CREDIT 2006 – Paper II

1. $C = \pi d$

diameter = $2 \times \left(4.96 \times 10^7\right)$ (radius given)

$C = \pi \times 2 \times \left(4.96 \times 10^7\right) = 31.165 \times 10^7$

Put in standard form: $= 3.12 \times 10^8$ km (3 sf)

2.

	x	$x - \bar{x}$	$\left(x - \bar{x}\right)^2$
	68	-8.5	72.25
	73	-3.5	12.25
	86	9.5	90.25
	72	-4.5	20.25
	82	5.5	30.25
	78	1.5	2.25
TOTAL	459		227.5

a) Mean = $\dfrac{\sum x}{n} = \dfrac{459}{6} = 76.5$

S.D. = $\sqrt{\dfrac{227.5}{5}} = \sqrt{45.5} = 6.745.... = 6.7$

b) The mean pulse rate of the children is **much higher** and **less spread out** (more consistent).

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3. An auction tax of 8% is added to his bid price.

His bill is now: 100% + 8% = 108%

So: 108% = £ 324

1% = £ 324 ÷ 108 = £ 3

Hence: 100% = £ 3 × 100 = £ 300

His bid price was £300 *(you can check by adding 8%)*

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4. a) $\left(x+4\right)\left(3x-1\right)$ use FOIL

$3x^2 - x + 12x - 4$

Collect terms: $\rightarrow 3x^2 + 11x - 4$

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4 b) Expand $m^{\frac{1}{2}}\left(2 + m^2\right)$
(*break the brackets)*

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

Simplify and use the rules of indices.

$2m^{\frac{1}{2}} + m^{\frac{1}{2}} \times m^{\frac{4}{2}}$ (since $2 = \frac{4}{2}$ as fraction)

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

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c) Simplify, leaving answer as a surd.

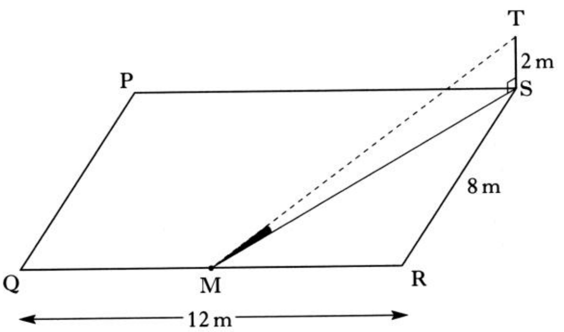
$2\sqrt{20} - 3\sqrt{5}$ *(Find largest square in 20)*

$2\sqrt{4 \times 5} - 3\sqrt{5} \rightarrow 2\sqrt{4}\sqrt{5} - 3\sqrt{5}$

$\rightarrow 2 \times 2\sqrt{5} - 3\sqrt{5} \rightarrow 4\sqrt{5} - 3\sqrt{5}$

$\rightarrow 1\sqrt{5} \rightarrow \sqrt{5}$

5.



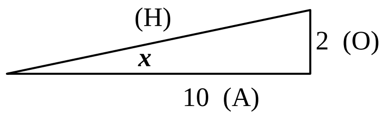
To find $\angle$ TMS, we need to use SOH-CAH-TOA on triangle TMS. But we only know one side in Δ TMS namely, TS. But we can find side MS, from Δ MRS.

M is the mid-point of QR, so MR is 6 m.

In Δ MRS, by Pythagoras,

$MS^2 = 6^2 + 8^2$

Hence, $MS^2 = 36 + 64 = 100 \rightarrow MS = 10$

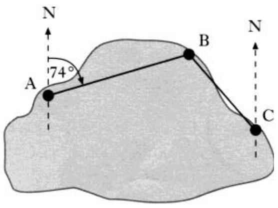


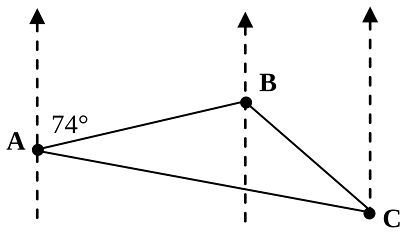
✓ ✓ ✓✓
SOH-CAH-TOA

$\tan x = \dfrac{2}{10} \rightarrow x = \tan^{-1}\left(\dfrac{2}{10}\right) \rightarrow x = 11.309...°$

Angle TMS is 11.3°

6. Make a sketch and show the North lines at each point A, B and C to be able to calculate angles from bearings. Also join the points A and C to form a triangle.

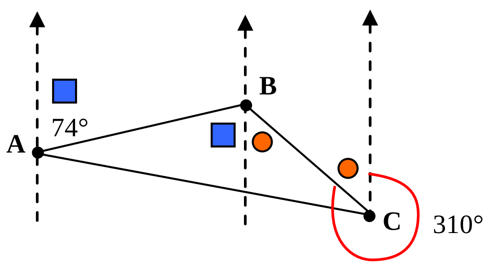




Now use the information given in the question.

From A, the bearing of B is 074°

From C, the bearing of B is 310°



Since all the North lines are parallel, we can use the fact that alternate angles are equal.

Now angle at C marked (orange circle) = 360° - 310° = 50°
which is equal to angle at B marked (orange circle) also = 50°

Similarly angle at A marked (blue square) is 74° (given)
and using alternate angles, angle at B marked (blue square) = 74°

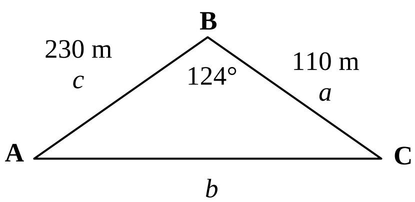
a) Hence $\angle ABC = 74 + 50 = 124°$

b) Calculate direct distance from A to C

Using the distances AB = 230 m and BC = 110 m

So we have

This is **SAS**



Using cyclic permutation:

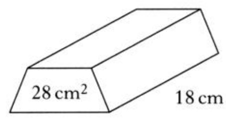
$$b^2 = c^2 + a^2 - 2ca \cos B$$

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

$$b^2 = 65000 - (-28295.16...) = 93295.16...$$

Hence b = 305.44.... **b = 305 metres** (3 sig. figs)

7. a)



Vol of prism = Area of cross-section × length

Volume = $28 \times 18 = 504\ cm^3$

b) This volume will be the same as the cylinder.

Volume of cylinder = $\pi r^2 h$

Note: diameter is given as 14 millimetres.
So **radius** is 7 millimetres
Changing units: **radius = 0.7 cm**

Hence: $V = \pi r^2 h \quad \rightarrow \quad 504 = \pi \times 0.7^2 \times l$

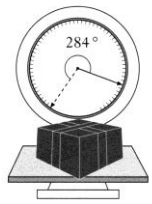
where l is length of cable (height of cylinder)

$$\rightarrow \quad 504 = 1.53938... \times l \quad \text{or} \quad l = \frac{504}{\pi \times 0.7^2}$$

$$\rightarrow \quad l = \frac{504}{1.53938...} = 327.404...$$

Hence length of cable is: 327.4 cm.

8. Calculate arc length for an angle of 284°



$$\frac{arc\ length}{circumference} = \frac{284}{360}$$

Pointer is 9 cm long *(radius)*

Hence diameter of circle is 18 cm

$$\frac{arc}{\pi \times 18} = \frac{284}{360} \quad \text{and so,} \quad arc = \frac{284 \times \pi \times 18}{360}$$

arc length = 44.6106... cm.

For every 2 cm, the weight on the scale is 100gm

Hence weight is:

$$\frac{44.6106...}{2} \times 100 = 2230.53..\ \text{gm}$$

Weight on scale = 2231 gm (nearest gm)

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

For 7 sides: $d = \frac{1}{2} \times 7(7-3)$

$= \frac{1}{2} \times 7 \times 4 = 14$ diagonals

b) If a polygon has 65 diagonals, then

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

$130 = n(n-3)$ *break the bracket*

$130 = n^2 - 3n$

rearrange to required form

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

c) Solve the equation (it will factorise)

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

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

Thus: $n - 13 = 0$ *or* $n + 10 = 0$

So, $n = 13$ or $n = -10$

Cannot have –10 sides,

So polygon has 13 sides.

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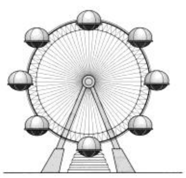
10. Height above ground given by:

$h = -31\cos t° + 33$



a) 20 seconds after start, t = 20

$h = -31\cos 20° + 33$

$h = 3.8695...$ metres.

b) She will reach 60m, when $h = 60$.

$60 = -31\cos t° + 33$

rearrange

$60 - 33 = -31\cos t°$

$\frac{60-33}{-31} = \cos t°$

$-0.8709... = \cos t°$

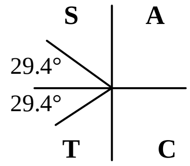
Thus we have: $\cos t° = -0.8709...$

To find t, take inverse cos
(ignore the – sign, sort this out with ASTC)

acute $t = \cos^{-1}(0.8709...)$

acute $t = 29.4°$

Cos is negative
in 2nd & 3rd quadrants



Hence first angle is 180 – 29.4° = 150.6

This angle corresponds to time in seconds

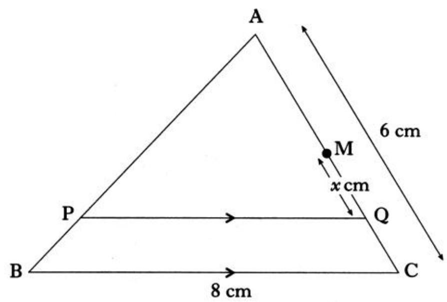
So she will be 60m above the ground
150.6 seconds after the start

c) She will next be at 60 m above the ground at the next angle, i.e. 180 + 29.4° = 209.4°

Since this corresponds to time in seconds,

She will next be 60m above the ground
209.4 seconds after the start.

11.



a) Since M is mid-point of AC,

then AM = 3m

So, AQ = 3 + x

b) Since the triangles are similar
Ratios of corresponding sides are equal.

So, $\frac{PQ}{BC} = \frac{AQ}{AC}$ i.e. $\frac{PQ}{8} = \frac{3+x}{6}$

re-arranging:

$PQ = 8 \times \frac{3+x}{6} = \frac{8}{6}(3+x)$

$PQ = \frac{4}{3}(3+x) \rightarrow \frac{4}{\cancel{3}} \cdot \frac{\cancel{3}}{1} + \frac{4}{3}x$

$PQ = 4 + \frac{4}{3}x$ cm

END OF QUESTION PAPER (*Rev. March 2007*)