

2500/405

NATIONAL
QUALIFICATIONS
2005

FRIDAY, 6 MAY
1.30 PM – 2.25 PM

MATHEMATICS
STANDARD GRADE
Credit Level
Paper 1
(Non-calculator)

- 1 You may NOT use a calculator.
- 2 Answer as many questions as you can.
- 3 Full credit will be given only where the solution contains appropriate working.
- 4 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: $\text{Area} = \frac{1}{2}ab \sin C$

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.

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1. Evaluate

$$3 \cdot 8 - (7 \cdot 36 \div 8).$$

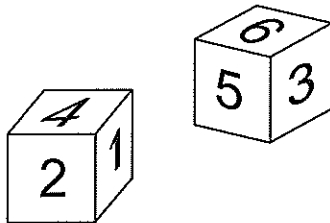
2. Evaluate

$$2\frac{1}{3} + \frac{5}{6} \text{ of } 1\frac{2}{5}.$$

3. Evaluate

$$12.5\% \text{ of } \pounds 140.$$

4. Two identical dice are rolled simultaneously.



Find the probability that the total score on adding both numbers will be greater than 7 but less than 10.

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5. In an experiment involving two variables, the following values for x and y were recorded.

x	0	1	2	3	4
y	6	4	2	0	-2

The results were plotted, and a straight line was drawn through the points. Find the gradient of the line **and** write down its equation.

6. Solve the equation

$$\frac{2}{x} + 1 = 6.$$

7. The speeds (measured to the nearest 10 kilometres per hour) of 200 vehicles are recorded as shown.

<i>Speed</i> (km/hr)	30	40	50	60	70	80	90	100	110
<i>Frequency</i>	1	4	9	14	38	47	51	32	4

Construct a cumulative frequency table and hence find the median for this data.

8. A number pattern is given below.

$$1^{\text{st}} \text{ term: } 2^2 - 0^2$$

$$2^{\text{nd}} \text{ term: } 3^2 - 1^2$$

$$3^{\text{rd}} \text{ term: } 4^2 - 2^2$$

(a) Write down a similar expression for the 4th term.

(b) Hence or otherwise find the n^{th} term in its simplest form.

9. (a) Emma puts £30 worth of petrol into the empty fuel tank of her car.

Petrol costs 75 pence per litre.

Her car uses 5 litres of petrol per hour, when she drives at a particular constant speed.

At this constant speed, how many litres of petrol will remain in the car after 3 hours.

2

- (b) The next week, Emma puts £20 worth of petrol into the empty fuel tank of her car.

Petrol costs c pence per litre.

Her car uses k litres of petrol per hour, when she drives at another constant speed.

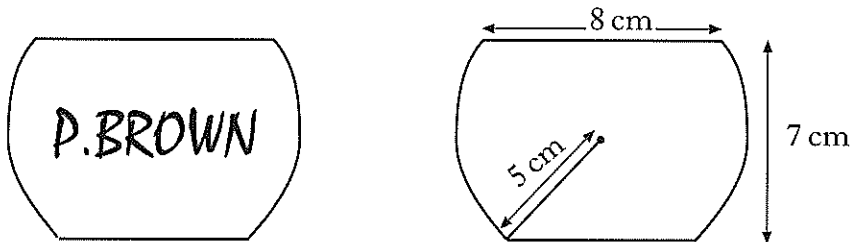
Find a formula for R , the amount of petrol remaining in the car after t hours.

3

10. A badge is made from a circle of radius 5 centimetres.

Segments are taken off the top and the bottom of the circle as shown.

The straight edges are parallel.



The badge measures 7 centimetres from the top to the bottom.

The top is 8 centimetres wide.

Calculate the width of the base.

5

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FRIDAY, 6 MAY
2.45 PM – 4.05 PM

MATHEMATICS
STANDARD GRADE
Credit Level
Paper 2

- 1 You may use a calculator.
- 2 Answer as many questions as you can.
- 3 Full credit will be given only where the solution contains appropriate working.
- 4 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: Area = $\frac{1}{2}ab \sin C$

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. $E = mc^2$.
 Find the value of E when $m = 3.6 \times 10^{-2}$ and $c = 3 \times 10^8$.
 Give your answer **in scientific notation**.

3

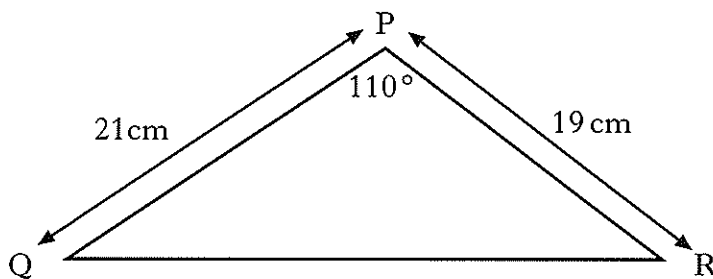
2. The running times in minutes, of 6 television programmes are:

77 91 84 71 79 75.

Calculate the mean and standard deviation of these times.

4

- 3.



Calculate the area of triangle PQR.

4

4. Solve the equation

$$x^2 + 2x = 9.$$

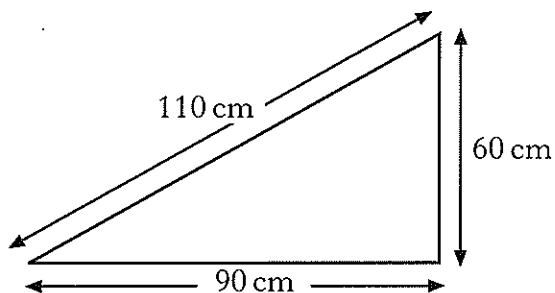
Give your answers **correct to 1 decimal place**.

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5. A triangular paving slab has measurements as shown.



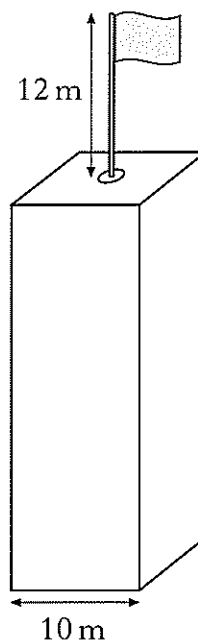
Is the slab in the shape of a right angled triangle?

Show your working.

3

6. A vertical flagpole 12 metres high stands at the centre of the roof of a tower.

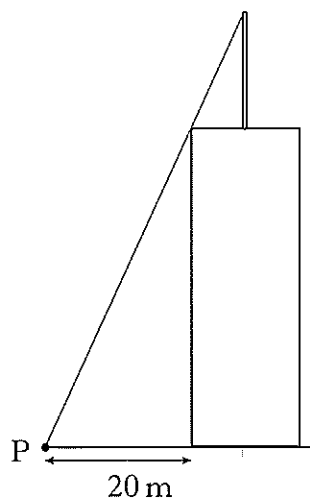
The tower is cuboid shaped with a square base of side 10 metres.



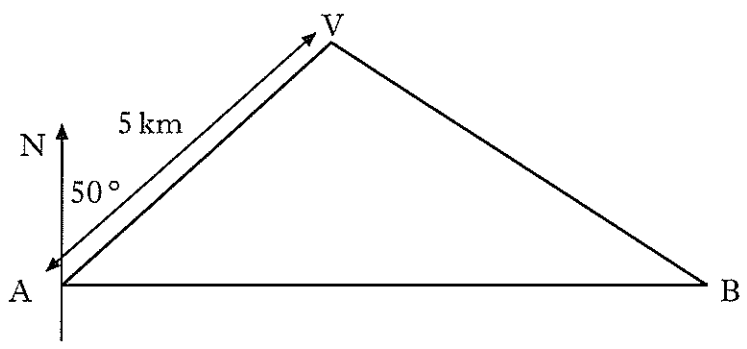
At a point P on the ground, 20 metres from the base of the tower, the top of the flagpole is just visible, as shown.

Calculate the height of the tower.

4



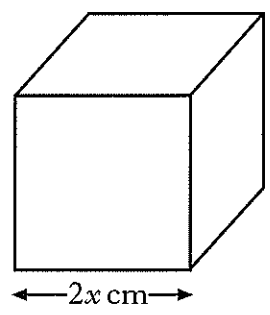
7. David walks on a bearing of 050° from hostel A to a viewpoint V, 5 kilometres away.
 Hostel B is due east of hostel A.
 Susie walks on a bearing of 294° from hostel B to the same viewpoint.



Calculate the length of AB, the distance between the two hostels.

5

8. The side length of a cube is $2x$ centimetres.



The expression for the volume in cubic centimetres is equal to the expression for the surface area in square centimetres.

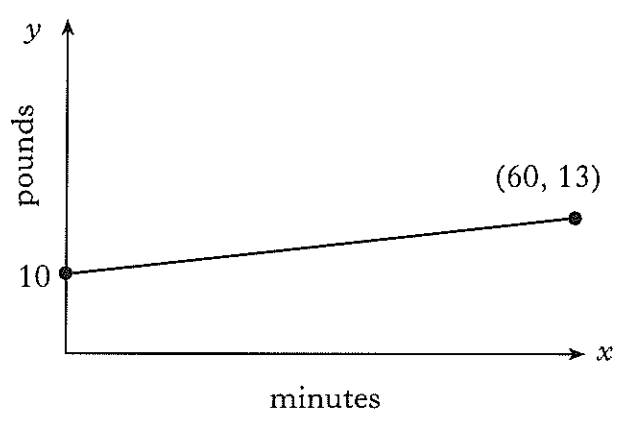
Calculate the side length of the cube.

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9. The monthly bill for a mobile phone is made up of a fixed rental plus call charges. Call charges vary as the time used.

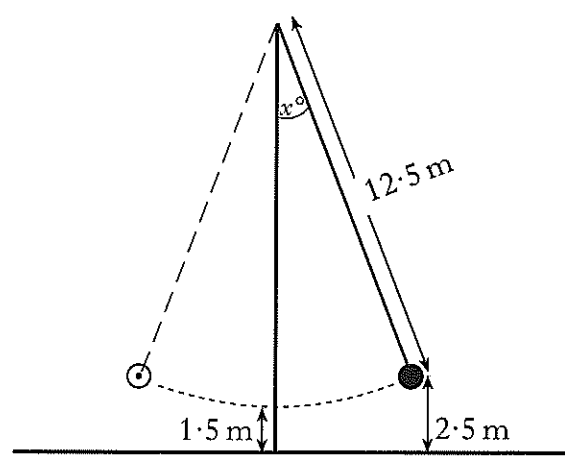
The relationship between the monthly bill, y (pounds), and the time used, x (minutes) is represented in the graph below.



- (a) Write down the fixed rental.
 (b) Find the call charge per minute.

1
3

10. The chain of a demolition ball is 12.5 metres long.
 When vertical, the end of the chain is 1.5 metres from the ground.



It swings to a maximum height of 2.5 metres above the ground on both sides.

- (a) At this maximum height, show that the angle x° , which the chain makes with the vertical, is approximately 23° .
 (b) Calculate the maximum length of the arc through which the end of the chain swings. Give your answer to 3 significant figures.

4
4

11. (a) Solve algebraically the equation

$$\sqrt{3}\sin x^\circ - 1 = 0 \quad 0 \leq x < 360.$$

(b) Hence write down the solution of the equation

$$\sqrt{3}\sin 2x^\circ - 1 = 0 \quad 0 \leq x < 90.$$

[END OF QUESTION PAPER]

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