# Pythag and trig ans studies 

0 min<br>0 marks

1. Unit penalty applies in parts (a) and (b)
(a) $\mathrm{AC}^{2}=7.2^{2}+9.6^{2}$

Note: Award (M1) for correct substitution in Pythagoras Theorem.

$$
\begin{equation*}
\text { UP } \quad \mathrm{AC}=12 \mathrm{~m} \tag{A1}
\end{equation*}
$$

(b) $\mathrm{AG}^{2}=12^{2}+3.5^{2}$

Note: Award (M1) for correct substitution in Pythagoras Theorem.

UP $\quad A G=12.5 \mathrm{~m}$
(A1)(ft) (C2)
Note: Follow through from their answer to part (a).
(c) $\tan \theta=\frac{3.5}{12}$ or $\sin \theta=\frac{3.5}{12.5}$ or $\cos \theta=\frac{12}{12.5}$

Note: Award (M1) for correct substitutions in trig ratio.
$\theta=16.3^{\circ}$
(A1)(ft)
(C2)
Notes: Follow through from parts (a) and/or part (b) where appropriate. Award (M1)(A0) for use of radians (0.284).
2. Unit penalty applies in parts (a) and (b)
(a) $\mathrm{AG}=\sqrt{0.8^{2}+0.5^{2}}$

UP
$\mathrm{AG}=0.943 \mathrm{~m}$
(b) $\mathrm{AF}=\sqrt{\mathrm{AG}^{2}+1.80^{2}}$
(M1)
UP
$=2.03 \mathrm{~m}$
(A1)(ft) (C2)
Note: Follow through from their answer to part (a).
(c) $\cos \mathrm{GA} \mathrm{F}=\frac{0.943(39 \ldots)}{2.03(22 \ldots)}$

GÂF $=62.3^{\circ}$
(A1)(ft) (C2)
Notes: Award (M1) for substitution into correct trig ratio. Accept alternative ratios that give $62.4^{\circ}$ or $62.5^{\circ}$. Follow through from their answers to parts (a) and (b).
3. Note: Unit penalty (UP) applies in part (a)
(a) $\mathrm{PB}=\frac{1}{2} \sqrt{40^{2}+40^{2}}=\sqrt{800}=28.28$ (28.3)
(M1)(A1)
Note: Award (M1) for correct substitutions, (A1) for correct answer.

UP

$$
\mathrm{OB}=\sqrt{40^{2}+28.28^{2}}=49.0 \mathrm{~cm}(\sqrt{2400} \mathrm{~cm})
$$

Note: Award (M1) 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)
(A1)(ft) (C2)
Note: Award (M1) for any correct trig. ratio.
In radians $=0.616$, $\operatorname{award}(M 1)(A 0)$.
Note: Common error: (a) $O B=\sqrt{40^{2}+20^{2}}=44.7 \mathrm{~cm}$.
Award (MO)(A0)(M1) (Al)(ft), and (b) angle
$O B P=63.4^{\circ}\left(63.5^{\circ}\right)(M 1)(A 1)(f t)$.
4. Unit penalty $(\boldsymbol{U P})$ is applicable where indicated.
(a) (i)


For A, B, C, $7.3,60^{\circ}, 90^{\circ}$, shown in correct places
(A1)
Note: The $90^{\circ}$ should look like $90^{\circ}$ (allow $\pm 10^{\circ}$ )
(ii) Using $\tan 60$ or $\tan 30$
4.21 cm
(A1)(ft)
(ft) on their diagram
Or
Using sine rule with their correct values
4.21 cm

Or
Using special triangle $\frac{7.3}{\sqrt{3}}$
UP
4.21 cm

Or
Any other valid solution
Note: If $A$ and $B$ are swapped then $B C=8.43 \mathrm{~cm}$
(b) (i) For ACD in a straight line and all joined up to B , for $20^{\circ}$ shown in correct place and D labelled. D must be on AC extended.
(ii) $B \hat{C} D=120^{\circ}$

$$
\begin{equation*}
C \hat{B} D=40^{\circ} \tag{A1}
\end{equation*}
$$

5. Unit penalty ( $\mathbf{U P}$ ) applies in parts ( $a$ ) and (b) in this question.

UP
(a) $\begin{aligned} & \mathrm{VM}^{2}=13^{2}-5^{2} \\ & =12 \mathrm{~cm}\end{aligned}$
(A1) (C2)
(b) $h^{2}=12^{2}-5^{2}$ (or equivalent)
(M1)
UP $\quad=10.9 \mathrm{~cm}$
(A1)(ft) (C2)
(c) $\cos \theta=\frac{5}{12}$ (or equivalent)
$\theta=65.4^{\circ}$
Note: Accept $\theta=65.3^{\circ}$ (use of 10.9 with sine ratio).
6. (a) For using tan
$h=12.3 \times \tan 63$ For using tan something
$h=24.1$
(A1) (G3)
(b) $24.1=4.9 t^{2}$ For substituting for h in the formula and attempting to solve

For taking a square root (can be implied)
2.22 sec
(A1) (C3)
7. $\frac{\text { height }}{5.7}=\tan 42^{\circ}$,
therefore height $=5.7 \tan 42^{\circ}(=5.1323 \ldots \mathrm{~cm})$
(M1)
(A1) or (G2)

Volume of prism $=\frac{5.7 \tan \left(42^{\circ}\right) \times 5.7 \times 8}{2}$
$=117 \mathrm{~cm}^{3}$ (3 s.f.)
[6]
8. (a) $X M=2$
(A1) (C1)
(b) $\mathrm{DM}=\sqrt{(9+4)}=\sqrt{13}(=3.61)$ (M1)(A2) (C3)
(c) $\quad \tan \mathrm{D} \hat{\mathrm{M}} \mathrm{X}=\frac{3}{2}$

Note: Award (M1) for the correct angle, (A1) for the correct ratio.
angle $\mathrm{DMX}=56.3^{\circ}$
OR
$\sin \mathrm{DM} \mathrm{X}=\frac{3}{3.61}$
angle $\mathrm{DMX}=56.2^{\circ}$
OR
$\cos \mathrm{DMX}=\frac{2}{3.61}$
(M1)(A1)
angle $\mathrm{DMX}=56.4^{\circ}$
Note: Accept correct answer given in radians, or degrees, minutes and seconds.
9.
(a) $\sqrt{5^{2}+1^{2}}=\sqrt{26}$ (or 5.10 (3 s.f.))
(M2)(A2) (C4)
(b) $\sqrt{4^{2}+\sqrt{26}^{2}}$
(M2)
$=\sqrt{42}=6.48$ (3 s.f.)
(A2) (C4)
10. (a)

(A1)
(b) $\quad x=\frac{26.5}{\tan 28^{\circ}}$ (or equivalent, allow follow-through from part (a))
$=49.83925 \ldots$
(A1)
$=50 \mathrm{~m}$ (correct to nearest metre)
(A1)
11. (a)

(M1) (C1)
Note: All three $\left(23^{\circ}, x, 450 \mathrm{~m}\right)$ must be labelled and in correct position for (M1)
(b) $\tan 23^{\circ}=\frac{450}{x}$

Note: Follow through from candidate's diagram
$x=\frac{450}{\tan 23^{\circ}}$
$x=1060.13 \ldots$
$x=1060$ ( 3 s.f.)
(A1) (C3)

