

Dr Oliver Mathematics
Mathematics Standard Grade: Credit Level
2007 Paper 1: Non-Calculator
55 minutes

The total number of marks available is 41.
You must write down all the stages in your working.

1. Evaluate

$$6.04 + 3.72 \times 20.$$

(2)

Solution

$$\begin{aligned} 6.04 + 3.72 \times 20 &= 6.04 + (7.44 \times 10) \\ &= 6.04 + 74.4 \\ &= \underline{\underline{80.44}}. \end{aligned}$$

2. Evaluate

$$3\frac{1}{6} \div 1\frac{2}{3}.$$

(2)

Solution

$$\begin{aligned} 3\frac{1}{6} \div 1\frac{2}{3} &= \frac{19}{6} \div \frac{5}{3} \\ &= \frac{19}{6} \times \frac{3}{5} \\ &= \frac{19}{2} \times \frac{1}{5} \\ &= \frac{19}{10} \\ &= \underline{\underline{1\frac{9}{10}}}. \end{aligned}$$

3. There are 400 people in a studio audience.

The probability that a person chosen at random from this audience is male is $\frac{3}{10}$.
How many males are in this audience?

(2)

Solution

$$\begin{aligned}\text{Males} &= \frac{5}{8} \times 400 \\ &= 5 \times 50 \\ &= \underline{\underline{250}}.\end{aligned}$$

4.

$$P = \frac{2(m-4)}{3}.$$

(3)

Change the subject of the formula to m .

Solution

$$\begin{aligned}P &= \frac{2(m-4)}{3} \Rightarrow 3P = 2(m-4) \\ &\Rightarrow \frac{3P}{2} = m-4 \\ &\Rightarrow \underline{\underline{m = \frac{3P}{2} + 4}}.\end{aligned}$$

5. Remove brackets and simplify

$$(2x+3)^2 - 3(x^2-6).$$

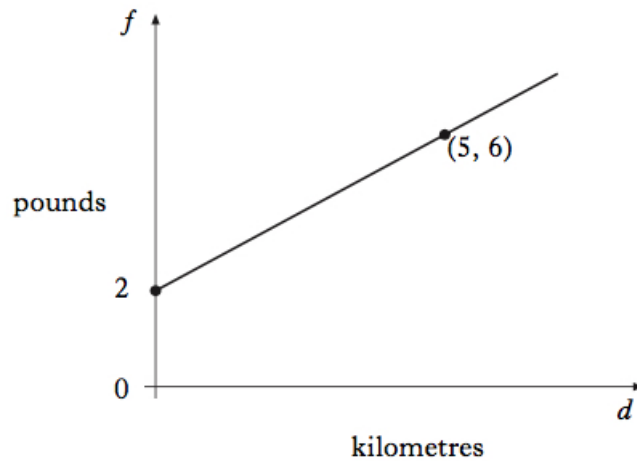
(3)

Solution

$$\begin{array}{r|rr} \times & 2x & +3 \\ \hline 2x & 4x^2 & +6x \\ +3 & +6x & +9 \\ \hline \end{array}$$

$$\begin{aligned}(2x+3)^2 - 3(x^2-6) &= (4x^2 + 12x + 9) - 3x^2 + 18 \\ &= \underline{\underline{x^2 + 12x + 27}}.\end{aligned}$$

6. A taxi fare consists of a £2 “call-out” charge plus a fixed amount per kilometre. (4)
The graph shows the fare, f pounds for a journey of d kilometres.



The taxi fare for a 5 kilometre journey is £6.
Find the equation of the straight line in terms of d and f .

Solution

$$\begin{aligned}\text{Gradient} &= \frac{6 - 2}{5 - 0} \\ &= \frac{4}{5}.\end{aligned}$$

Finally, the equation is

$$\underline{\underline{f = \frac{4}{5}d + 2.}}$$

7. Remove brackets and simplify (2)

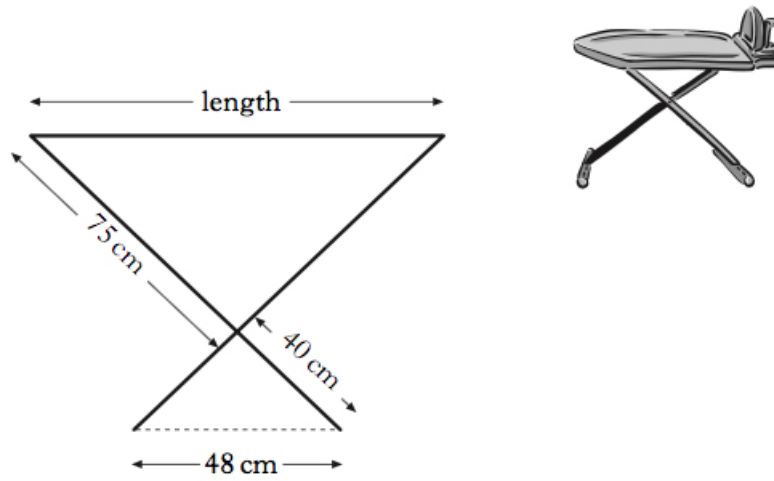
$$a^{\frac{1}{2}}(a^{\frac{1}{2}} - 2).$$

Solution

$$a^{\frac{1}{2}}(a^{\frac{1}{2}} - 2) = \underline{\underline{a - 2a^{\frac{1}{2}}.}}$$

8. Mick needs an ironing board.
He sees one in a catalogue with measurements as shown in the diagram below.

(3)



When the ironing board is set up, two similar triangles are formed.
Mick wants an ironing board which is at least 80 centimetres in length.
Does this ironing board meet Mick's requirements?
Show all your working.

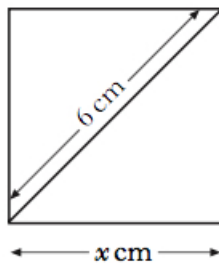
Solution

$$\begin{aligned}\frac{\text{length}}{48} &= \frac{75}{40} \Rightarrow \text{length} = \frac{75 \times 48}{40} \\ &\Rightarrow \text{length} = \frac{75 \times 6}{5} \\ &\Rightarrow \text{length} = 15 \times 6 \\ &\Rightarrow \text{length} = 90;\end{aligned}$$

so, yes: this ironing board meet Mick's requirements.

9. A square of side x centimetres has a diagonal 6 centimetres long.

(3)



Calculate the value of x , giving your answer as a surd in its simplest form.

Solution

$$\begin{aligned}
 x^2 + x^2 &= 6^2 \Rightarrow 2x^2 = 36 \\
 &\Rightarrow x^2 = 18 \\
 &\Rightarrow x = \sqrt{18} \\
 &\Rightarrow x = \sqrt{9 \times 2} \\
 &\Rightarrow x = \sqrt{9} \times \sqrt{2} \\
 &\Rightarrow \underline{\underline{x = 3\sqrt{2}}}.
 \end{aligned}$$

10. A relationship between T and L is given by the formula,

(2)

$$T = \frac{k}{L^3},$$

where k is a constant.

When L is doubled, what is the effect on T ?

Solution

$$\begin{aligned}
 T &= \frac{k}{(2L)^3} \\
 &= \frac{k}{8L^3} \\
 &= \frac{1}{8} \times \frac{k}{L^3};
 \end{aligned}$$

so, when L is doubled, T is an eighth of what it was.

11. (a) A cinema has 300 seats which are either standard or deluxe. (1)
Let x be the number of standard seats and y be the number of deluxe seats.
Write down an algebraic expression to illustrate this information.

Solution

$$\underline{x + y = 300} \quad (1).$$

- (b) A standard seat costs £4 and a deluxe seat costs £6. (2)
When all the seats are sold the ticket sales are £1 380.
Write down an algebraic expression to illustrate this information.

Solution

$$\underline{4x + 6y = 1\,380} \quad (2).$$

- (c) How many standard seats and how many deluxe seats are in the cinema? (3)

Solution

E.g.,

$$4x + 4x = 1\,200 \quad (3)$$

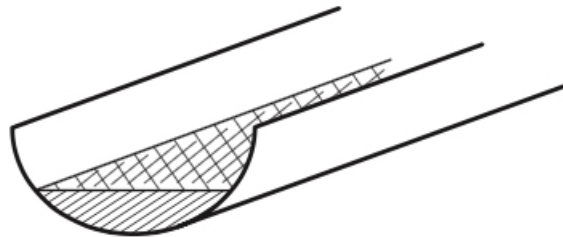
$$4x + 6y = 1\,380 \quad (2)$$

Now, (2) – (3):

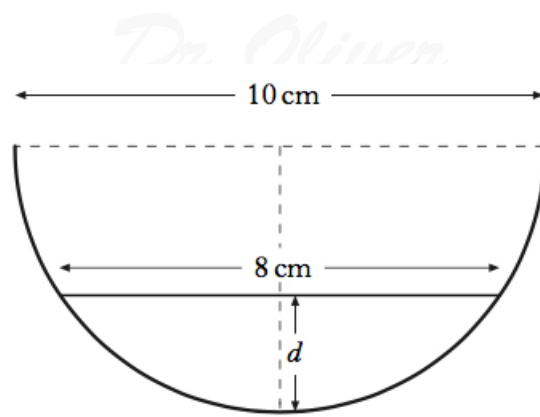
$$2y = 180 \Rightarrow \underline{y = 90}$$

$$\Rightarrow \underline{x = 210}.$$

12. The diagram shows water lying in a length of roof guttering. (4)



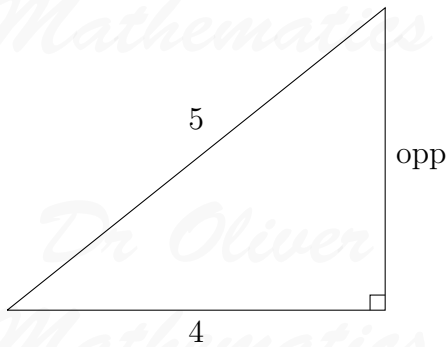
The cross-section of the guttering is a semi-circle with diameter 10 centimetres.
The water surface is 8 centimetres wide.



Calculate the depth, d , of water in the guttering.

Solution

Half the diameter of the radius (and you get 5) and half the water surface (and you get 4).



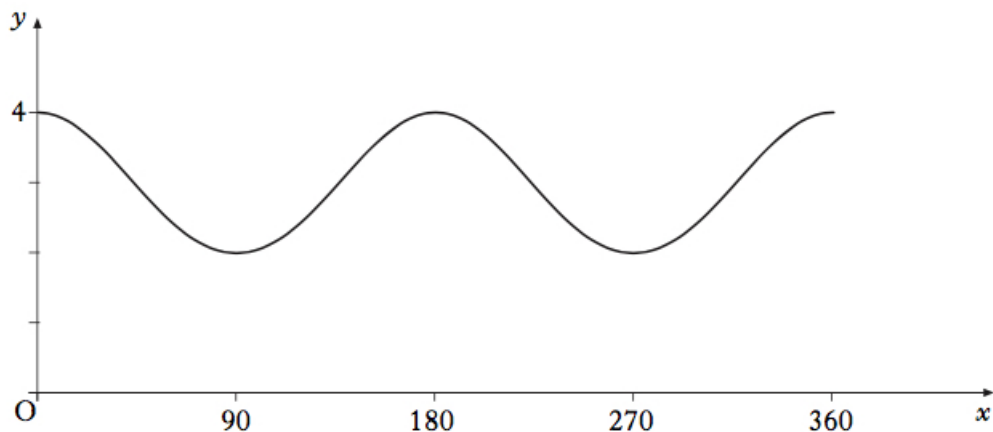
$$\begin{aligned} \text{hyp}^2 &= \text{opp}^2 + \text{adj}^2 \Rightarrow 5^2 = \text{opp}^2 + 4^2 \\ &\Rightarrow \text{opp}^2 = 25 - 16 \\ &\Rightarrow \text{opp}^2 = 9 \\ &\Rightarrow \text{opp} = 3, \end{aligned}$$

and we will get the depth:

$$d = 5 - 3 = \underline{\underline{2 \text{ cm}}}.$$

13. Part of the graph of $y = \cos bx^\circ + c$ is shown below.

(2)



Write down the values of b and c .

Solution

$b = 2$ and $c = 3$.

14. The **sum** S_n of the first n terms of a sequence, is given by the formula

$$S_n = 3^n - 1.$$

(a) Find the **sum** of the first 2 terms.

(1)

Solution

$$\begin{aligned} S_2 &= 3^2 - 1 \\ &= \underline{8}. \end{aligned}$$

(b) When $S_n = 80$, calculate the value of n .

(2)

Solution

$$\begin{aligned} 3^n - 1 &= 80 \Rightarrow 3^n = 81 \\ &\Rightarrow 3^n = 3^4 \\ &\Rightarrow \underline{n = 4}. \end{aligned}$$