

### 3D Trig

1) (a)  $\sin(55^\circ) = \frac{3}{AD}$  (M1)(A1)  
 $AD = \frac{3}{\sin(55^\circ)}$  (M1)  
 $AD = 3.66232 = 3.66 \text{ m to 3 s.f. (units not required).}$  (A1) (C4)

(b)  $DB^2 = AD^2 + DC^2 = 3.66232^2 + 7^2$  (M1)(A1)  
 $DB^2 = 62.4126$  hence  $DB = 7.90 \text{ m (units not required).}$  (A1)(A1) (C4)

**Note:** Use of  $3.66^2$  makes no difference to final answer.  
 Award at most (M0)(A0)(A0)(A1)ft for an incorrect cosine rule formula.  
 Award at most (M1)(A0)(A0)(A1)ft for incorrect substitution into correct cosine rule formula.

2) (a)  $XM = 2$  (A1) (C1)  
 (b)  $DM = \sqrt{(9+4)} = \sqrt{13} (= 3.61)$  (M1)(A2) (C3)  
 (c)  $\tan DMX = \frac{3}{2}$  (M1)(A1)

**Note:** Award (M1) for the correct angle, (A1) for the correct ratio.

angle  $DMX = 56.3^\circ$  (A2) (C4)

**OR**

$\sin DMX = \frac{3}{3.61}$  (M1)(A1)

angle  $DMX = 56.2^\circ$  (A2)

**OR**

$\cos DMX = \frac{2}{3.61}$  (M1)(A1)

angle  $DMX = 56.4^\circ$  (A2)

**Note:** Accept correct answer given in radians, or degrees, minutes and seconds.

3)

|                                                                                                                                          |                  |           |
|------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------|
| <b>Unit penalty (UP) applies in parts (a) and (b) in this question.</b>                                                                  |                  |           |
| (a) $VM^2 = 13^2 - 5^2$<br>$= 12 \text{ cm}$                                                                                             | (M1)<br>(A1)     | (C2)      |
| (b) $h^2 = 12^2 - 5^2$ (or equivalent)<br>$= 10.9 \text{ cm}$                                                                            | (M1)<br>(A1)(ft) | (C2)      |
| (c) $\cos \theta = \frac{5}{12}$ (or equivalent)<br>$\theta = 65.4^\circ$<br>Accept $\theta = 65.3^\circ$ (use of 10.9 with sine ratio). | (M1)<br>(A1)(ft) | (C2)      |
|                                                                                                                                          |                  | [6 marks] |

### 3D Trig

4) (a)  $PB = \frac{1}{2}\sqrt{40^2 + 40^2} = \sqrt{800} = 28.28(28.3)$  (MI)(AI)

**Note:** Award (MI) for correct substitutions, (AI) for correct answer

(UP)  $OB = \sqrt{40^2 + 28.28^2} = 49.0 \text{ cm} (\sqrt{2400} \text{ cm})$  (MI)(AI)(ft) (C4)

**Note:** Award (MI) for correct substitution, can (ft) from any answer to PB.

(b)  $\sin^{-1}\left(\frac{40}{49}\right)$

**OR**

$\cos^{-1}\left(\frac{28.28}{49}\right)$

**OR**

$\tan^{-1}\left(\frac{40}{28.28}\right)$

$= 54.7 (54.8)$

(MI)

(AI)(ft) (C2)

**Note:** Award (MI) for any correct trig. ratio.  
In radians = 0.616, award (MI)(A0)

**Note:** Common error: (a)  $OB = \sqrt{40^2 + 20^2} = 44.7 \text{ cm}$ . Award (M0)(A0)(MI)  
(AI)(ft), and (b) angle  $OBP = 63.4^\circ (63.5^\circ)$  (MI)(AI)(ft).

5)

[6 marks]

(a)  $AG = \sqrt{0.8^2 + 0.5^2}$  (MI)  
(UP)  $AG = 0.943 \text{ m}$  (AI) (C2)

(b)  $AF = \sqrt{AG^2 + 1.80^2}$  (MI)  
(UP)  $= 2.03 \text{ m}$  (AI)(ft) (C2)

**Note:** Follow through from their answer to part (a).

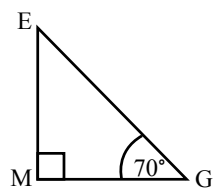
(c)  $\cos \hat{GAF} = \frac{0.943(39...)}{2.03(22...)}$  (MI)  
 $\hat{GAF} = 62.3^\circ$  (AI)(ft) (C2)

**Notes:** Award (MI) for substitution into correct trig ratio.  
Accept alternative ratios which give  $62.4^\circ$  or  $62.5^\circ$ .  
Follow through from their answers to parts (a) and (b).

# 3D Trig

6)

(a)



(A1)

[1 mark]

(b)  $\tan 70 = \frac{h}{5}$   
 $h = 5 \tan 70 = 13.74$   
 $h = 13.7 \text{ cm}$

(M1)

(A1)

(AG)

[2 marks]

(c) (i)  $EG^2 = 5^2 + 13.7^2$  OR  $5^2 + (5 \tan 70)^2$   
 $EG = 14.6 \text{ cm}$

(M1)

(A1)(G2)

(ii)  $\text{DEC} = 2 \times \tan^{-1} \left( \frac{5}{14.6} \right)$   
 $= 37.8^\circ$

(M1)

(A1)(ft)(G2)

[4 marks]

(d)  $\text{Area} = 10 \times 10 + 4 \times 0.5 \times 10 \times 14.619$   
 $= 392 \text{ cm}^2$

(M1)

(A1)(ft)(G2)

[2 marks]

(e)  $\text{Volume} = \frac{1}{3} \times 10 \times 10 \times 13.7$   
 $= 457 \text{ cm}^3$  (458 cm<sup>3</sup>)

(M1)

(A1)(G2)

[2 marks]

**Total [19 marks]**

### 3D Trig

7)

(a) (i)  $60^\circ$  (AI)

(ii)  $\text{Area} = \frac{6 \times 6 \times \sin 60^\circ}{2}$  (MI)(AI)

(UP)  $= 15.6 \text{ cm}^2 \quad (9\sqrt{3})$  (AI)(ft)(G2) [4 marks]

**Note:** Award (MI) for substitution into correct formula, (AI) for correct values. Accept alternative correct methods.

(b) Surface Area  $= 15.58 \times 2 + 23 \times 6 \times 3$  (MI)(MI)

**Note:** Award (MI) for two terms with 2 and 3 respectively, (MI) for  $23 \times 6$  (138).

(UP) Surface Area  $= 445 \text{ cm}^2$  (AI)(ft)(G2) [3 marks]

(c) weight  $= 1.5 \times 15.59 \times 23$  (MI)(MI)

**Note:** Award (MI) for finding the volume, (MI) for multiplying their volume by 1.5.

(UP) weight  $= 538 \text{ g}$  (AI)(ft)(G3) [3 marks]

(d)  $\cos \alpha = \frac{4^2 + 6^2 - 7^2}{2 \times 4 \times 6}$  (MI)(AI)

**Note:** Award (MI) for using cosine rule with values from the problem, (AI) for correct substitution.

$\alpha = 86.41 \dots$  (AI)

$\alpha = 86.4^\circ$  (AG) [3 marks]

**Note:** 86.41... must be seen for final (AI) to be awarded.

(e)  $l \times \frac{4 \times 6 \times \sin 86.4^\circ}{2} \times 1.5 = 500$  (MI)(AI)(MI)

**Notes:** Award (MI) for finding an expression for the volume, (AI) for correct substitution, (MI) for multiplying the volume by 1.5 and equating to 500, or for equating the volume to  $\frac{500}{1.5}$ .  
If formula for volume is not correct but consistent with that in (c) award at most (MI)(A0)(ft)(MI)(A0).

(UP)  $l = 27.8 \text{ cm}$  (AI)(G3) [4 marks]

**Total [17 marks]**