C

2500/104

MATHEMATICS
STANDARD GRADE
Credit Level

1 Answer as many questions as you can.

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 $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

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

1. Paul bought a car last year.

   It has lost $12\frac{1}{2}\%$ of its value since then.

   It is now valued at £10 500.

   How much did Paul pay for his car?

2. A newspaper report stated:

   "Concorde has now flown $7 \cdot 1 \times 10^7$ miles.

   This is equivalent to 300 journeys from the earth to the moon."
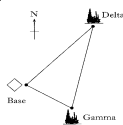
   Calculate the distance from the earth to the moon.

   Give your answer in **scientific notation correct to 2 significant figures**.

3. Solve **algebraically** the inequality

   $$5x - 4 < 2(1 - 2x).$$

4. The diagram shows the positions of a helicopter base and two oil rigs, Delta and Gamma.

   From the helicopter base, the oil rig Delta is 35 kilometres away on a bearing of 050°.

   From the same base, the oil rig Gamma is 20 kilometres away on a bearing of 125°.

   Calculate the distance between Delta and Gamma.

   Do not use a scale drawing.

5.
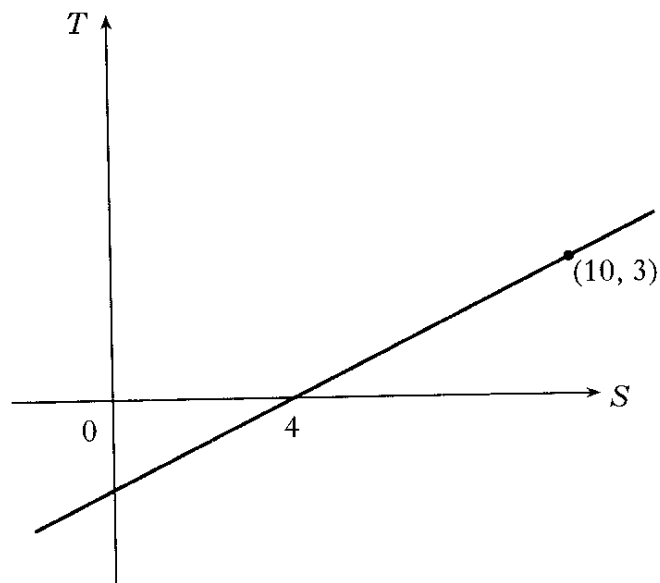
Find the equation of the given straight line in terms of T and S.

6. Factorise $3x^2 - 5x - 2$.

7. Anna hired a mobile phone at a fixed charge of £17·50 per month.

She is also charged for her total call time each month.

15 minutes of this total call time are **free**. The rest of her call time is charged at 35 pence per minute.

(a) What is the total cost for Anna's phone in a month when her **total call time** is 42 minutes?

(b) Write down a formula for the total cost, £C, for Anna's phone in a month when her **total call time** is t minutes, where $t \geq 15$.

8.

A Fibonacci sequence is a sequence of numbers.

After the first two terms, each term is the sum of the previous two terms.

$$13 = 5 + 8$$

eg   2,   3,   5,   8,   13, ...

$$5 = 2 + 3$$

(a) Write down the next three terms of this Fibonacci sequence.

5,   −1,   4,   __,   __,   __,

(b) For the Fibonacci sequence

4,   −3,   1,   −2,   −1,   −3,   −4, ...

show that the sum of the first six terms is equal to four times the fifth term.

(c) If p and q are the first two terms of a Fibonacci sequence, **prove** that the sum of the first six terms is equal to four times the fifth term.

9. The diagram shows a table whose top is in the shape of part of a circle with centre, O, and radius 60 centimetres.
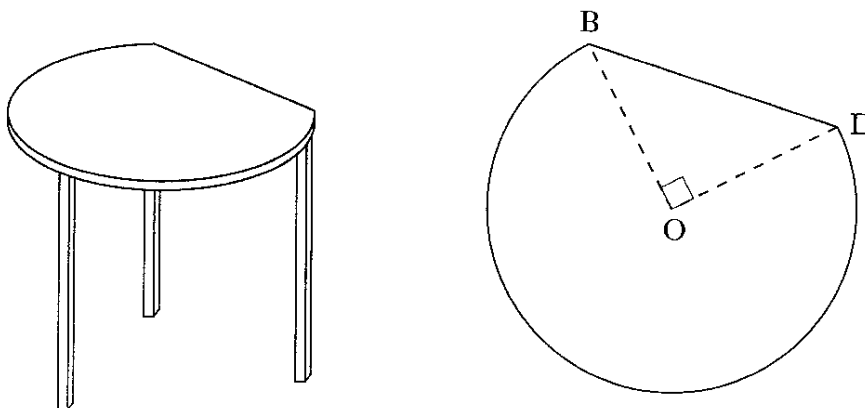
BD is a straight line.

Angle BOD is 90°.

Calculate the perimeter of the table top.

10. A wooden toy box is prism-shaped as shown in figure 1.

figure 1

The uniform cross-section of the box is shown in figure 2.

figure 2

Calculate the volume of the box in **cubic metres**.

4

11. The diagram below shows two jugs which are mathematically similar.

The volume of the smaller jug is 0·8 litre.

Find the volume of the larger jug.

3

12. Solve **algebraically** the equation

$$2 + 3\sin x° = 0 \text{ for } 0 \le x < 360.$$

13.

SPORTS CLUB
DISCO

Friday 15th July
7.30 pm

MEMBERS   £2
NON-MEMBERS £3

The tickets for a Sports Club disco cost £2 for members and £3 for non-members.

(*a*) The total ticket money collected was £580.

x tickets were sold to members and *y* tickets were sold to non-members.

Use this information to write down an equation involving *x* and *y*.

(*b*) 250 people bought tickets for the disco.

Write down another equation involving *x* and *y*.

(*c*) How many tickets were sold to members?

[Turn over

2

1

3

14. The end wall of a bungalow is in the shape of a rectangle and a triangle as shown below.

The roof has one edge inclined at 24° to the horizontal and the other edge inclined at 42° to the horizontal.

The width of the house is 12·8 metres.

Calculate the length of the longer sloping edge of the roof.
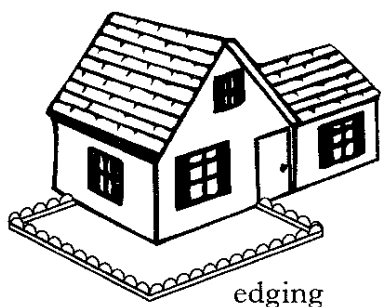
Do not use a scale drawing.

4

15.

A gardener creates an L-shaped flower-bed. He uses the house walls and concrete edging for the boundary as shown in figure 1.

figure 1

He plans his flower-bed as shown in figure 2.
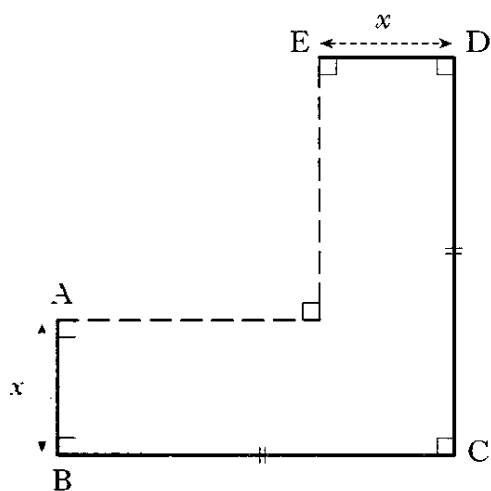

figure 2

(a) He uses a total of **6 metres of edging**.

AB = ED = x metres
BC = DC

Show that the length, in metres, of BC can be expressed as BC = $3 - x$.

(b) Hence show that the area, A, in square metres, of the flower-bed can be expressed as

$$A = 6x - 3x^2.$$

(c) Calculate **algebraically** the maximum area of the flower-bed.

[Turn over

16. (a) Express $\sqrt{32}$ as a surd in its simplest form.

(b) Simplify $a^2(a^{-5}+4)$.

(c) Multiply out the brackets and collect like terms

$$(x-2)(x^2+3x-4).$$

17. A statue stands at the corner of a square courtyard.

The statue is 4·6 metres high.

The angle of elevation from the opposite corner of the courtyard to the top of the statute is 8 °.

(a) Find the distance from the base of the statue to the opposite corner of the courtyard.

(b) Show that the length of the side of the courtyard is approximately 23 metres.

18. $f(x)=3^x$

(a) Find $f(4)$.

(b) Given that $f(x)=\sqrt{27}$, find x.

19.

The table below shows the distances, in metres (*d*), travelled by a snowboarder in seconds (*t*).

Time in seconds (*t*)	1	2	3	4
Distance in metres (*d*)	5	20	45	80

(*a*) Explain why *d* varies directly as t^2.

1

(*b*) Write down the formula connecting *d* and *t*.

1

(*c*) How does the distance change when the time is multiplied by six?

2

[*END OF QUESTION PAPER*]