

Exam Solution Paper 2 2005

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Graduate Bsc (Hons) MathsSci (Open) GIMA

1. From the information given we have

$$E = mc^2$$

$$E = 3.6 \cdot 10^{-2} (3 \cdot 10^8)^2$$

$$E = 3.24 \cdot 10^{15}$$

2. From the information given we have

77 91 84 71 79 75

- (a)

The mean of the data is.

$$\text{mean} = \frac{77 + 91 + 84 + 71 + 79 + 75}{6} = 79.5$$

- (b) The standard deviation is

$$\Sigma x^2 = 77^2 + 91^2 + 84^2 + 71^2 + 79^2 + 75^2 = 38173 \quad (\Sigma x)^2 = 227529$$

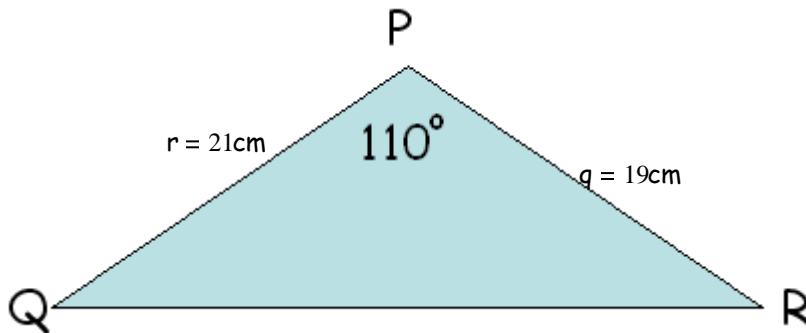
$$\text{Standard dev} = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}} = \sqrt{\frac{38173 - \frac{227529}{6}}{6-1}} = 7.09$$

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3. From the information given we can deduce the following:-



$$A = \frac{1}{2} \cdot q \cdot r \cdot \sin(110^\circ)$$

$$A = \frac{1}{2} \cdot 19 \cdot 21 \cdot \sin(110^\circ)$$

$$A = 187.5 \text{ cm}^2$$

4. From the information given we have

$$x^2 + 2x = 9$$

$$x^2 + 2x - 9 = 0$$

$$a = 1 \quad b = 2 \quad c = -9$$

Using the roots formula we have

$$x = \frac{-b + \sqrt{(b^2 - 4ac)}}{2a} \quad \text{and} \quad x = \frac{-b - \sqrt{(b^2 - 4ac)}}{2a}$$

$$x = \frac{-2 + \sqrt{[2^2 - 4 \times 1 \cdot (-9)]}}{2 \times 1} \quad \text{and} \quad x = \frac{-2 - \sqrt{[2^2 - 4 \times 1 \cdot (-9)]}}{2 \times 1}$$

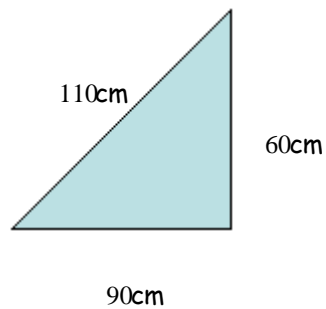
$$x = 2.2$$

$$\text{and} \quad x = -4.2$$

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5. If triangle is right-angled then:-



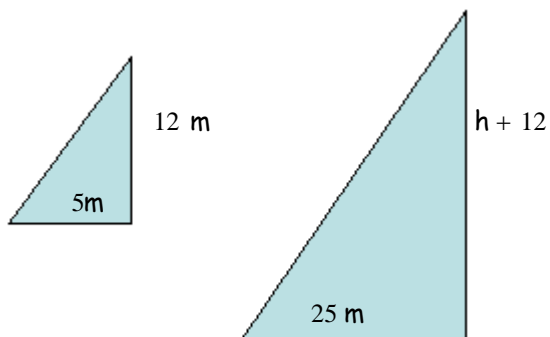
Right-angled if $a^2 + b^2 = c^2$

$$90^2 + 60^2 = 11700$$

$$110^2 = 12100$$

Hence triangle is not right-angled.

6. From the information given we have can draw similar triangles.



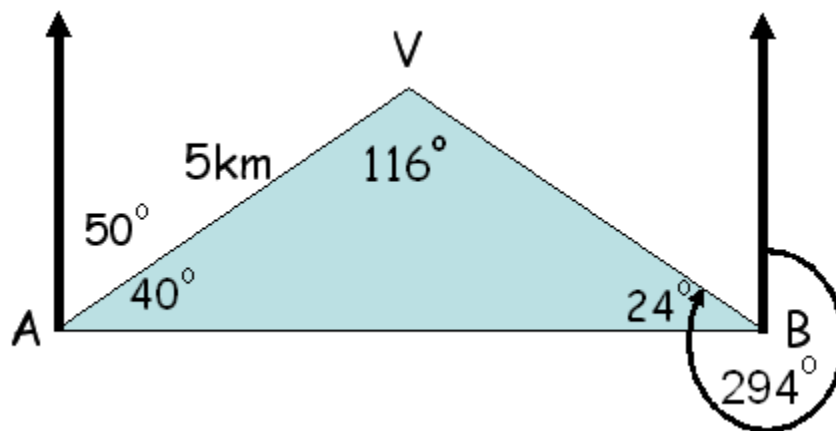
$$E.S.F. = \frac{25}{5} = 5$$

Hence we have $60 = h + 12$ $h = 48$ m

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7. From information given we can deduce the diagram below and applied the Sine Rule.



Using the Sine Rule we get

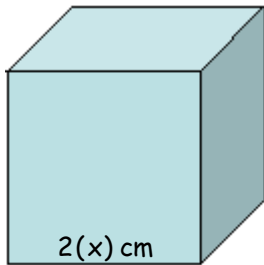
$$\frac{AB}{\sin(116^\circ)} = \frac{5}{\sin(24^\circ)}$$

$$AB = \frac{5 \cdot \sin(116^\circ)}{\sin(24^\circ)} = 11.05 \text{ km}$$

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8. Since the surface area of the cube is equal to the volume we have:-



$$6(2x)^2 = (2x)^3$$

$$8x^3 - 24x^2 = 0$$

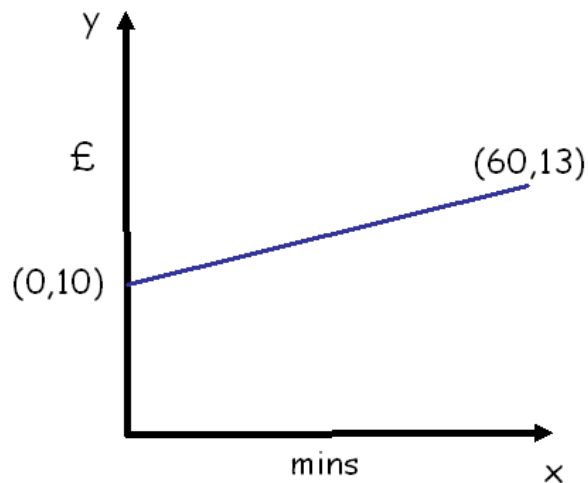
$$8x^2(x - 3) = 0$$

$$x = 0 \text{ and } x = 3$$

We reject $x=0$ since the length is obviously not 0.

Solution therefore is $x=3\text{cm}$.

9. From the information given we have



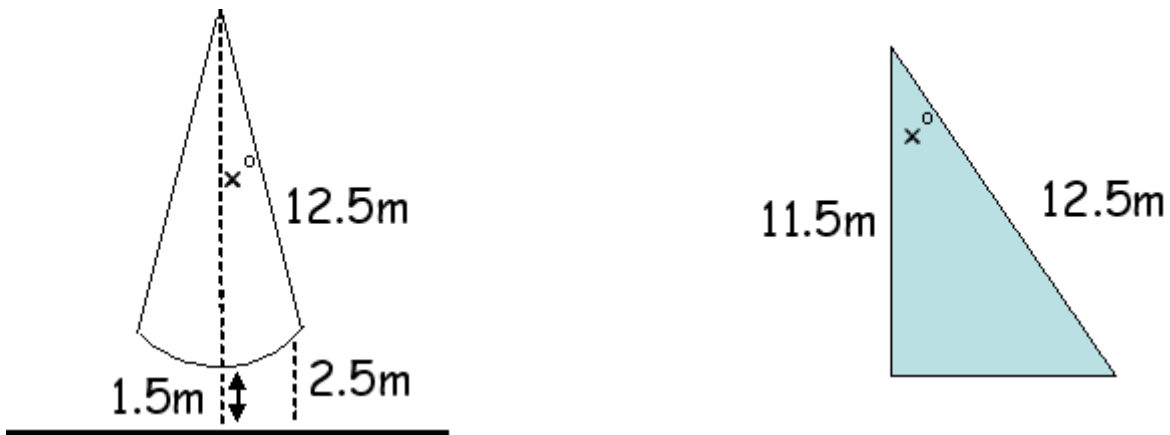
Fixed rental is when $x=0$ i.e. where line crosses y-axis. Fixed rental = £10

Call charge rate is the gradient of the line. Call charge = $\frac{Y_2 - Y_1}{x_2 - x_1} = \frac{13 - 10}{60 - 0} = \frac{3}{60} = \frac{1}{20} = £0.05 = 5\text{p}$

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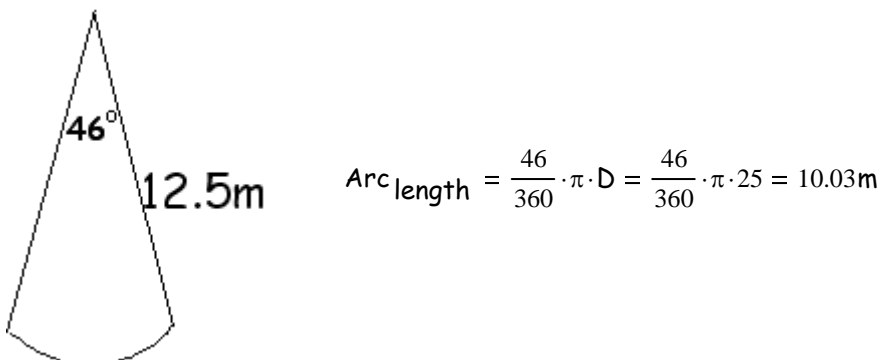
10. From the information given we have



- (a) Using SOHCAHTOA we get

$$\cos(x^\circ) = \frac{11.5}{12.5} \quad x^\circ = \cos^{-1}\left(\frac{11.5}{12.5}\right) = 23^\circ$$

- (b) Arc length is given by:-



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11. (a) Solving we get:-

$$\sqrt{3} \cdot \sin(x^\circ) - 1 = 0$$

$$\sin(x^\circ) = \frac{1}{\sqrt{3}}$$

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

$$x^\circ = 35.3^\circ \quad \text{and} \quad x^\circ = 180^\circ - 35.3^\circ = 144.7^\circ \quad \text{In the range } 0 \leq x^\circ \leq 360^\circ$$

(b) Solving we get:-

$$\sqrt{3} \cdot \sin(2x^\circ) - 1 = 0$$

$$\sin(2x^\circ) = \frac{1}{\sqrt{3}}$$

$$2x^\circ = \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$$

$$2x^\circ = 35.3^\circ \quad \text{and} \quad 2x^\circ = 144.7^\circ$$

$$x^\circ = 17.65^\circ \quad \text{and} \quad x^\circ = 72.35^\circ \quad \text{In the range } 0 \leq x^\circ \leq 90^\circ$$