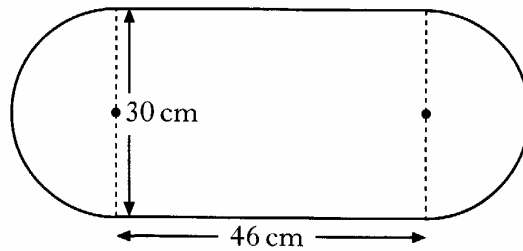
[Turn over

6. A garden trough is in the shape of a prism.



The height of the trough is 25 centimetres.

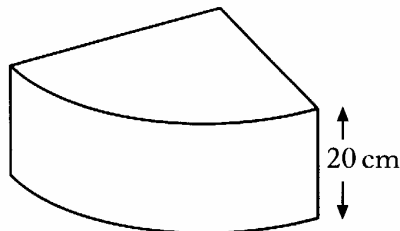
The cross-section of the trough consists of a rectangle and two semi-circles with measurements as shown.



- (a) Find the volume of the garden trough in cubic centimetres.
Give your answer correct to two significant figures.

4

A new design of garden trough is planned by the manufacturer.



The height of the trough is 20 cm.

The uniform cross-section of this trough is a quarter of a circle.

The volume of the trough is $30\,000\text{ cm}^3$.

- (b) Find the radius of the cross-section.

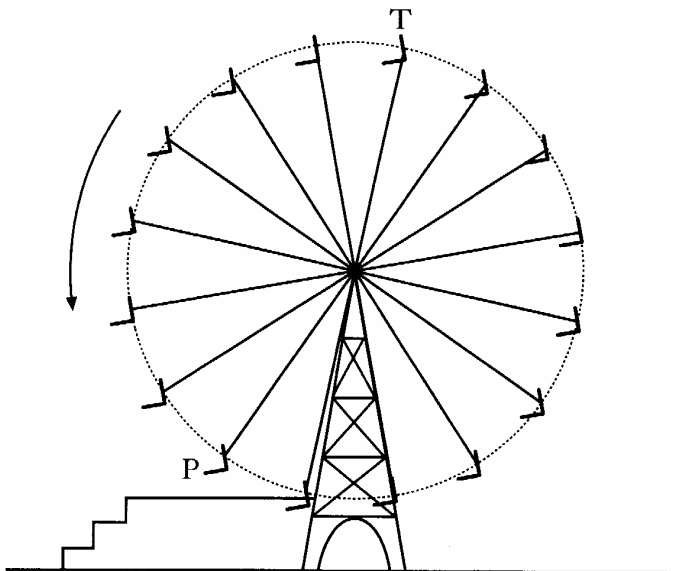
3

7. Change the subject of the formula

$$y = ax^2 + c \quad \text{to } x.$$

3

8. The diagram below shows a big wheel at a fairground.



The wheel has sixteen chairs equally spaced on its circumference.

The radius of the wheel is 9 metres.

As the wheel rotates in an anticlockwise direction, find the distance a chair travels in moving from position T to position P in the diagram.

4

9. Solve the equation

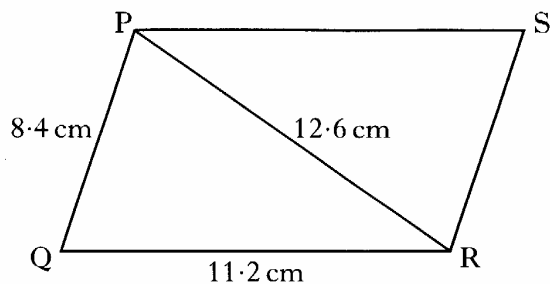
$$2x^2 + 4x - 9 = 0,$$

giving the roots correct to one decimal place.

4

[Turn over for Questions 10 to 12 on Page eight

10. The sketch shows a parallelogram, PQRS.



- (a) Calculate the size of angle PQR.

Do not use a scale drawing.

3

- (b) Calculate the area of the parallelogram.

3

11. (a) Express

$$a^{\frac{2}{3}}(a^{\frac{2}{3}} - a^{-\frac{2}{3}})$$

in its simplest form.

2

- (b) Express

$$\frac{a}{x} - \frac{b}{y}, \quad x \neq 0, \quad y \neq 0,$$

as a fraction in its simplest form.

2

12. (a) Solve the equation

$$2 \tan x^\circ + 7 = 0, \quad 0 \leq x < 360.$$

3

- (b) Prove that

$$\sin^3 x^\circ + \sin x^\circ \cos^2 x^\circ = \sin x^\circ.$$

2

[END OF QUESTION PAPER]