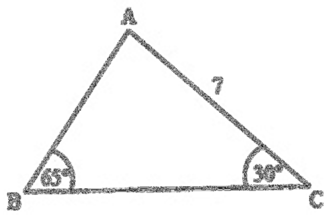
Geometry Test IB Review Answers

6. *Unit penalty* (UP) *may apply in this question.*

(a)



(A1)

Note: *(A1) for fully labelled sketch.* (C1)

(b) $\frac{\text{AB}}{\sin 30} = \frac{7}{\sin 65}$ (M1)

AB = 3.86 cm (A1)(ft)

Note: *(M1) for use of sine rule with correct values substituted.* (UP) (C2)

(c) Angle $\text{B}\hat{\text{A}}\text{C} = 85°$ (A1)

Area = $\frac{1}{2} \times 7 \times 3.86 \times \sin 85°$ (M1)

= $13.5\ \text{cm}^2$ (A1)(ft) (C3)
(UP)

[6]

8. (a) $\pi R^2 = 36\pi$ so R = 6 cm (M1)(A1)(C2)

(b) Use cosine rule. $AB^2 = 6^2 + 6^2 - 2 \times 6 \times 6 \cos(110°)$ (M1)(A1)(ft)

$AB^2 = 96.6$

AB = 9.83 cm
(A1)(ft)

OR

$\frac{6}{\sin(35°)} = \frac{AB}{\sin(110°)}$ (M1)(A1)(ft)

AB = 9.83 cm (A1)(ft)

OR

$\frac{110}{2} = 55$

$\sin(55°) = \frac{\frac{1}{2}AB}{6}$ (M1)(A1)(ft)

AB = 9.83 (A1)(ft)(C3)

Note: *If this method is used, then the $\frac{1}{2}$ AB must be evident to obtain the (M1) and the first (A1) requires the 55 and the 6 to be correct.*

(c) L = $\sqrt{36\pi}$ or $6\sqrt{\pi}$ or 10.6 cm (A1)(C1)

[6]

15. (a) $BD^2 = 15^2 + 20^2 - 2 \times 15 \times 20 \times \cos 110°$ (M1)(A1)

Note: *Award (M1) for using the cosine rule, award (A1) for correct substitution.*

$BD^2 = 830.212$

BD = 28.8 (A1)

OR

BD = 28.8 (G3) 3

(b) $\frac{28.81}{\sin C} = \frac{22}{\sin 30°}$ (M1)(A1)

C = 40.9° (G1)

OR

C = 40.9° (G3) 3

(c) BD = 30 (A1) 1

(d) $\frac{30}{\sin C} = \frac{22}{\sin 30°}$ (M1)

C = 43.0° (A1)

OR

C = 43.0° (G2) 2

(e) Percentage error = $\frac{43.0 - 40.9}{40.9} \times 100$ (M1)(A1)

= 5.13% (A1) 3

[12]

19. (a) $AC^2 = CD^2 + AD^2 - 2 \times AD \times CD \times \cos(C\hat{D}A)$ (M1)

$= 80^2 + 30^2 - 2 \times 30 \times 80 \times \cos(60°)$ (A1)

$AC^2 = 4900$ (A1)

so AC = 70 m (units not required) (A1) (C4)

(b) $\frac{50}{\sin(30°)} = \frac{70}{\sin(A\hat{B}C)}$ (M1)

$\sin(A\hat{B}C) = \frac{1}{2} \times \frac{70}{50} = \frac{7}{10}$ (M1)(A1)

$A\hat{B}C = \sin^{-1}\left(\frac{7}{10}\right) = 44.4°$ (A1) (C4)

Note: *Accept 44° 25′ ± 1′.*

[8]

5. (a) $AE^2 + OE^2 = OA^2$ .... (3)

$\Rightarrow AE^2 + k^2 = 8^2$ (M1)

Note: *Award (M1) for using and substituting correctly in equation (3).*

$AE^2 = \sqrt{64 - h^2}$ (A1) 2

(b) Volume $(V) = 2h\pi r^2$ (M1)

$= 2\pi h(AE^2)$ (M1)

$= 2\pi h(64 - h^2)$ cm^3 .... (4) (AG) 2

(c) (i) From (b) $V = 128\pi h - 2\pi h^3$ (M1)

Note: *Award (M1) for using equation (4) or any other correct approach.*

$\frac{dV}{dh} = 128\pi - 6\pi h^2 = 0$ at maximum/minimum points (M2)

Note: *Award (M2) for correctly differentiating V w.r.t. x.*

$\Rightarrow h = \sqrt{\frac{64}{3}} = \pm 4.62$ cm (3 s.f.) (A1)

Test to show that V is maximum when $h = 4.62$ (R1) 5

Note: *Award (R1) for testing to confirm V is indeed maximum.*

(ii) $AE^2 = 64 - h^2$

$= 64 - \frac{64}{3} = \frac{128}{3}$ (M1)

Notes: *Follow through with candidate's AE from part (a)*
(M1) is for correctly obtaining candidate's AE^2.

Therefore maximum volume $= \pi r^2(2h) = \pi\left(\frac{128}{3}\right)\left(2\left(\sqrt{\frac{64}{3}}\right)\right)$ (M1)

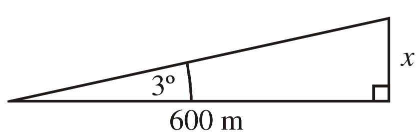
Note: *Follow through with candidate's AE^2*

$= 1238.7187... = 1239$ cm^3 (nearest cm^3) (A1) 3

Notes: *Correct answer only.*
Accept 1238 cm^3 if and only if candidate uses $\pi = 3.14$

[12]

17. (a)



(M1)

$\tan 3° = \frac{x}{600}$

$x = 600 \tan 3°$

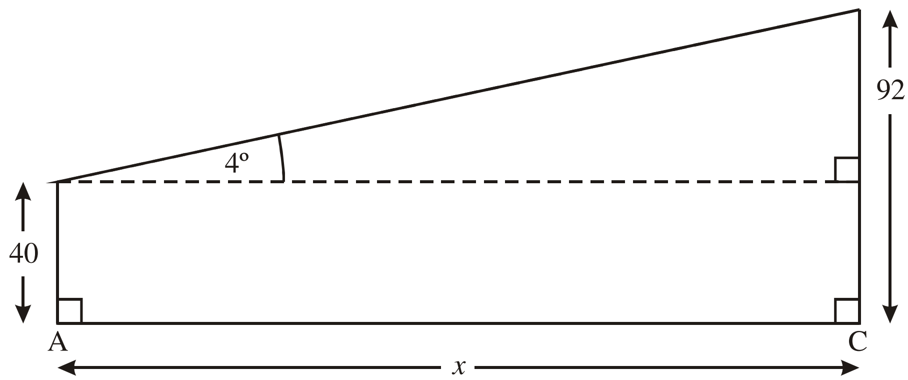
$x = 31.4447$

$x = 31.4$ m (A1)

Therefore, height = 40 m + 31.4 m

= 71.4 m (A1) 3

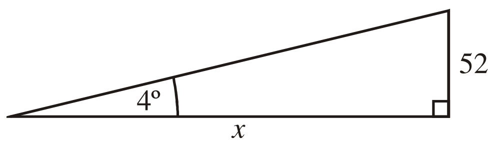
(b) (i)



(A1)

Note: *For (A1) the candidate must have the 40, the 92 and the 4° in the appropriate places.*

(ii)



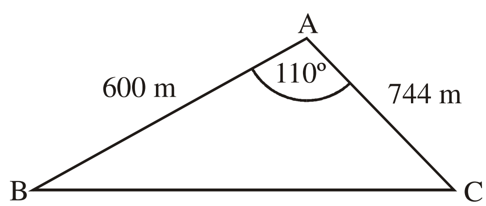
(A1)

$\tan 4° = \dfrac{52}{x}$ (M1)

$x = \dfrac{52}{\tan 4°}$

$x = 743.6346453 = 744$ m (A1) 4

(c) (i)



$BC^2 = 600^2 + 744^2 - 2 \times 600 \times 744 \cos 110°$ (M1)

$BC^2 = 1218891.584$ (or 1218198.119) (A1)

BC = 1104.034231 (or 1103.720...)

BC = 1104 (to the nearest metre) (A1)

(ii) $\dfrac{\sin c}{600} = \dfrac{\sin 110°}{1104}$ (M1)

$\sin c = \dfrac{600 \times \sin 110°}{1104}$ (M1)

$c = 30.710635°$

$c = 30.7°$ (3 s.f.) (A1)

(iii) area $= \dfrac{1}{2} \times 600 \times 744 \sin 110°$ (M1)

= 209739.393

= 210000 m^2 (3 s.f.) (A1) 8

[15]