

## Credit Paper 2 Exam solutions 2006

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1. Given that the orbit of a planet around a star is circular, and the radius of the orbit is  $4.96 \times 10^7$  km

The circumference of the orbit is:

$$C = 2\pi r = 2 \times \pi \times 4.96 \times 10^7 = 3.12 \times 10^8 \text{ km}$$

2. (a) Given the pulse rate of 6 adults.

68 , 73 , 86 , 72 , 82 , 78

The mean is:

$$\frac{(68 + 73 + 86 + 72 + 82 + 78)}{6} = 76.5 \text{ beats per min.}$$

$$\sum(x^2) = (68^2 + 73^2 + 86^2 + 72^2 + 82^2 + 78^2) = 35341$$

$$(\sum x)^2 = (68 + 73 + 86 + 72 + 82 + 78)^2 = 151321$$

$$s = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}} = \sqrt{\frac{35341 - \frac{210681}{6}}{5}} = 6.7$$

- (b) Given 6 children have a mean pulse rate of 89.4 and a standard deviation of 5.4. Then two valid comparisons are:

On average children have higher pulse rates.

There is a wider variation in adult pulse rates.

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3. Given total price is £324 and auction tax is 8%. Bid price is:

$$108\% \rightarrow \pounds 324$$

$$100\% \rightarrow \textit{Bid price}$$

$$\textit{Bid price} = \frac{324 \times 100}{108} = \pounds 300$$

4. (a) Expanding  $(x + 4)(3x - 1)$  we get:

$$3x^2 + 11x - 4$$

- (b) Expanding  $m^{\frac{1}{2}}(2 + m^2)$  we get:

$$2m^{\frac{1}{2}} + m^{\frac{5}{2}}$$

- (c) Simplifying  $2\sqrt{20} - 3\sqrt{5}$  we get:

$$\begin{aligned} 2\sqrt{20} - 3\sqrt{5} &= 2 \times \sqrt{4} \times \sqrt{5} - 3\sqrt{5} \\ &= 4\sqrt{5} - 3\sqrt{5} \\ &= \sqrt{5} \end{aligned}$$

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5. Given PQRS is a rectangle, M is midpoint of QR and the diagram below. TS is a vertical pole 2m. Then the angle TMS is:

Step 1: MR is 6m

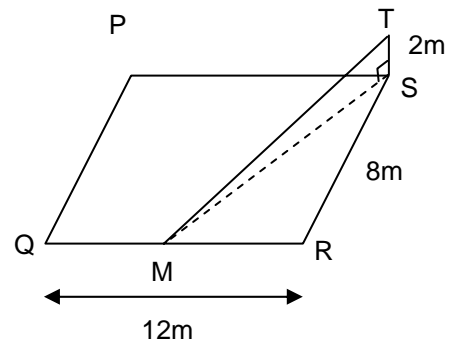
By Pythagoras  $SM = \sqrt{6^2 + 8^2} = 10m$

Step 2: By SOHCA TOA

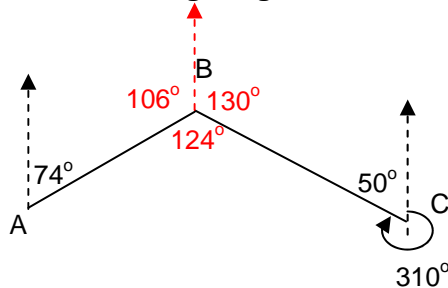
Angle TMS is:

$$\tan(\angle TMS) = \frac{2}{10}$$

$$\angle TMS = \tan^{-1}\left(\frac{2}{10}\right) = 11.3^\circ$$



6. (a) Given the mooring diagram. The size of the angle ABC is:



From information given we can deduce that ABC is

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$$360^{\circ} - 106^{\circ} - 130^{\circ} = 124^{\circ}$$

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6. (b) Given B is 230m from A and 110m from C. Then by the Cosine Rule we can calculate AC.

$$b^2 = a^2 + c^2 - 2ac \times \cos B$$

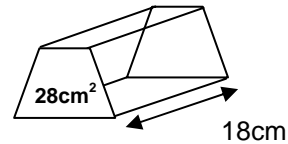
$$b^2 = 110^2 + 230^2 - 2 \times 110 \times 230 \times \cos(124^\circ)$$

$$b^2 = 93295$$

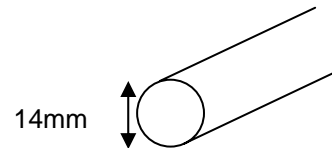
$$b = \sqrt{93295} = 305m \text{ to 3 significant figures}$$

7. (a) Given the prism with cross section area  $28\text{cm}^2$  and length  $18\text{cm}$ . The volume is:

$$\begin{aligned} \text{Volume} &= \text{Area} \times \text{length} \\ &= 28 \times 18 \\ &= 504\text{cm}^3 \end{aligned}$$



- (b) Given it is melted down into a cylindrical cable with diameter  $14\text{mm}$ . The length will be:



$$\text{Volume} = \pi r^2 h$$

$$504000 = \pi \times (7)^2 \times h \quad \text{remember to convert to mm}$$

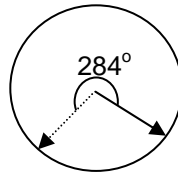
$$h = \frac{504000}{49\pi} = 3274\text{mm}$$

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8. Given the scales dial is circular and moves through 2cm for every 100g. Also pointer is 9cm. Then the weight of the parcel is:



The arc length is a fraction of the whole circle, so we have:

$$\begin{aligned} \text{Arc length} &= \frac{284^\circ}{360^\circ} \times 2\pi r \\ &= \frac{284^\circ}{360^\circ} \times 18\pi \\ &= 44.61\text{cm} \end{aligned}$$

So weight is equal to:

$$44.61 \div 2 \times 100 = 2230.5\text{g}$$

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9. Given the polygon formula:  $d = \text{diagonals}, n = \text{sides}$

$$d = \frac{1}{2}n(n-3)$$

- (a) A polygon with 7 sides has:

$$d = \frac{1}{2}7(7-3) = 14 \text{ diagonals}$$

- (b) If a polygon has 65 diagonals then the formula will be:

$$65 = \frac{1}{2}n(n-3)$$

$$130 = n^2 - 3n$$

$$n^2 - 3n - 130 = 0$$

- (c) Factorising formula in (b) we get number of sides  $n$ :

$$(n-13)(n+10) = 0$$

$$n = 13$$

since  $n = -10$  does not make sense

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10. Given the trig. Formula for the "Big Eye"

$$h = -31\cos(t^\circ) + 33$$

- (a) Emma's height after 20 seconds is:

$$h = -31\cos(20^\circ) + 33$$

$$h = 3.87m$$

- (b) Emma will reach 60m first when:

$$60 = -31\cos(t^\circ) + 33$$

$$t = \cos^{-1}\left(\frac{60-33}{-31}\right) = 150.6s$$

Reaches 60m after 150.6s

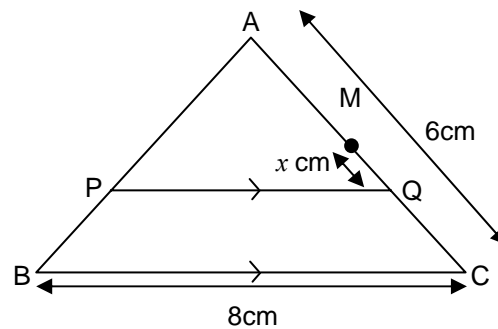
- (c) The next time it reaches 60m will be:

$$180 + 29.4 = 209.4 \text{ (symmetry of cos function)}$$

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11. Given the triangle diagram and  $BC=8\text{cm}$ ,  $AC=6\text{cm}$ ,  $PQ$  is parallel to  $BC$  and  $M$  is midpoint of  $AC$ .  $Q$  lies on  $AC$ ,  $x$  centimetres from  $M$ .



- (a) An expression for  $AQ$  is:

$$AM + MQ = 3 + x$$

- (b) Noting that triangles  $AQP$  and  $ACB$  are similar we have:

$$\frac{AQ}{PQ} = \frac{AC}{BC}$$

$$\frac{3 + x}{PQ} = \frac{6}{8} = \frac{3}{4}$$

$$PQ = \frac{4}{3}(3 + x)$$

$$PQ = \left(4 + \frac{4}{3}x\right) \text{ cm as required}$$