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1. From information given we have

Radio speed is $3 \cdot 10^8 ms^{-1}$

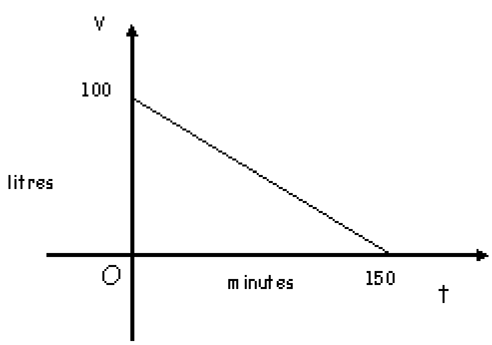
Time for radio signals to reach probe is 8hrs

Hence distance from earth to probe is

$$D = V \cdot T$$

$$3 \cdot 10^8 m \cdot s^{-1} \cdot (8 \cdot 60)\, 60s = 8.64 \times 10^{12} m$$

2. From the graph we have



(a) $m = \frac{v_2 - v_1}{t_2 - t_1} = \frac{100 - 0}{0 - 150} = \frac{-2}{3}$ $\quad$ $c = 100$ where the line crosses the y-axis.

Hence the equation is $y = \frac{-2}{3} \cdot t + 100$

(b) If tank is at 100litres then it is allowed to drop to 70litres then this will be a drop 30 litres. The time taken will be

$$70 = \frac{-2}{3} \cdot t + 100 \qquad t = \frac{3(70 - 100)}{-2} = 45\text{mins}$$

3. The 7 bottles have volume given below

52 50 51 49 52 53 50

$$\text{mean} = \frac{52 + 50 + 51 + 49 + 52 + 53 + 50}{7} = 51$$

$$\Sigma x^2 = 52^2 + 50^2 + 51^2 + 49^2 + 52^2 + 53^2 + 50^2 = 18219$$

$$(\Sigma x)^2 = 127449$$

$$\text{Standard}_{\text{dev}} = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n - 1}} = \sqrt{\frac{18219 - \frac{12749}{7}}{7 - 1}} = 1.414$$

4. From the information given we have

250mg at 12:00 hrs rate of decrease per hour is 20%

After 3 hours we have

$$d = 200(1 - 0.2)^3 = 128$$

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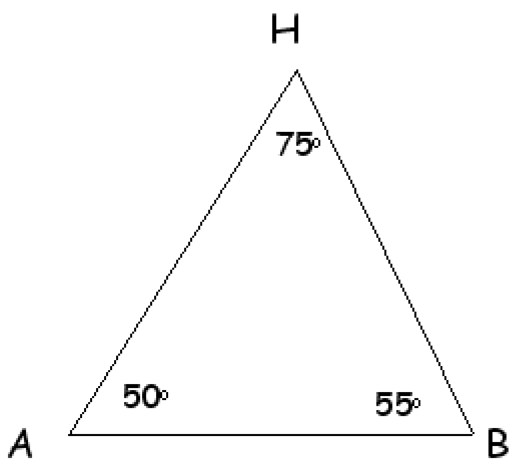
5. From the information given we can deduce the following diagram:-



To find the distances we use the Sine Rule.

$$\frac{AH}{\sin(55^o)} = \frac{BH}{\sin(50^o)} = \frac{1500}{\sin(75^o)}$$

$$AH = \frac{1500 \cdot \sin(55^o)}{\sin(75^o)} = \frac{1500 \cdot \sin(55^o)}{\sin(75^o)} = 1272m$$

$$BH = \frac{1500 \cdot \sin(50^o)}{\sin(75^o)} = \frac{1500 \cdot \sin(50^o)}{\sin(75^o)} = 1190m$$

Hence nearest distance between helicopter and carrier is

$$BH = 1190m$$

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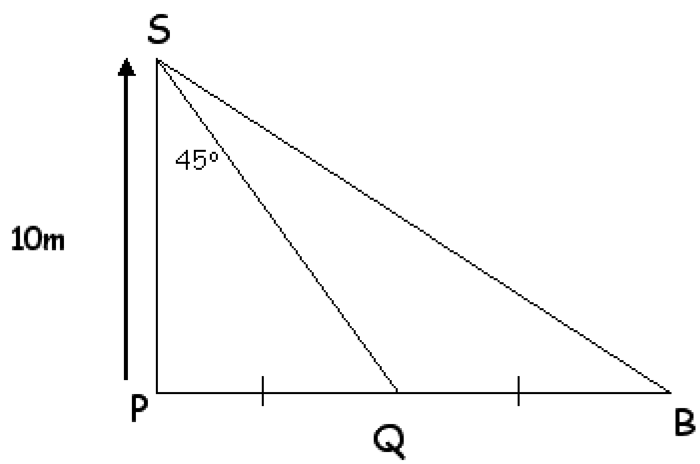
6. From the information given we can deduce the following diagram:-



By basic trig.

$PQ = 10 \cdot \tan(45^o) = 10m$ Since PQ = QB $QB = 10m$ Hence $PB = 20m$

Again using basic trig. We have

$\text{angle } BSP = \tan^{-1}\left(\frac{20}{10}\right) = \tan^{-1}(2) = 63.4^o$

Finally $\text{angle } BSQ = 63.4^o - 45^o = 18.4^o$

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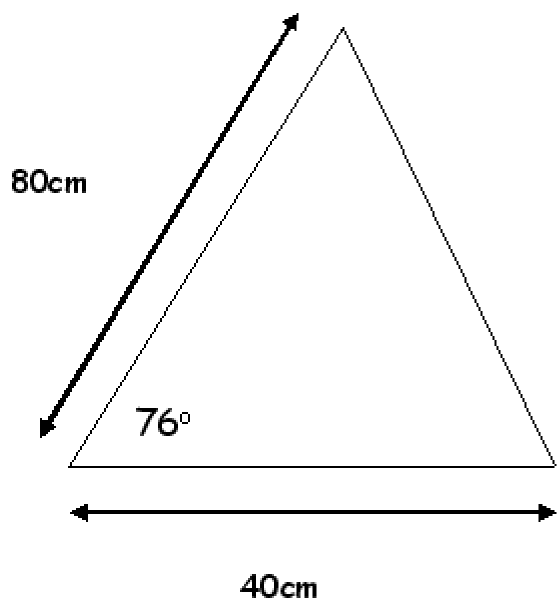
7. From information given we have



Role length

Using the cosine rule we can find the role length

$a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos(A)$ $\quad A = 76^o \quad b = 80cm \quad c = 40cm$

$a = \sqrt{(80^2 + 40^2 - 2 \cdot 80 \cdot 40 \cdot \cos(76^o))}$

$a = 80cm$ To 2 significant figures

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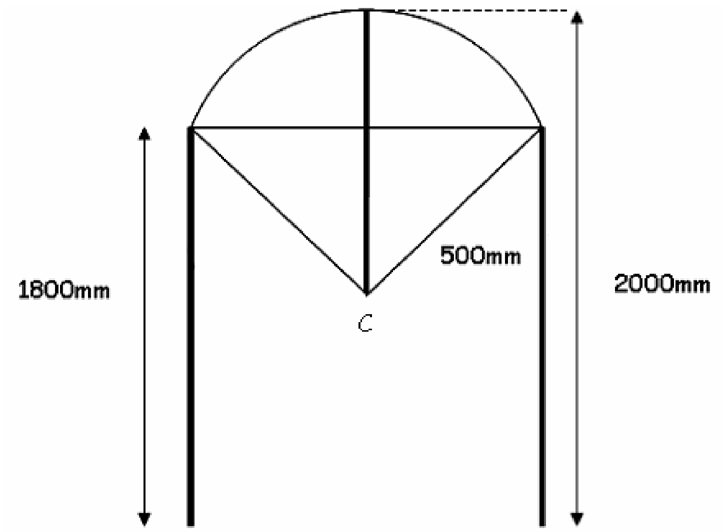
8. From the information given we have

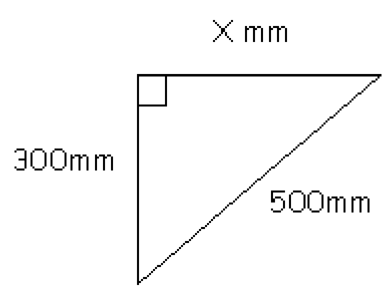


Length of the line from C to the top of the arc of the circle is simply the radius 500mm. The length of the same line from C to the intersection point with the horizontal line (the width of the doorway) is.

$$500 - (2000 - 1800) = 300$$

Using Pythagoras Theorem we have

$$x = \sqrt{(500^2 - 300^2)} = 400\text{mm}$$



Hence the width of the doorway is twice this value since we have 2 similar triangles.

Doorway width is $2 \cdot 400 = 800\text{mm}$

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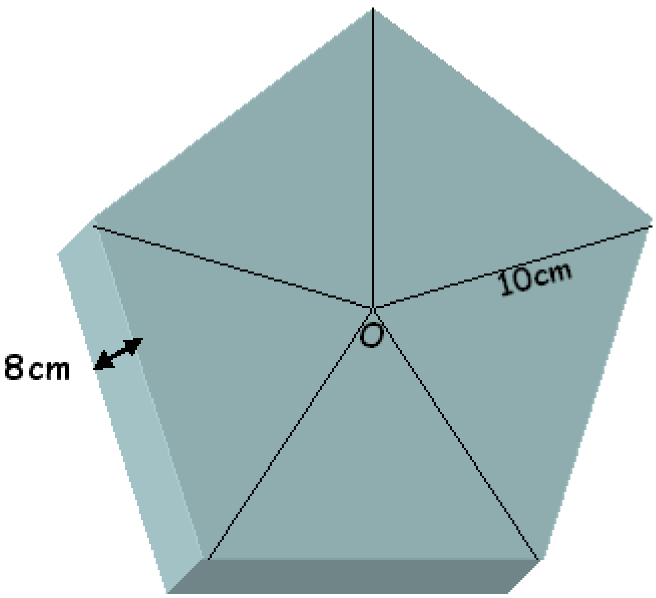
9. From the information given we have



Since it is a regular pentagon the angle at the centre O for each triangle is

$$\frac{360^o}{5} = 72^o$$

Since each triangle is an isosceles triangle the area of one is given by

$$\text{Area} = \frac{1}{2} \cdot a \cdot b \cdot \sin(c) = \frac{1}{2} \cdot 10 \cdot 10 \cdot \sin(72^o) = 47.55 cm^2$$

Hence full area is $5 \cdot 47.44 = 237.76 cm^2$

Finally volume is $8 \cdot 237.76 = 1902 cm^3$

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10. From the information given we have $0^o < x < 360^o$

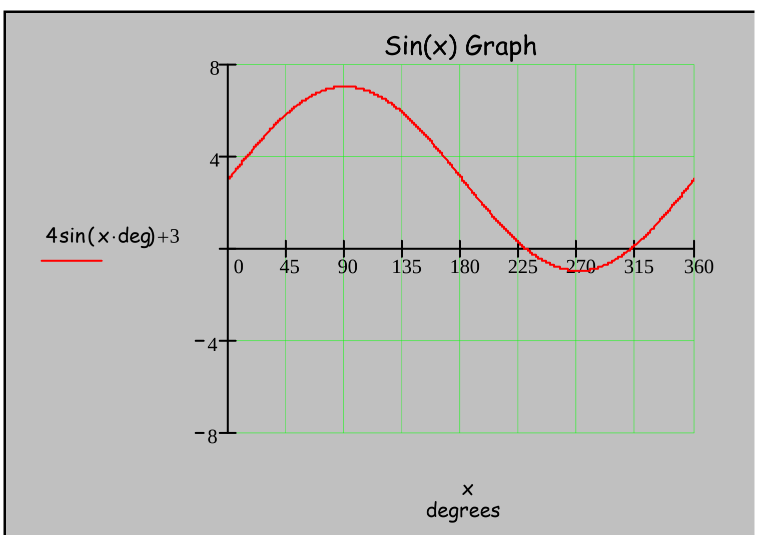
$$4\cdot\sin\left(x^o\right) + 1 = -2$$

$$4\cdot\sin\left(x^o\right) = -3$$

$$\sin\left(x^o\right) = \frac{-3}{4}$$

$$x^o = \sin^{-1}\left(\frac{-3}{4}\right)$$

$x^o = 228.6^o$ And 311.4^o



$4\cdot\sin\left(x^o\right) + 1 = -2$ is the same as $4\cdot\sin\left(x^o\right) + 3 = 0$

it just written in a different format !

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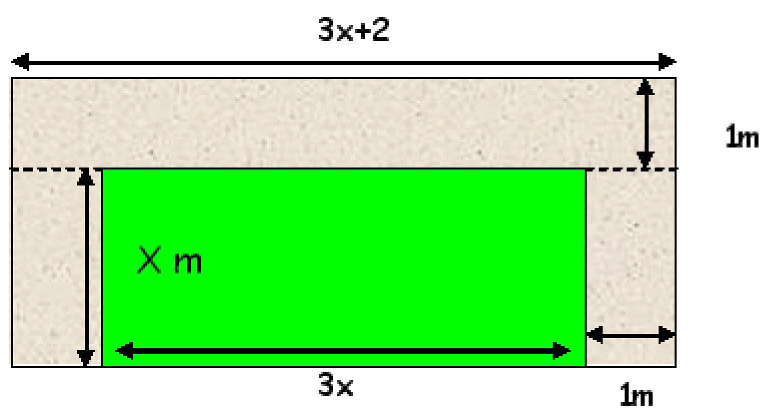
10. From the information given we can deduce the following



(a) Given that the area of the lawn and the path are equal we have

$$\text{Lawn}_{area} = 3x \cdot x = 3x^2$$

$$\text{Path}_{area} = x + (3x + 2) + x = 5x + 2$$

Hence we have

$$3x^2 = 5x + 2$$
$$3x^2 - 5x - 2 = 0 \qquad \text{As required}$$

(b) Length of lawn is found by solving the quadratic in part (a).

$$3x^2 - 5x - 2 = 0$$
$$(3x + 1)(x - 2) = 0$$
$$x = \frac{-1}{3} \text{ and } x = 2$$

Since we cannot have a negative length we rule out $x = \frac{-1}{3}$

Hence length of lawn is $x = 2$