# IB 3D Geometry Answers

**1.** (a) $l = \sqrt{8^2 + 8^2}$ (M1)

$= \sqrt{128}$

$= 11.3$ (3 s.f.) (A1)

(b) $L = \sqrt{\sqrt{128^2} + 8^2}$ **OR** $L = \sqrt{11.3^2 + 8^2}$ *(allow ft from (a))* (M1)

$= \sqrt{128 + 64}$ **OR** $= \sqrt{127.69} + 64$

$= 13.9$ (3 s.f.) **OR** $= 13.8$ (3 s.f.) (A1)

**[4]**

**14.** (a) XM = 2 (A1) (C1)

(b) DM $= \sqrt{(9 + 4)} = \sqrt{13}$ (= 3.61) (M1)(A2)

(c) $\tan \hat{DMX} = \frac{3}{2}$ (M1)(A1)

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

angle $\hat{DMX} = 56.3°$ (A2) (C4)

**OR**

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

angle $\hat{DMX} = 56.2°$ (A2)

**OR**

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

angle $\hat{DMX} = 56.4°$ (A2)

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

**[8]**

**15.** (a) $\sin(55°) = \frac{3}{AD}$ (M1)(A1)

$AD = \frac{3}{\sin(55°)}$ (M1)

$AD = 3.66232 = 3.66$ 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 m (units not required). (A1)(A1)

***Note:*** *Use of 3.662 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.*

**[8]**

**8.** (a) $XO^2 = 252 - 7^2$ (M1)

***Note:*** *Award* (M1) *for using Pythagoras' Theorem with correct signs and values*

XO = 24 (A1)(G2) 2

(b) $\cos\alpha = \frac{7}{25}$

(M1)

***Note:*** *Award* (M1) *for using any correct ratio.*

$\alpha = 73.7°$ (73° 44′) (A1)(ft)(G2) 2

***Note:*** *Do not accept radians.*

(c) 120°

(A1) 1

(d) $AB^2 = 7^2 + 7^2 - 2 \times 7 \times 7 \times \cos 120°$

(M1)(A1)

***Note:*** *Award* (M1) *for using cosine rule.*

$AB = 12.1(\sqrt{147})$ (A1)(ft)(G2) 3

***Notes:*** *Award* (M1) *for substituting values from the problem into the cosine rule,* (A1) *for correct values.*

*Accept alternative, correct methods*

(e) $\cos\theta = \frac{25^2 + 25^2 - 147}{2 \times 25 \times 25}$

(M1)(A1)

***Note:*** *Award* (M1) *for substituting values from the problem into the cosine rule,* (A1) *for correct values.*

$\theta = 28.1°$ (28.0°) (A1)(ft)(G2) 3

***Note:*** *Accept 28°. If using an isosceles triangle, award* (M1) *for angle,* (A1) *for answer,* (A1) *for doubling.*

**[11]**

**3.** *Unit penalty* (UP) *is applicable in question parts (a) (b) and (e)* ***only****.*

(a) $V = \frac{1}{3} \times 3.2^2 \times 2.8$ (M1)

***Note:*** *(M1) for substituting in correct formula*

$= 9.56\ cm^3$ (A1)(G2) (UP) 2

(b) $9.56 \times 9.3$ (M1)

$= 88.9$ grams (A1)(ft)(G2) (UP) 2

(c) $\frac{1}{2}$ base = 1.6 seen (M1) 4

***Note:*** *Award (M1) for halving base*

$OC^2 = 1.6^2 + 1.6^2 = 5.12$ (A1)

***Note:*** *Award* (A1) *for one correct use of Pythagoras*

$5.12 + 2.8^2 = 12.96 = VC^2$ (M1)

***Note:*** *Award (M1) for using Pythagoras again to find* $VC^2$

VC = 3.6 **AG** (A1)

***Note:*** *Award* (A1) *for 3.6 obtained from 12.96 only (not 12.95…)*

**OR**

$AC^2 = 3.2^2 + 3.2^2 = 20.48$

***Note:*** *Award* (A1) *for one correct use of Pythagoras*

$\text{OC} = \frac{1}{2}\sqrt{20.48}\ (= 2.26...)$ (M1)

***Note:*** *Award (M1) for halving AC*

$2.8^2 + (2.26...)^2 = \text{VC}^2 = 12.96$ (M1)

***Note:*** *Award (M1) for using Pythagoras again to find* $VC^2$

$\text{VC} = 3.6$ **AG** (A1)

***Note:*** *Award* (A1) *for 3.6 obtained from 12.96 only (not 12.95…)*

(d) $3.2^2 = 3.6^2 + 3.6^2 - 2 \times (3.6)\ (3.6)\cos\ \text{B}\hat{\text{V}}\text{C}$ (M1)(A1)

$\text{B}\hat{\text{V}}\text{C} = 52.8°$ *(no (ft) here)* (A1)(G2)

***Note:*** *Award (M1) for substituting in correct formula,* (A1) *for correct substitution*

**OR**

$\sin\ \text{B}\hat{\text{V}}\text{M} = \frac{1.6}{3.6}$ where *M* is the midpoint of BC (M1)(A1)

$\text{B}\hat{\text{V}}\text{C} = 52.8°$ *(no (ft) here)* (A1) 3

(e) $4 \times \frac{1}{2}(3.6)^2 \times \sin(52.8°) + (3.2)^2$ (M1)(M1)(M1)

***Note:*** *Award (M1) for 4, (M1) for substitution in relevant triangle area,* $(\frac{1}{2}(3.2)(2.8)$ *gets (M0))*

*(M1) for* $+(3.2)^2$

(UP)

$= 30.9\ \text{cm}^2$ *((ft) from their (d))* (A1)(ft)(G2) (UP) 4

**[15]**