

Geometry and Trig Answers

1)

- (i) (a) Third angle of triangle = $180 - (75 + 40)$ (M1)
 $= 65^\circ$ (A1)

Notes: Award (A2) for 65 seen.
 For use of 40° or 75° in an otherwise correct sine rule award (M1)(A0)(A0)

Length of fence: $\frac{x}{\sin 65^\circ} = \frac{410}{\sin 75^\circ}$ (sine rule) (M1)(A1)

$x = 385 \text{ m (3 s.f.)}$ (A1)
or (G2)

[5 marks]

(b) Area = $\frac{1}{2}ab \sin c$

area = $\frac{1}{2} \times 385 \times 245 \sin 24^\circ$ (M1)(A1)

$= 19\,200 \text{ (m}^2\text{) (3 s.f.)}$ (A1)
or (G2)

[3 marks]

(ii) $\frac{\text{height}}{5.7} = \tan 42^\circ$, (M1)

therefore height = $5.7 \tan 42^\circ$ (= 5.1323...cm) (A1)
or (G2)

Volume of prism = $\frac{5.7 \tan(42^\circ) \times 5.7 \times 8}{2}$ (M1)

$= 117 \text{ cm}^3$ (3 s.f.) (A1)
or (G2)

Note: The only departures from the substituted volume formula allowed are those where the $5.7 \tan(42)$ is replaced with a value that the candidate seems to believe is the height. e.g. 5.7 repeated is a possibility. In such cases, award (M1)(A0).

[4 marks]

Total [12 marks]

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- 2) (a) (i) 15.4×5.5 (MI)
 84.7 m^2 (AI)
 (UP) $= 847000 \text{ cm}^2$ (AI)(G3)

Note: Award (G2) if 84.7 m^2 seen with no working.

OR

- (UP) 1540×550 (AI)(MI)
 $= 847000 \text{ cm}^2$ (AI)(ft)(G3)

Note: Award (AI) for both dimensions converted correctly to cm, (MI) for multiplication of both dimensions. (AI)(ft) for correct product of their sides in cm.

- (UP) (ii) 242 cm^2 (0.0242 m^2) (AI)

- (iii) $\frac{15.4}{0.22} = 70$ (MI)
 $\frac{5.5}{0.11} = 50$
 $70 \times 50 = 3500$ (AI)(G2) [6 marks]

OR

$$\frac{847000}{242} = 3500 \quad (MI)(AI)(ft)(G2)$$

Note: Follow through from parts (a) (i) and (ii).

- (b) (i) $BC^2 = 4^2 + 6^2 - 2 \times 4 \times 6 \times \cos 40^\circ$ (MI)(AI)
 (UP) $BC = 3.90 \text{ m}$ (AI)(G2)

Note: Award (MI) for correct substituted formula, (AI) for correct substitutions, (AI) for correct answer.

- (UP) (ii) perimeter = 13.9 m (AI)(ft)(G1)

Notes: Follow through from part (b) (i).

- (iii) Area = $\frac{1}{2} \times 4 \times 6 \times \sin 40^\circ$ (MI)
 (UP) $= 7.71 \text{ m}^2$ (AI)(ft)(G2)

Notes: Award (MI) for correct formula and correct substitution, (AI)(ft) for correct answer.

- (iv) $\frac{7.713}{84.7} \times 100\% = 9.11\%$ (AI)(MI)(AI)(ft)(G2) [9 marks]

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3)

(a) $\frac{\sin \text{BCA}}{35} = \frac{\sin 105^\circ}{80}$ (MI)(AI)

Note: Award (MI) for correct substituted formula, (AI) for correct substitutions.

$\hat{\text{BCA}} = 25.0^\circ$ (AI)(G2) [3 marks]

(b) Length BD = 40 m (AI)
 Angle ABC = $180^\circ - 105^\circ - 25^\circ = 50^\circ$ (AI)(ft)

Note: (ft) from their answer to (a).

$\text{AD}^2 = 35^2 + 40^2 - (2 \times 35 \times 40 \times \cos 50^\circ)$ (MI)(AI)(ft)

Note: Award (MI) for correct substituted formula, (AI)(ft) for correct substitutions.

(UP) AD = 32.0 m (AI)(ft)(G3) [5 marks]

Notes: If 80 is used for BD award at most (A0)(AI)(ft)(MI)(AI)(ft)(AI)(ft) for an answer of 63.4 m.
 If the angle ABC is incorrectly calculated in this part award at most (AI)(A0)(MI)(AI)(ft)(AI)(ft).
 If angle BCA is used award at most (AI)(A0)(MI)(A0)(A0).

(c) length of fence = $35 + 40 + 32$ (MI)
 = 107 m (AI)(ft)(G2) [2 marks]

Note: (MI) for adding $35 + 40 +$ their (b).

(d) cost per metre = $\frac{802.50}{107}$ (MI)

Note: Award (MI) for dividing 802.50 by their (c).

cost per metre = 7.50 USD (7.5 USD) (USD not required) (AI)(ft)(G2) [2 marks]

(e) Area of ABD = $\frac{1}{2} \times 35 \times 40 \times \sin 50^\circ$ (MI)
 = 536.2311102 (AI)(ft)
 = 536 m^2 (AI)(ft)(G2) [3 marks]

Note: Award (MI) for correct substituted formula, (AI)(ft) for correct substitution, (ft) from their value of BD and their angle ABC in (b).

(f) Volume = 0.03×536 (AI)(MI)
 = 16.08 (AI)(ft)(G2) [3 marks]
 = 16.1

Note: Award (AI) for 0.03, (MI) for correct formula. (ft) from their (e).
 If 3 is used award at most (A0)(MI)(A0).

Total [18 marks]

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4)

Unit penalty (UP) is applicable in (a), (b)(ii) and (d)		
<p>(a) $AC^2 = 9^2 + 4.2^2 - 2 \times 9 \times 4.2 \times \cos 95^\circ$ $AC = 10.3 \text{ m}$ (MI) for correct substituted formula and (AI) for correct substitution If radians used answer is 6.59. Award at most (MI)(AI)(A0)</p>	<p>(MI)(AI) (AI)(G2)</p>	[3 marks]
<p>(b) (i) $\hat{BCA} = 25^\circ$</p> <p>(ii) $\frac{AB}{\sin 25^\circ} = \frac{10.258\dots}{\sin 130^\circ}$ $AB = 5.66 \text{ m}$ (MI) for correct substituted formula and (AI) for correct substitution. (AI) for correct answer. Follow through with angle \hat{BCA} and their AC. Allow $AB = 5.68$ if $AC = 10.3$ used. If radians used answer is 0.938 (unreasonable answer). Award at most (MI)(AI)(A0)(ft)</p> <p style="text-align: center;">OR</p> <p>Using that ABC is isosceles</p> $\cos 25^\circ = \frac{\frac{1}{2} \times 10.258\dots}{AB} \text{ (or equivalent)}$ <p>$AB = 5.66 \text{ m}$</p> <p>(AI) for $\frac{1}{2}$ of their AB seen, (MI) for correct trigonometric ratio and correct substitution, (AI) for correct answer. If $\frac{1}{2} AB$ seen and correct answer is given award (AI)(G1). Allow $AB = 5.68$ if $AC = 10.3$ used. If radians used answer is 3.32. Award (AI)(MI)(AI)(ft). If $\sin 65$ and radians used answer is 3.99. Award (AI)(MI)(AI)(ft)</p>	<p>(AI)</p> <p>(MI)(AI) (AI)(ft)(G2)</p> <p>(AI)(MI)(ft) (AI)(ft)(G2)</p>	
<p>(c) Area = $\frac{1}{2} \times 9 \times 4.2 \times \sin 95^\circ + \frac{1}{2} \times (5.6592\dots)^2 \times \sin 130^\circ$ $= 31.095\dots = 31.1 \text{ m}^2$ (correct to 3 s.f.)</p> <p>(MI)(MI) each for correct substitution in the formula of the area of each triangle, (MI) for adding both areas. (AI) for unrounded answer. Follow through with their length of AB but last mark is lost if they do not reach the correct answer.</p>	<p>(MI)(MI)(ft)(MI) (AI)(AG)</p>	[4 marks]
<p>(d) Volume of sand = $\frac{1}{3} (31.09\dots \times 0.4)$ $= 4.15 \text{ m}^3$ (MI) for correct formula of volume of prism and for correct substitution, (MI) for multiplying by $\frac{1}{3}$ and last (AI) for correct answer only.</p>	<p>(MI)(MI) (AI)(G2)</p>	
Total [14 marks]		