

Standard Grade Credit Paper 2 2007

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Graduate Bsc (Hons) MathsSci (Open) GIMA

1. Given Alistair buys an antique chair for £600. It increases by 4.5% each year. After 3 years it will be worth:

Short Method

$$\text{Value} = 600(1+0.045)^3 = \text{£}684.70$$

You could use the long method !

2. Given the equation $3x^2 - 2x - 10 = 0$. Solving to 2 significant figures we get:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4 \times 3 \times (-10)}}{2 \times 3}$$

$$x = \frac{2 \pm \sqrt{124}}{6}$$

$$x = \frac{2 + \sqrt{124}}{6} \quad \text{and} \quad x = \frac{2 - \sqrt{124}}{6}$$

$$x = 2.2 \quad \text{and} \quad x = -1.5$$

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3. Given during his lunch break, Luke records the number of birds visiting a bird-table over a week. The values are:

28, 32, 14, 19, 18, 26, 31

- (a) The mean is:

$$\frac{(28 + 32 + 14 + 19 + 18 + 26 + 31)}{7} = 24 \text{ birds}$$

The Standard Deviation

$$\sum(x^2) = (28^2 + 32^2 + 14^2 + 19^2 + 18^2 + 26^2 + 31^2) = 4326$$

$$(\sum x)^2 = (28 + 32 + 14 + 19 + 18 + 26 + 31)^2 = 28224$$

$$s = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}} = \sqrt{\frac{4326 - \frac{28224}{7}}{6}} = 7$$

- (b) Given Erin records the number of birds over the same period. The mean and standard deviation for Erin values are 25 and 5 respectively.

Two valid comparisons are:

On average Erin saw more birds.

In general Erin's values are more consistent (less spread out).

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4. Solving the given inequality we get:

$$\frac{x}{4} - \frac{1}{2} < 5$$

Multiplying through by 4

$$x - 2 < 20$$

$$x < 22$$

5. Given the total bill for the food is £148.50.
This includes the meal + 10% service charge.

The price for just the meal is:

$$100\% + 10\% = 148.50$$

$$110\% = 148.50$$

$$1\% = 1.35$$

$$100\% = 135$$

The meal cost £135

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Q6. Given that Brunton is 30km north of Appleton.

From Appleton, the bearing of Carlton is 065° .

From Brunton, the bearing of Carlton is 153° .

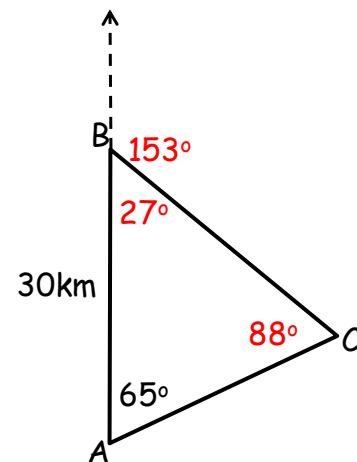
The distance between Brunton and Carlton is:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{\sin 65^\circ} = \frac{30}{\sin 88^\circ}$$

$$a = \frac{30 \times \sin 65^\circ}{\sin 88^\circ}$$

$$a = 27.2\text{km}$$



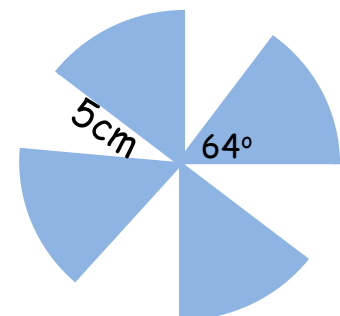
7. Given the diagram of the fan.

The fan blades are sectors of a circle and are identical.

The radius is 5cm and angle at the centre is 64° .

The total area is:

$$\begin{aligned} \text{Area} &= 4 \times \frac{\text{angle}}{360} \times \pi \times r^2 \\ \text{Area} &= 4 \times \frac{64}{360} \times \pi \times 5^2 \\ &= 55.85\text{cm}^2 \end{aligned}$$



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8. Give the triangle diagram and that the area of the triangle is 15cm^2 .

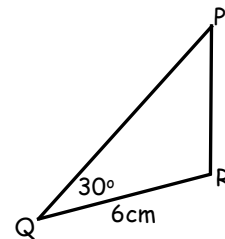
Length of PQ is:

$$\text{Area} = \frac{1}{2} \times (QR) \times (PQ) \times \sin Q$$

$$15 = 0.5 \times 6 \times PQ \times \sin 30^\circ$$

$$15 = 1.5PQ$$

$$PQ = \frac{15}{1.5} = 10\text{cm}$$



9. Given "14 carat" gold is made up of copper and gold in the ratio 5:7.
The maximum weight of 14carat gold for 160g of copper and 245g gold is:

$$5:7 \rightarrow 1:1.4$$

For every 1g of copper we need 1.4g gold

160g of copper we need 224g gold

Total weight of gold is $160\text{g} + 224\text{g} = 384\text{g}$

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10. Solving $5 \cos x^\circ + 4 = 0$ $0 \leq x \leq 360^\circ$

Remember there will be 2 solutions in the range $0 \leq x^\circ \leq 360^\circ$

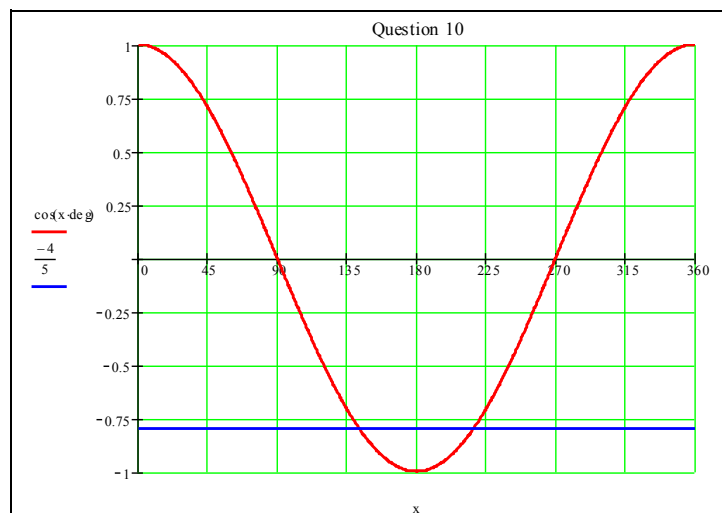
$\cos x^\circ = \frac{-4}{5}$ (negative value so solutions in 2nd and 4th quadrant)

$x^\circ = \cos^{-1}\left(\frac{4}{5}\right) = 36.9^\circ$

Solutions $x^\circ = 180 - 36.9^\circ = 143.1^\circ$

$x^\circ = 180^\circ + 36.9^\circ = 216.9^\circ$

Graphical solution

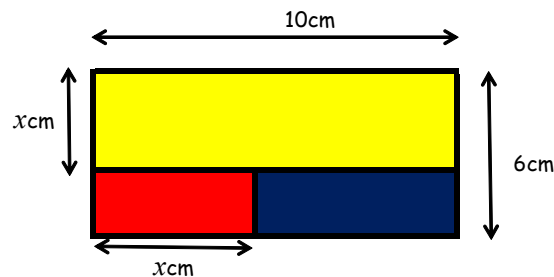


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11. Given the diagram of the decorator's logo.



- (a) To show that the area of the blue rectangle is $A_{Blue} = x^2 - 16x + 60$

We have:

$$\begin{aligned} A_{Blue} &= l \times b = (10 - x)(6 - x) \\ &= x^2 - 10x - 6x + 60 \\ &= x^2 - 16x + 60 \text{ as required} \end{aligned}$$

- (b) Given the area of blue rectangle is $\frac{1}{5}$ of the total area.

To find the value of x we have:

$$\text{Total Area} = 10 \times 6 = 60 \quad A_{Blue} = \frac{1}{5} \text{ of } 60 = 12$$

$$\begin{aligned} A_{Blue} &= x^2 - 16x + 60 = 12 \\ x^2 - 16x + 60 - 12 &= 0 \\ x^2 - 16x + 48 &= 0 \\ (x - 4)(x - 12) &= 0 \\ x = 4 \quad \text{and} \quad x = 12 \end{aligned}$$

From the diagram we can see that x must be less than 6 (look at breadth) hence $x = 4$ cm

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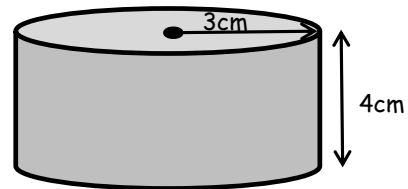
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Q12. Given the diagram, the paperweight contains sand and is in the shape of cylinder.

(a) The volume of sand is:

$$V = \pi r^2 h = \pi \times (3)^2 \times 4 = 113\text{cm}^3$$



(b) Given the hemisphere has the same volume as the cylinder in part (a).

The radius of the hemisphere is:

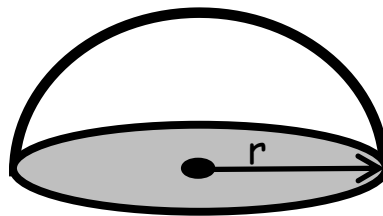
$$V = \frac{2}{3}\pi r^3$$

$$r^3 = \frac{3V}{2\pi}$$

$$r = \sqrt[3]{\frac{3V}{2\pi}}$$

$$r = \sqrt[3]{\frac{3 \times 113}{2\pi}}$$

$$r = 3.8\text{cm}$$



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13. Given the diagram and the profit for the magazine is given by the formula:

$$y = 4x(140 - x)$$

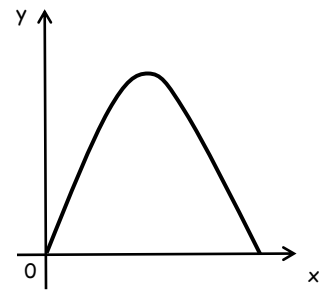
The maximum profit the company can make from the sale of the magazine is:

Step 1: First find the roots.

$$4x(140 - x) = 0$$

$$4x = 0 \quad \text{and} \quad 140 - x = 0$$

$$x = 0 \quad \text{and} \quad x = 140$$



Step 2: By the symmetry of the quadratic function the x coordinate for the maximum value will be halfway between 0 and 140, therefore $x = 70$.

Step 3: Evaluate function (y coordinate) for $x = 70$

$$y = 4 \times 70(140 - 70) = 280 \times 70 = \text{£}19\,600$$