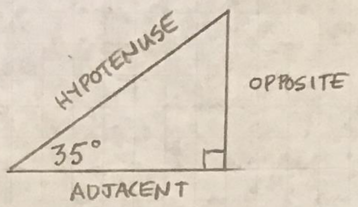
FMPC 10
8.1, page 306
#1ac, 2a

FMPC 10 8.1 p.306

1a) $\sin 35^\circ = 0.5736$

This means that for the triangle where the acute angle = 35°

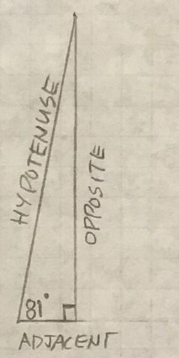


the ratio of $\dfrac{\text{the length of the opposite side}}{\text{the length of the hypotenuse}} = 0.573576$

$= 0.5736$

rounded up because the fifth decimal place is 5 or greater

1c) $\tan 81^\circ = 6.3138$



This means that the ratio of the $\dfrac{\text{length of the opposite side}}{\text{length of the adjacent side}}$

$= 6.313751$

$= 6.3138$

We round the 7 up to 8 because the digit that follows is 5 or greater.

2a) $\sin\theta = 0.6348$ (make sure your calculator is in DEG mode)

$\theta = \sin^{-1}(0.6348)$

$\theta = 39.4^\circ$

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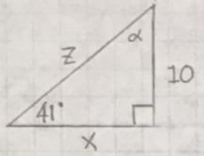
8.1, page 307
#3a

FMPC 10 8.1 p.307

3a)



STEP ① The sum of the angles in a triangle = 180°

A right angle is 90°

This means the sum of the other two angles is 90°

$$\therefore\ 41° + \alpha = 90°$$
$$\alpha = 90° - 41°$$
$$\boxed{\alpha = 49°}$$

STEP ② Find the length x

With respect to the angle 41° we know the OPPOSITE side = 10

we want the ADJACENT side, X

- DECIDE which of the three trig functions you need to use

SOH CAH TOA

- base on what we $\underbrace{\text{have}}_{\text{opposite side}}$ and what we $\underbrace{\text{want}}_{\text{adjacent side}}$ we would use TOA

$$\therefore\ \tan 41° = \frac{10}{x} \longrightarrow x \tan 41° = 10 \longrightarrow x = \frac{10}{\tan 41°}$$

$$\boxed{x = 11.5}$$

STEP ③ Find the length y

- we have the opposite side and we want the hypotenuse

∴ we would use SOH

$$\sin 41° = \frac{10}{z} \longrightarrow z \sin 41° = 10 \longrightarrow z = \frac{10}{\sin 41°}$$

$$\boxed{z = 15.2}$$

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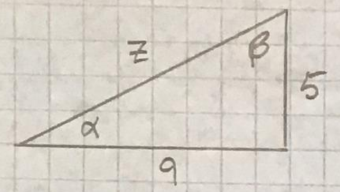
#3b

3b)



STEP 1 Find angle α

With respect to α we have the OPPOSITE side = 5

ADJACENT side = 9

This means we will use TOA

$\therefore \tan\alpha = \frac{5}{9} \longrightarrow \alpha = \tan^{-1}\left(\frac{5}{9}\right)$

$\boxed{\alpha = 29.1^\circ}$

STEP 2 Find angle β

We know $\alpha + \beta = 90^\circ$ $\therefore$ $\beta = 90^\circ - \alpha$

$= 90^\circ - 29.1^\circ$

$\boxed{\beta = 60.9^\circ}$

STEP 3 Use the PYTHAGOREAN THEOREM to find z

$\therefore 5^2 + 9^2 = z^2$

$25 + 81 = z^2$

$106 = z^2$

$\sqrt{106} = z$

$\boxed{z = 10.3}$

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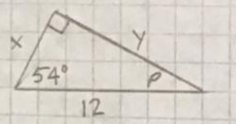
#3c

3c)



STEP ① Find angle P. We know $54° + P = 90°$

$$P = 90° - 54°$$

$$\boxed{P = 36°}$$

STEP ② Find the length x.

With respect to the 54° angle, we have the HYPOTENUSE = 12

we want the ADJACENT side, x

$\therefore$ we will use CAH $\longrightarrow$ $\cos 54° = \frac{x}{12}$

$$12 \cos 54° = x$$

$$\boxed{x = 7.1}$$

STEP ③ Find the length y

With respect to the 54° angle, we have the HYPOTENUSE = 12

we want the OPPOSITE side, y

$\therefore$ we will use SOH $\longrightarrow$ $\sin 54° = \frac{y}{12}$

$$12 \sin 54° = y$$

$$\boxed{y = 9.7}$$

OR, using the PYTHAGOREAN THEOREM

$x^2 + y^2 = 12^2 \longrightarrow 7.1^2 + y^2 = 12^2 \longrightarrow y^2 = 12^2 - 7.1^2$

$y^2 = 144 - 50.41 \longrightarrow y^2 = 93.59 \longrightarrow \boxed{y = 9.7}$

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#3d

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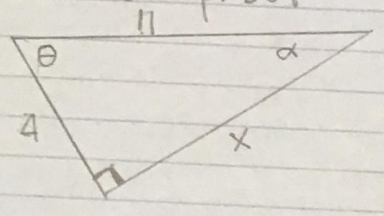
3d)



① With respect to angle α we are given its opposite side and the length of the hypotenuse $\longrightarrow$ use SOH

$$\therefore \sin\alpha = \frac{4}{11} \longrightarrow \alpha = \sin^{-1}\left(\frac{4}{11}\right)$$

$$\boxed{\alpha = 21.3^\circ}$$

② $\alpha + \theta = 90^\circ \longrightarrow 21.3^\circ + \theta = 90^\circ$

$$\boxed{\theta = 90^\circ - 21.3^\circ = 68.7^\circ}$$

③ Use the Pythagorean Theorem to find x.

$$x^2 + 4^2 = 11^2$$

$$x^2 = 11^2 - 4^2$$

$$x^2 = 121 - 16$$

$$x^2 = 105$$

$$x = \sqrt{105}$$

$$\boxed{x = 10.2}$$

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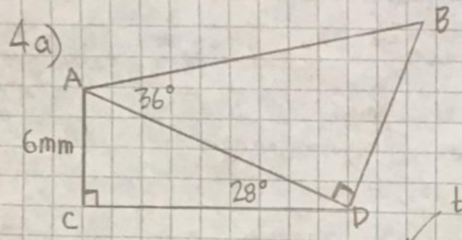
#4a

FMPC 10 8.1 p.308

4a)



We want to find the length of AB.
To do this we must find the length of AD first.

this means "the length of" AD

STEP 1 Find $\overline{AD}$

With respect to the 28° angle we have the OPPOSITE side
we want the HYPOTENUSE

$\therefore$ we will use SOH $\longrightarrow$ $\sin 28° = \dfrac{6\text{mm}}{\overline{AD}}$

$\overline{AD}\sin 28° = 6\text{ mm}$

$\overline{AD} = \dfrac{6\text{mm}}{\sin 28°}$

$\overline{AD} = 12.78\text{ mm}$

(carry the extra decimal place)

STEP 2 Find $\overline{AB}$

With respect to the 36° angle we have the ADJACENT side
we want the HYPOTENUSE

$\therefore$ we will use CAH $\longrightarrow$ $\cos 36° = \dfrac{12.78\text{mm}}{\overline{AB}}$

$\overline{AB}\cos 36° = 12.78\text{mm}$

$\overline{AB} = \dfrac{12.78\text{ mm}}{\cos 36°}$

$\boxed{\overline{AB} = 15.8\text{ mm}}$

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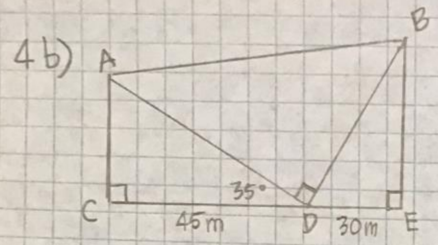
#4b

4b)



STEP ① Find the length of AD

With respect to the 35° angle we have the ADJACENT side

we want the HYPOTENUSE

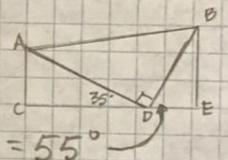
∴ we will use CAH ⟶ $\cos 35° = \frac{45\text{m}}{\overline{AD}}$

$\overline{AD}\cos 35° = 45\text{m}$

$\overline{AD} = \frac{45\text{m}}{\cos 35°} = 54.93\text{m}$

STEP ② The sum of the angles on a line = 180°.

This means $35° + 90° + \angle BDE = 180°$



$\angle BDE = 180° - 35° - 90° = 55°$

STEP ③ Find the length of BE

With respect to the 55° angle we have the ADJACENT side

we want the HYPOTENUSE

∴ we will use CAH ⟶ $\cos 55° = \frac{30\text{m}}{\overline{BD}}$

$\overline{BD} = \frac{30\text{m}}{\cos 55°} = 52.30\text{m}$

STEP ④ Use the PYTHAGOREAN THEOREM to find $\overline{AB}$

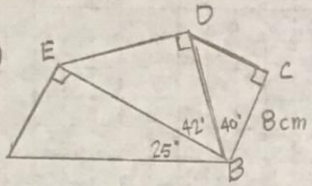
$\overline{AD}^2 + \overline{BD}^2 = \overline{AB}^2$

$54.93^2 + 52.30^2 = \overline{AB}^2$

$5752.59 = \overline{AB}^2$ ⟶ $\boxed{\overline{AB} = 75.8\text{m}}$

FMPC 10
8.1, page 308
#4cd

4c)



We will work our way around to $\overline{AB}$ by determining the length of the common sides.

Step ① Determine $\overline{BD}$ using CAH $\longrightarrow$ $\cos 40° = \dfrac{8\text{cm}}{\overline{DB}}$

$$\overline{DB} = \frac{8\text{cm}}{\cos 40°} = 10.44\text{ cm}$$

Step ② Determine $\overline{BE}$ using CAH $\longrightarrow$ $\cos 42° = \dfrac{10.44\text{cm}}{\overline{BE}}$

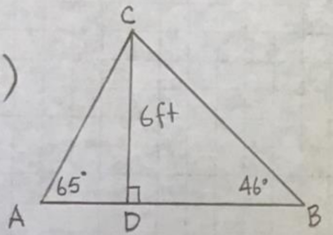
$$\overline{BE} = \frac{10.44\text{cm}}{\cos 42°} = 14.05\text{ cm}$$

Step ③ Determine $\overline{AB}$ using CAH

$$\cos 25° = \frac{14.05\text{cm}}{\overline{AB}}$$

$$\boxed{\overline{AB} = \frac{14.05\text{cm}}{\cos 25°} = 15.5\text{cm}}$$

4d)



Before we start, add point D on the picture

so, $\overline{AD} + \overline{DB} = \overline{AB}$

Step ① Determine $\overline{AD}$ using TOA $\longrightarrow$ $\tan 65° = \dfrac{6\text{ft}}{\overline{AD}}$

$$\overline{AD} = \frac{6\text{ft}}{\tan 65°} = 2.79\text{ ft}$$

② Determine $\overline{DB}$ using TOA $\longrightarrow$ $\tan 46° = \dfrac{6\text{ft}}{\overline{DB}}$

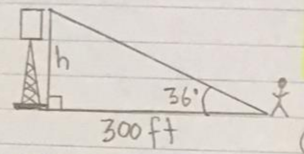
$$\overline{DB} = \frac{6\text{ft}}{\tan 46°} = 5.79\text{ ft}$$

③ $\overline{AB} = \overline{AD} + \overline{DB} = 2.79 + 5.79 = 8.58 = \boxed{8.6\text{ft}}$

FMPC 10
8.4, page 325
#1-5

FMPC 10 8.4 p.325

1.



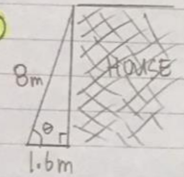
① DRAW A DIAGRAM

② With respect to the 36° angle...
We have the ADJACENT side — A
We want the OPPOSITE side — O ∴ TOA

③ $\tan 36° = \frac{h}{300ft}$

$(300ft)\tan 36° = h \longrightarrow \boxed{h = 218.0\,ft}$

2. ①

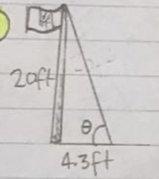


② With respect to angle θ we have H and A ∴ CAH

③ $\cos\theta = \frac{1.6m}{8m} \longrightarrow \theta = \cos^{-1}\left(\frac{1.6}{8}\right)$ *the units cancel

$\boxed{\theta = 78.5°}$

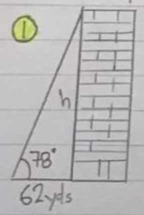
3. ①



② With respect to θ we have O and A ∴ use TOA

③ $\tan\theta = \frac{20ft}{4.3ft} \longrightarrow \theta = \tan^{-1}\left(\frac{20}{4.3}\right) \longrightarrow \boxed{\theta = 77.9°}$

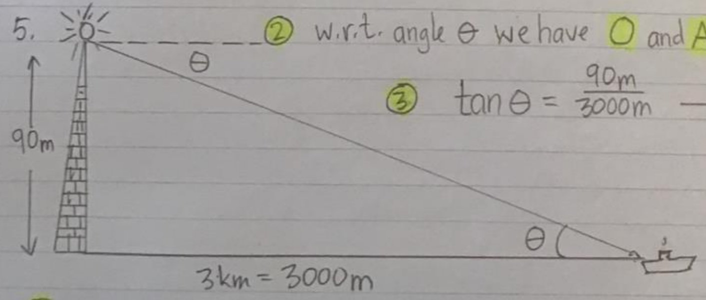
4. ①



② w.r.t 78° angle we have A and want O ∴ use TOA

③ $\tan 78° = \frac{h}{62yds} \longrightarrow (62yds)\tan 78° = h \longrightarrow \boxed{h = 291.7\,yds}$

5.



② w.r.t. angle θ we have O and A ∴ use TOA

③ $\tan\theta = \frac{90m}{3000m} \longrightarrow \theta = \tan^{-1}\left(\frac{90}{3000}\right)$

$\boxed{\theta = 1.7°}$

①

NOTE: the angle of depression from the light = angle of elevation from the ship.

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#6, 7

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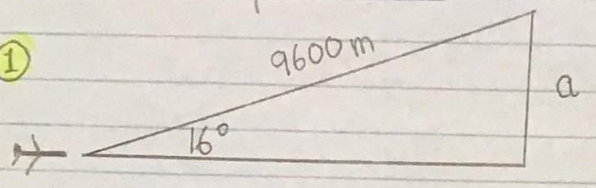
6. ①



After 2 minutes (120 seconds) the plane has travelled

$(80\,m/s)(120\,s) = 9600\,m$

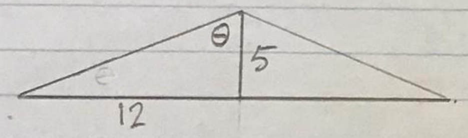
② w.r.t. 16° angle, we have H and we want O ∴ use SOH

③ $\sin 16° = \frac{a}{9600\,m} \longrightarrow (9600\,m)\sin 16° = a$

$\boxed{a = 2646.1\,m}$

---

7. ① A 5 to 12 pitch means the rise = 5 and run = 12



② w.r.t. angle θ, we have O and A ∴ use TOA

③ $\tan\theta = \frac{12}{5} \longrightarrow \theta = \tan^{-1}\left(\frac{12}{5}\right)$

$\boxed{\theta = 67.4°}$

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8.4, page 326
#8-11

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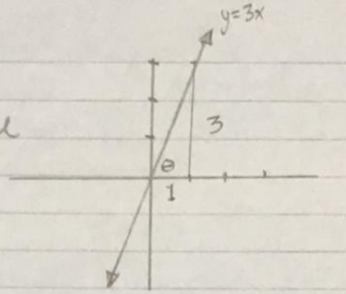
8. $y = 3x$ is the line



$\tan\theta = \frac{3}{1}$

$\theta = \tan^{-1}(3)$

$\boxed{\theta = 71.6^\circ}$

9.

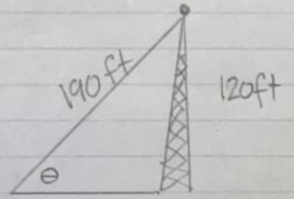
w.r.t. the angle, we want the opposite side
we have the hypotenuse ∴ SOH

$\sin 37^\circ = \frac{h}{200m} \longrightarrow 200m \sin 37^\circ = h$

$h = 120.4m$

but the person is 2m tall ∴ the height of the kite is $120.4m + 2m = \boxed{122.4m}$

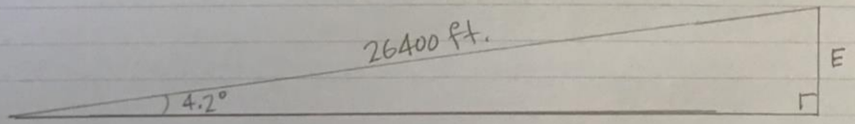
10.



$\sin\theta = \frac{120ft}{190ft}$

$\theta = \sin^{-1}\left(\frac{120}{190}\right) = \boxed{39.2^\circ}$

11. $5 \text{ miles} \times 1760 \text{ yd/mile} \times 3 \text{ ft/yd} = 26400 \text{ ft.}$



$\sin 4.2^\circ = \frac{E}{26400ft} \longrightarrow (26400ft)\sin 4.2^\circ = E$

$\boxed{E = 1933.5 ft}$

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#12-15

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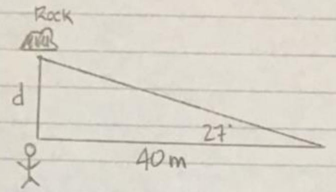
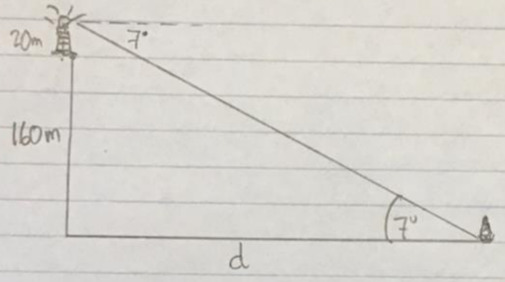
12.



$$\tan 27° = \frac{d}{40m} \longrightarrow (40m)\tan 27° = d$$

$$\boxed{d = 20.4m}$$

13. 20m

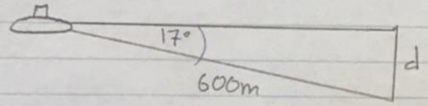


$$\tan 7° = \frac{180m}{d}$$

$$d \tan 7° = 180m$$

$$d = \frac{180m}{\tan 7°} = \boxed{1466.0m}$$

14.



$$\sin 17° = \frac{d}{600m}$$

$$(600m)\sin 17° = d$$

$$\boxed{d = 175.4m}$$

15.

(a) $\sin 58° = \frac{h}{46cm} \longrightarrow (46cm)\sin 58° = h$

$$\boxed{h = 39.0cm}$$

(b) half of the base = b $\therefore$ $\cos 58° = \frac{b}{46cm}$

$$(46cm)\cos 58° = b$$

$$b = 24.4\ cm$$

$$base = 2 \times 24.4cm = \boxed{48.8cm}$$

(c) $Area = \frac{1}{2} b \times h = \frac{1}{2}(48.8cm)(39.0cm) = \boxed{951.6cm^2}$

* answer in book is incorrect

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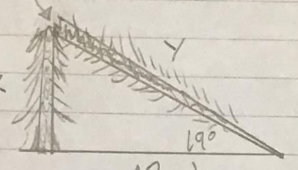
8.5, page 330
#1, 2

FMPC 10 8.5 p.330

1. tree breaks here



$x + y$ = height of tree

$\tan 19° = \dfrac{x}{12\text{yd.}} \longrightarrow (12\text{yds}) \tan 19° = x$

$x = 4.13$ yds.

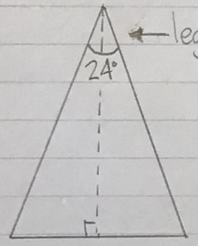
$\cos 19° = \dfrac{12\text{yd.}}{y} \longrightarrow y = \dfrac{12\text{yd}}{\cos 19°}$

$y = 12.69$ yds

$x + y = 4.13 + 12.69 = 16.82$ yds

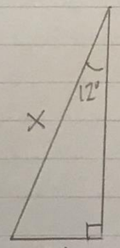
$\boxed{16.8 \text{ yds}}$ rounded to the nearest tenth

2. legs meet at angle of 24°



① draw a line from the midpoint of the base to where the two legs meet. This bisects the 24° angle to two 12° angles

②



Solve for x

$\sin 12° = \dfrac{9\text{in}}{x}$

$x = \dfrac{9\text{in}}{\sin 12°}$

$\boxed{x = 43.3 \text{ inches}}$

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#3

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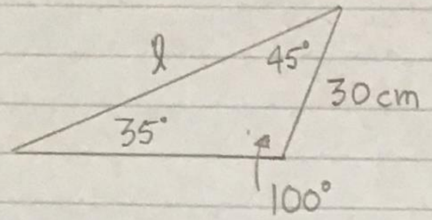
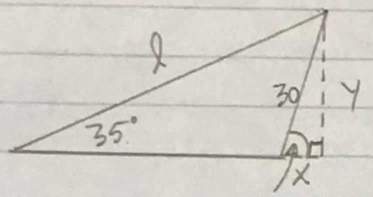
3.



① Draw a triangle as described in the question.

② The sum of the angles in a triangle $= 180°$
∴ the other angle $= 180° - (45° + 35°) = 100°$

③ Create a right triangle similar to example 1



80° because angles on a line add to 180° $(180° - 100° = 80°)$

using the sine function ... $\sin 80° = \frac{y}{30\text{ cm}}$

$(30\text{ cm}) \sin 80° = y$ $\quad y = 29.54\text{ cm}$

④ ∴ $\sin 35° = \frac{y}{\ell}$

$\sin 35° = \frac{29.54\text{ cm}}{\ell} \longrightarrow \ell = \frac{29.54\text{ cm}}{\sin 35°} = \boxed{51.5\text{ cm}}$

* The solution in the workbook differs because of the perspective of the diagram.

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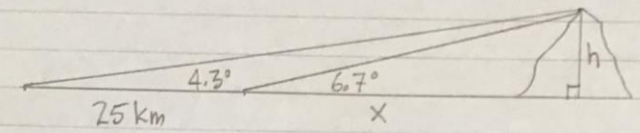
#4

FMPC 10 8.5 p.330

4.



From the diagram we know two things:

① $\tan 4.3° = \dfrac{h}{25+x}$ ② $\tan 6.7° = \dfrac{h}{x}$

$(25+x)\tan 4.3° = h$ and $x \tan 6.7° = h$

$\therefore$ $(25+x)\tan 4.3° = x\tan 6.7$ because both = h

EXPAND $25\tan 4.3 + x\tan 4.3 = x\tan 6.7$

$25\tan 4.3 = x\tan 6.7 - x\tan 4.3$ FACTOR OUT x

$25\tan 4.3 = x(\tan 6.7 - \tan 4.3)$ SOLVE FOR x

$\dfrac{25\tan 4.3}{\tan 6.7 - \tan 4.3} = x$

$\dfrac{1.88 \text{ km}}{0.04228} = x$

$x = 44.46$ km

$\therefore$ $x\tan 6.7 = h$

$(44.46 \text{ km})\tan 6.7 = h$

$\boxed{h = 5.2 \text{ km}}$

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8.5, page 330
#5

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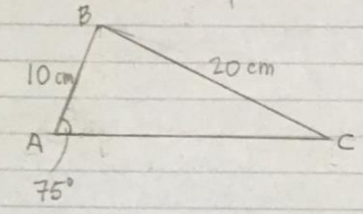
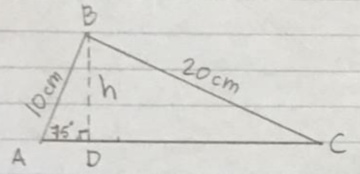
5.



Area of triangle = ½ base × height

① Draw a line from B perpendicular (⊥) to AC.
- Label where the line meets AC point D



② find the height, h

$$\sin 75° = \frac{h}{10\text{cm}}$$

$$(10\text{ cm})\sin 75° = h$$

$$h = 9.66\text{ cm}$$

③ find the length of AC

$$\overline{AC} = \overline{AD} + \overline{DC}$$

(i) $$\cos 75° = \frac{\overline{AD}}{10\text{cm}}$$

* the notation $\overline{AC}$ means "the length of AC"

$$10\text{cm}\cos 75° = \overline{AD}$$

$$\overline{AD} = 2.59\text{ cm}$$

(ii) Use PYTHAGOREAN THEOREM to find $\overline{DC}$

$$\overline{DC}^2 + h^2 = 20^2 \longrightarrow \overline{DC}^2 = 20^2 - h^2 \quad \text{but } h = 9.66\text{cm}$$

$$\therefore \overline{DC}^2 = 20^2 - 9.66^2 \longrightarrow \overline{DC} = \sqrt{20^2 - 9.66^2} = 17.51\text{ cm}$$

$$\therefore \overline{AC} = 2.59 + 17.51 = 20.10\text{ cm}$$

④ AREA of triangle $= \frac{1}{2}(20.10\text{cm})(9.66\text{cm}) = \boxed{97.1\text{ cm}^2}$

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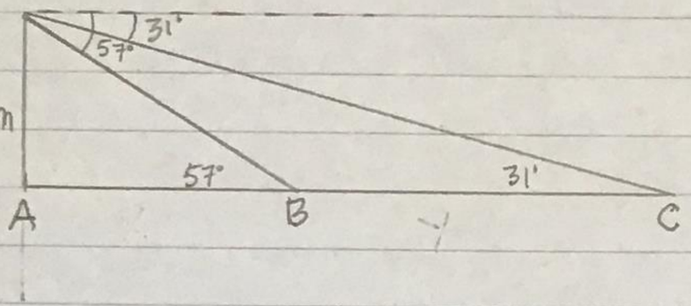
6.



DISTANCE between the two cities is $\overline{AC} - \overline{AB}$

① Determine $\overline{AC}$

$$\tan 31° = \frac{11\text{km}}{\overline{AC}}$$

$$\overline{AC} = \frac{11\text{km}}{\tan 31°} = 18.31\text{ km}$$

② Determine $\overline{AB}$

$$\tan 57° = \frac{11\text{km}}{\overline{AB}}$$

$$\overline{AB} = \frac{11\text{km}}{\tan 57} = 7.14\text{ km}$$

$$\therefore\ 18.31\text{ km} - 7.14\text{ km} = 11.17\text{ km} \longrightarrow \boxed{11.2\text{ km}}$$