

**2500/405**

NATIONAL  
QUALIFICATIONS  
2002

THURSDAY, 9 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:** 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.

KU	RE
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1. Evaluate

$$7 \cdot 18 - 2 \cdot 1 \times 3.$$

2. Evaluate

$$1\frac{1}{8} \div \frac{3}{4}.$$

3. Solve the inequality  $5 - x > 2(x + 1)$ .

4. Given that  $f(x) = x^2 + 5x$ , evaluate  $f(-3)$ .

5. (a) Factorise  $p^2 - 4q^2$ .

(b) Hence simplify

$$\frac{p^2 - 4q^2}{3p + 6q}.$$

6.  $L = \frac{1}{2}(h - t)$ .

Change the subject of the formula to  $h$ .

[Turn over



10. Simplify

$$\sqrt{27} + 2\sqrt{3}.$$

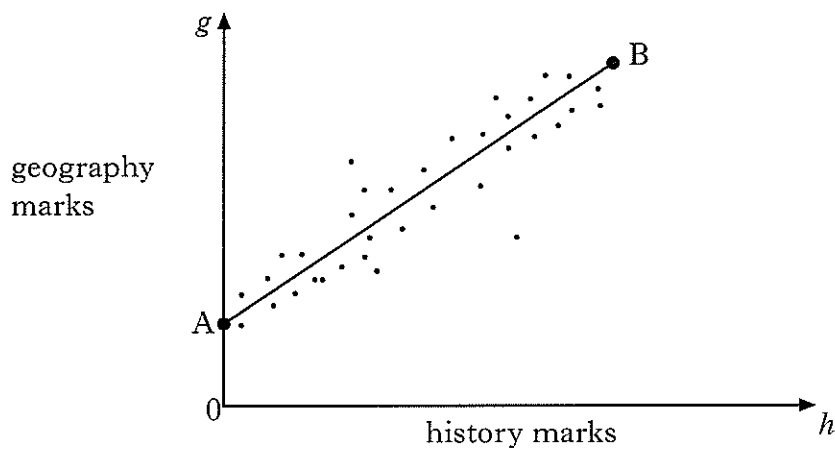
2

11. Express in its simplest form

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

2

12. The graph below shows the relationship between the history and geography marks of a class of students.



A best-fitting straight line, AB has been drawn.

Point A represents 0 marks for history and 12 marks for geography.

Point B represents 90 marks for history and 82 marks for geography.

Find the equation of the straight line AB in terms of  $h$  and  $g$ .

4

[Turn over for Question 13 on Page six

13. (a) 4 peaches and 3 grapefruit cost £1.30.  
Write down an algebraic equation to illustrate this.
- (b) 2 peaches and 4 grapefruit cost £1.20.  
Write down an algebraic equation to illustrate this.
- (c) Find the cost of 3 peaches and 2 grapefruit.

[END OF QUESTION PAPER]

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**2500/406**

NATIONAL  
QUALIFICATIONS  
2002

THURSDAY, 9 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  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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**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. A spider weighs approximately  $19.06 \times 10^{-5}$  kilograms.  
A humming bird is 18 times heavier.  
Calculate the weight of the humming bird.  
Give your answer **in scientific notation**.

2. A microwave oven is sold for £150.  
This price includes VAT at 17.5%.  
Calculate the price of the microwave oven **without** VAT.

3. Solve the equation

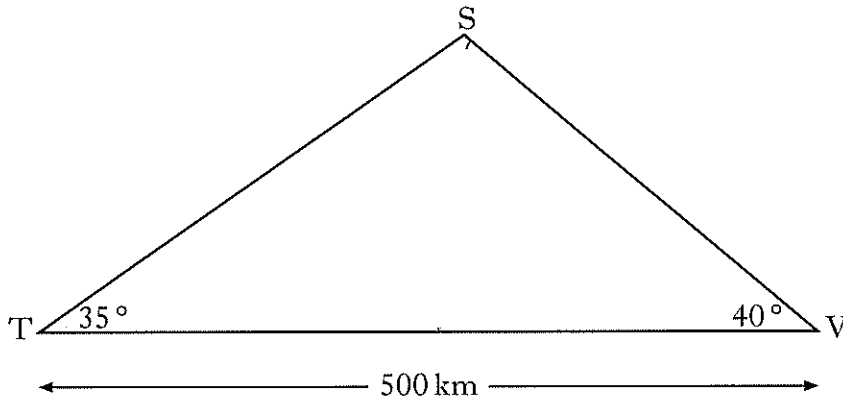
$$2x^2 + 3x - 7 = 0.$$

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

[Turn over

KU	RE
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4. A TV signal is sent from a transmitter T, via a satellite S, to a village V, as shown in the diagram. The village is 500 kilometres from the transmitter.



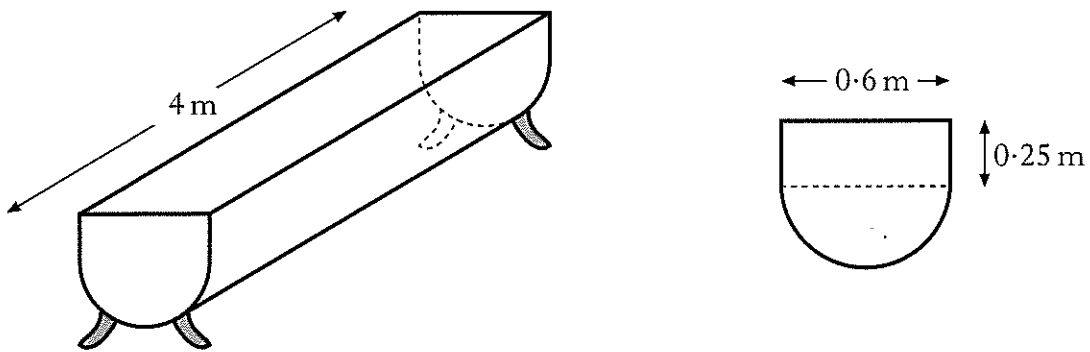
The signal is sent out at an angle of  $35^\circ$  and is received in the village at an angle of  $40^\circ$ .

Calculate the height of the satellite above the ground.

5

5. A feeding trough, 4 metres long, is prism-shaped.

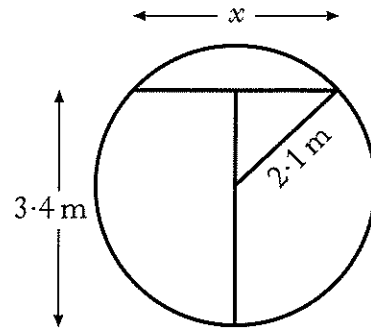
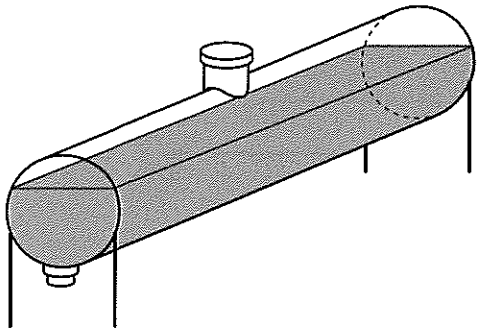
The uniform cross-section is made up of a rectangle and semi-circle as shown below.



Find the volume of the trough, **correct to 2 significant figures**.

5

6. An oil tank has a circular cross-section of radius 2.1 metres.  
It is filled to a depth of 3.4 metres.



- (a) Calculate  $x$ , the width in metres of the oil surface.  
(b) What other depth of oil would give the same surface width?

3

1

7. A coffee shop blends its own coffee and sells it in one-kilogram tins.

One blend consists of two kinds of coffee, Brazilian and Colombian, in the ratio 2 : 3.

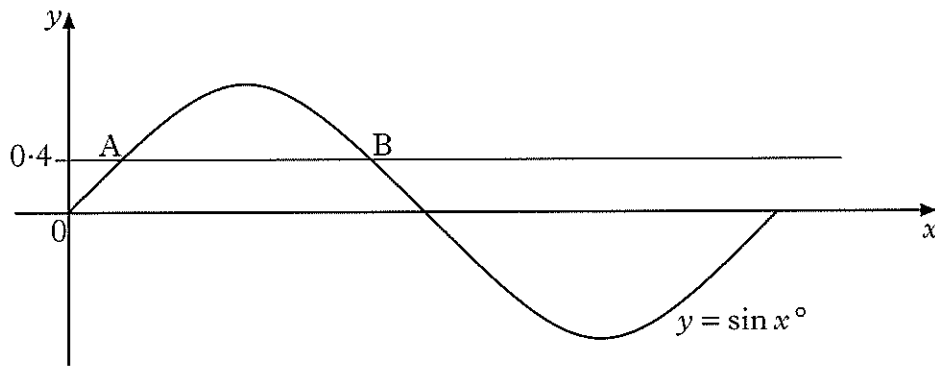
The shop has 20 kilograms of Brazilian and 25 kilograms of Colombian in stock.

What is the **maximum** number of one-kilogram tins of this blend which can be made?

3

[Turn over

8. The diagram shows part of the graph of  $y = \sin x^\circ$ .



The line  $y = 0.4$  is drawn and cuts the graph of  $y = \sin x^\circ$  at A and B.  
Find the  $x$ -coordinates of A and B.

9. Esther has a new mobile phone and considers the following daily rates.

**Easy Call**

25 pence per minute for the first 3 minutes

5 pence per minute **after** the first three minutes

**Green Call**

40 pence per minute for the first 2 minutes

2 pence per minute **after** the first two minutes

- (a) For Easy Call, find the cost of ten minutes in a day.
- (b) For Easy Call, find a formula for the cost of “ $m$ ” minutes in a day,  $m > 3$ .
- (c) For Green Call, find a formula for the cost of “ $m$ ” minutes in a day,  $m > 2$ .
- (d) Green Call claims that its system is cheaper.  
Find **algebraically** the least number of minutes (to the nearest minute) which must be used each day for this claim to be true.

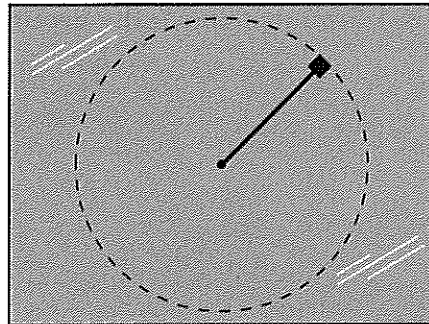
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1

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3

10. A weight on the end of a string is spun in a circle on a smooth table.



The tension,  $T$ , in the string varies directly as the square of the speed,  $v$ , and inversely as the radius,  $r$ , of the circle.

- (a) Write down a formula for  $T$  in terms of  $v$  and  $r$ .
- (b) The speed of the weight is multiplied by 3 and the radius of the string is halved.  
What happens to the tension in the string?

1

2

11. (a) Solve the equation

$$2^n = 32.$$

(b) A sequence of numbers can be grouped and added together as shown.

The sum of 2 numbers:  $(1 + 2) = 4 - 1$

The sum of 3 numbers:  $(1 + 2 + 4) = 8 - 1$

The sum of 4 numbers:  $(1 + 2 + 4 + 8) = 16 - 1$

Find a **similar** expression for the sum of 5 numbers.

(c) Find a formula for the sum of the first  $n$  numbers of this sequence.

1

1

2

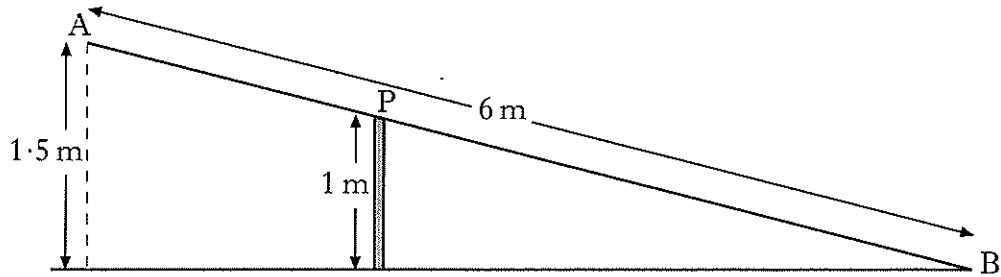
[Turn over for Question 12 on Page eight

12. A metal beam, AB, is 6 metres long.

It is hinged at the top, P, of a vertical post 1 metre high.

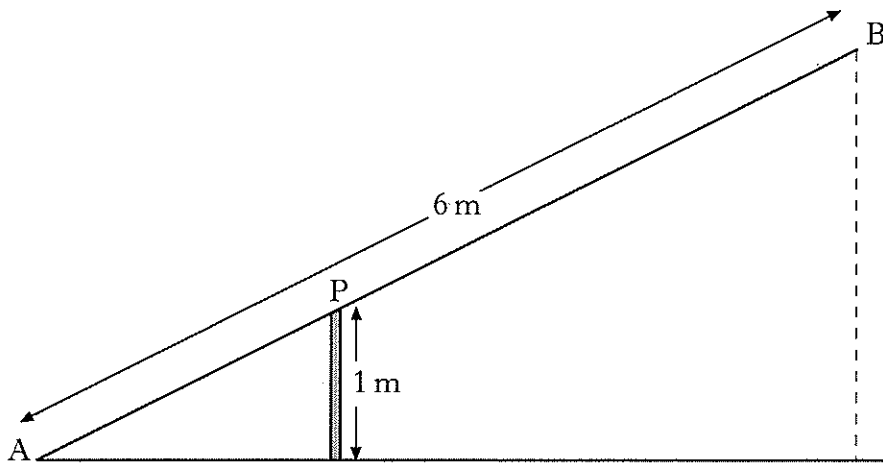
When B touches the ground, A is 1.5 metres above the ground, as shown in Figure 1.

Figure 1



When A comes down to the ground, B rises, as shown in Figure 2.

Figure 2



By calculating the length of AP, or otherwise, find the height of B above the ground.

**Do not use a scale drawing.**

[END OF QUESTION PAPER]