Dr Oliver Mathematics
Mathematics Standard Grade: Credit Level
2011 Paper 2: Calculator
1 hour 20 minutes

The total number of marks available is 49.
You must write down all the stages in your working.

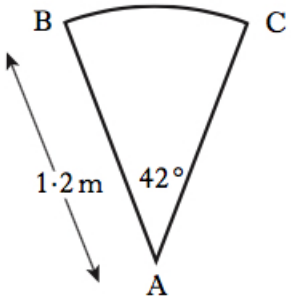
1. Olga normally runs a total distance of 28 miles per week. (3)
   She decides to increase her distance by 10% a week for the next four weeks.
   How many miles will she run in the fourth week?

2. Expand and simplify (3)
   $$(3x + 1)(x^2 - 5x + 4).$$

3. Solve the equation (4)
   $$2x^2 + 3x - 7 = 0.$$
   Give your answers **correct to 2 significant figures**.

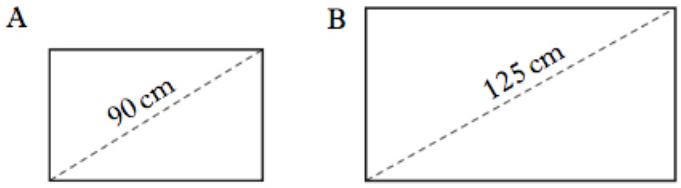
4. A car is valued at £3 780. (3)
   This is 16% less than last year's value.
   What was the value of the car last year?

5. A spiral staircase is being designed. (4)



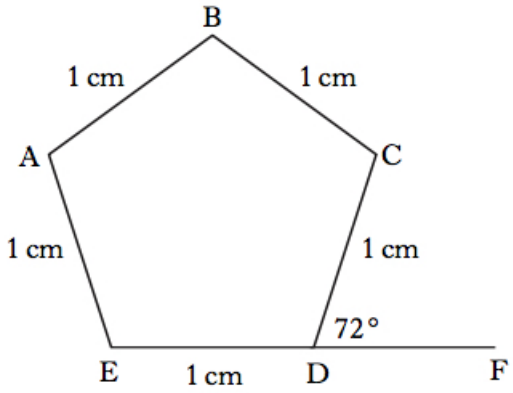
   Each step is made from a sector of a circle as shown.
   The radius is 1.2 metres.
   Angle BAC is 42°.
   For the staircase to pass safety regulations, the arc BC must be at least 0.9 metres.
   Will the staircase pass safety regulations?

6. Two rectangular solar panels, A and B, are mathematically similar. (4)
Panel A has a diagonal of 90 centimetres and an area of 4 020 square centimetres.



A salesman claims that panel B, with a diagonal of 125 centimetres, will be double the area of panel A.
Is this claim justified?
Show all your working.

7. $ABCDE$ is a regular pentagon with each side 1 centimetre.

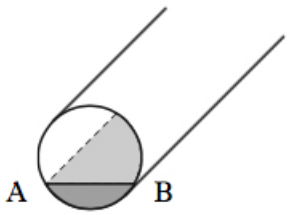


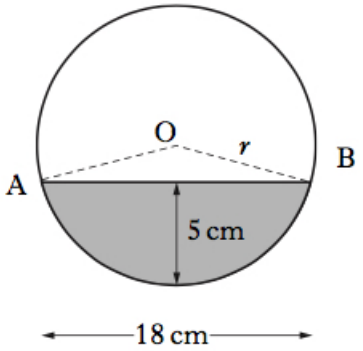
Angle CDF is 72°.
EDF is a straight line.

(a) Write down the size of angle ABC. (1)

(b) Calculate the length of AC. (3)

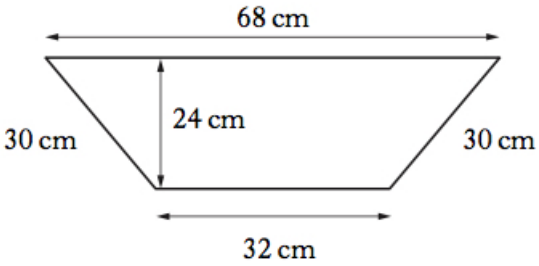
8. A pipe has water in it as shown. (3)





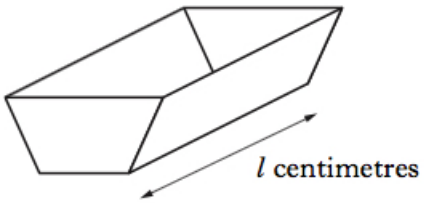
The depth of the water is 5 centimetres.
The width of the water surface, AB, is 18 centimetres.
Calculate r, the radius of the pipe.

9. A flower planter is in the shape of a prism.
The cross-section is a trapezium with dimensions as shown.



(a) Calculate the area of the cross-section of the planter. (2)

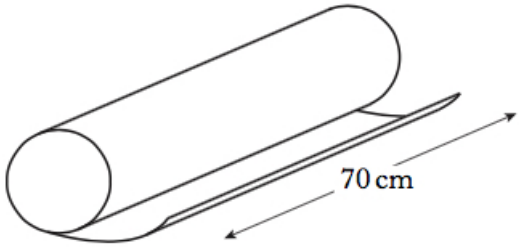
The volume of the planter is 156 litres.



(b) Calculate the length, l centimetres, of the planter. (3)

10. Tom and Samia are paid the same hourly rate. (3)
Harry is paid $\frac{1}{3}$ more per hour than Tom.
Tom worked 15 hours, Samia worked 8 hours, and Harry worked 12 hours.
They were paid a total of £429.
How much was Tom paid?

11. Paper is wrapped round a cardboard cylinder **exactly** 3 times. (4)
The cylinder is 70 centimetres long.

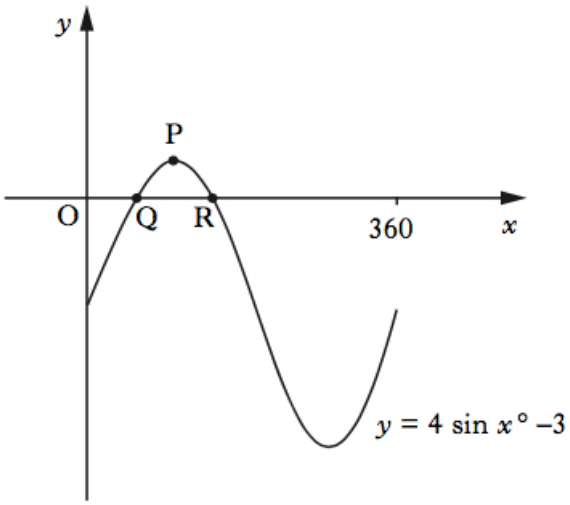


The area of the paper is 3 000 square centimetres.
Calculate the diameter of the cylinder.

12. Part of the graph of

$$y = 4\sin x^\circ - 3$$

is shown below.



The graph cuts the x-axis at Q and R.
P is the maximum turning point.

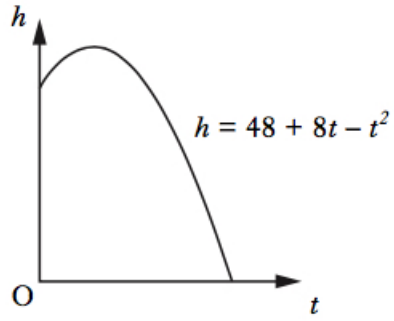
(a) Write down the coordinates of P. (1)

(b) Calculate the x-coordinates of Q and R. (4)

13. The diagram shows the path of a flare after it is fired. (4)
The height, h metres above sea level, of the flare is given by

$$h = 48 + 8t - t^2,$$

where t is the number of seconds after firing.



Calculate, **algebraically**, the time taken for the flare to enter the sea.