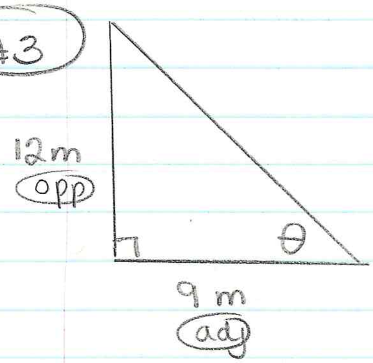
2D Trig Problems

#3

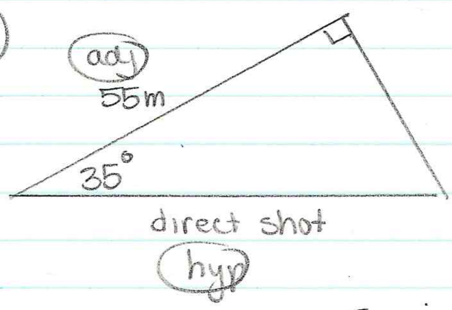


$$\tan\theta = \frac{12}{9}$$

$$\theta = \tan^{-1}\left(\frac{12}{9}\right)$$

$$= 53^\circ$$

#4



$$\cos 35^\circ = \frac{55}{x}$$

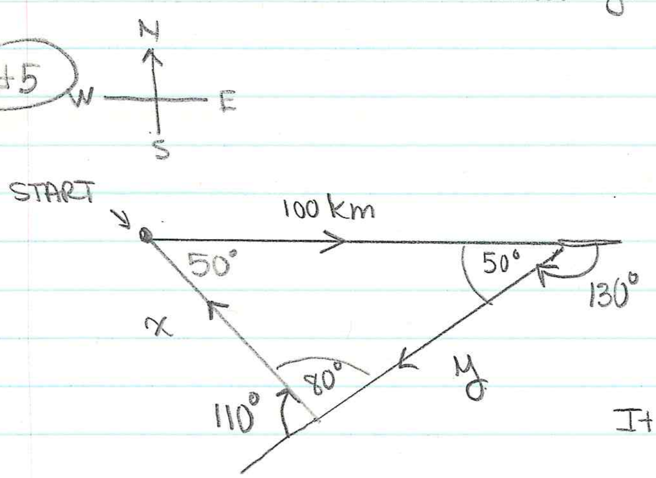
$$x\cos 35^\circ = 55$$

$$x = \frac{55}{\cos 35^\circ}$$

$$= 67\text{ m}$$

Since the golfer usually only hits the ball 60 m, he should go around the water hazard.

#5



$$\frac{x}{\sin 50^\circ} = \frac{100}{\sin 80^\circ}$$

$$x = \frac{100\sin 50^\circ}{\sin 80^\circ}$$

$$= 77.786\text{ km}$$

It's an isosceles triangle

$$\therefore y = x$$

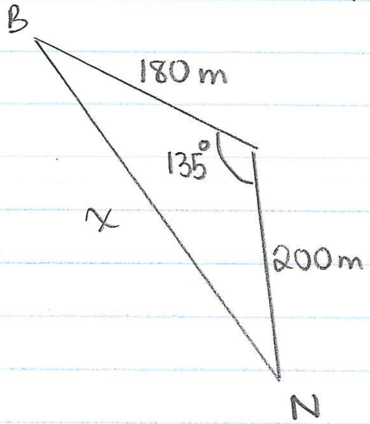
$$= 77.786\text{ km}$$

Total distance $= 100 + 2(77.786)$

$= 256$ km.

2D Problems - cont'd

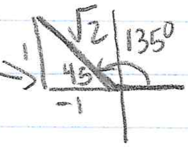
#7



$x^2 = 180^2 + 200^2 - 2(180)(200)\cos 135°$

$= 32400 + 40000 - 72000 \cos 135°$

$= 32400 + 40000 - 72000\left(-\frac{1}{\sqrt{2}}\right)$



$= 72400 + \frac{72000}{\sqrt{2}}$

$= \frac{72400\sqrt{2} + 72000}{\sqrt{2}} \quad \frac{\times\sqrt{2}}{\times\sqrt{2}}$

$= \frac{72400\sqrt{4} + 72000\sqrt{2}}{\sqrt{4}}$

$= \frac{144800 + 72000\sqrt{2}}{2}$

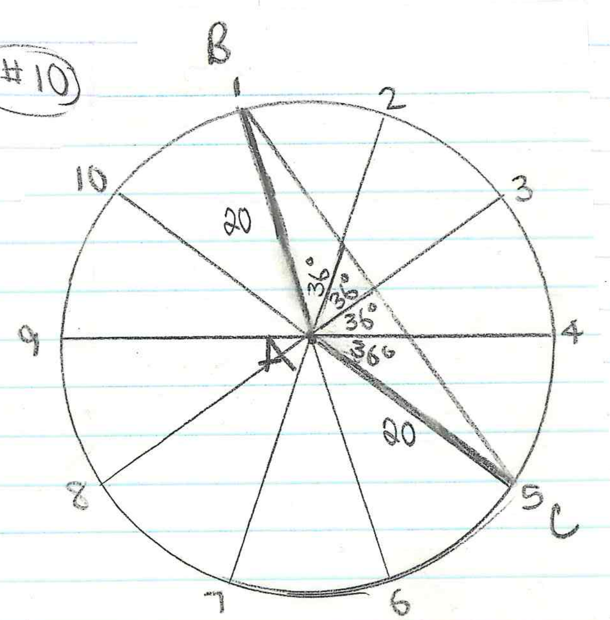
$= 72400 + 36000\sqrt{2}$

$x = \sqrt{72400 + 36000\sqrt{2}}$ ← pos sq. rt. because it's distance

$= \sqrt{400(181 + 90\sqrt{2})}$

$= 20\sqrt{181 + 90\sqrt{2}}$ m

#10



$x^2 = 20^2 + 20^2 - 2(20)(20)\cos 144°$

$= 400 + 400 - 800\cos 144°$

$= 400 + 400 - (-647.21)$

$= 1447.21$

$x = \sqrt{1447.21}$ ← pos because it's distance

$= 38$ m

p.g. 256 11

a) use cosine law to find distance

$a^2 = 24^2 + 27^2 - 2(24)(27)\cos 110^\circ$
$= 1748$
$a = 41.8$ km

b) use sine law to find C in Δ

$\frac{\sin C}{27} = \frac{\sin 110^\circ}{41.8}$

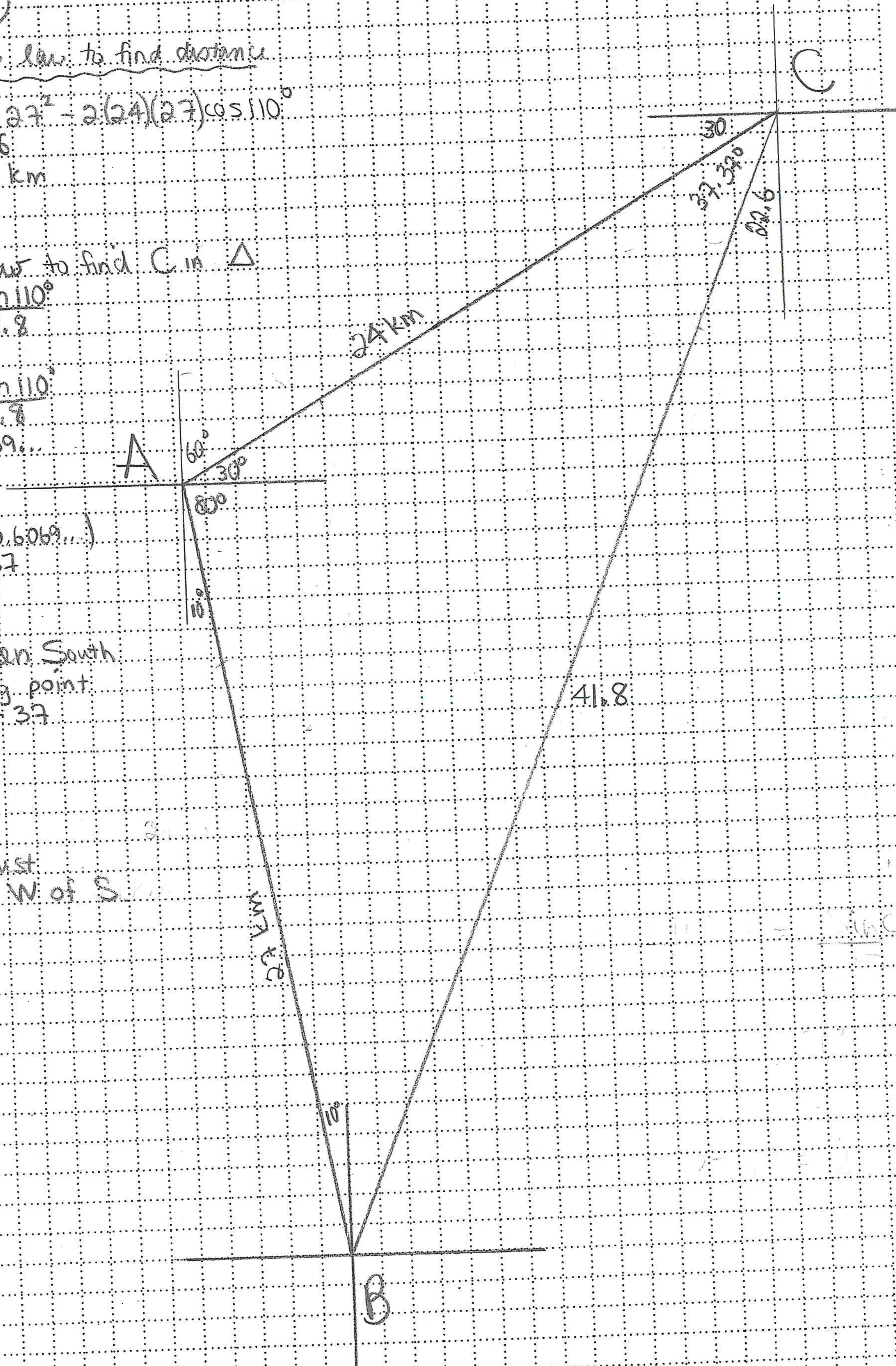
$\sin C = \frac{27 \sin 110^\circ}{41.8}$
$= 0.6069...$

$C = \sin^{-1}(0.6069...)$
$= 37.37$

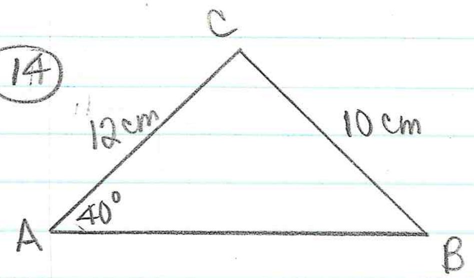
Angle between South and starting point
$= 90 - 30 - 37$

$= 23^\circ$

$\therefore$ Charles must travel 23° W of S

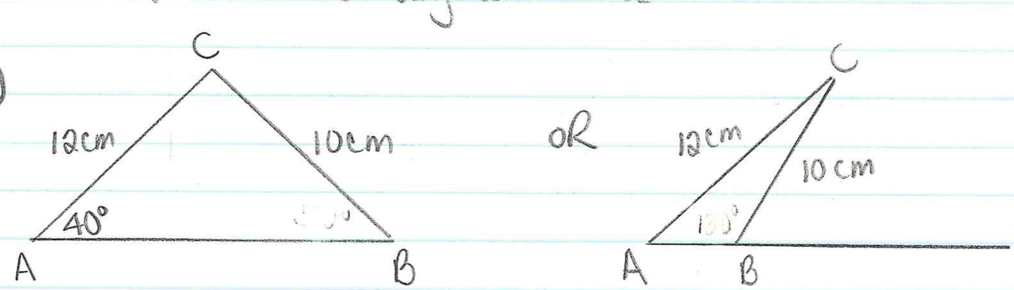


14



a) Ambiguous case must be considered because the opp. side is ~~smaller~~ smaller than the adjacent side.

b)

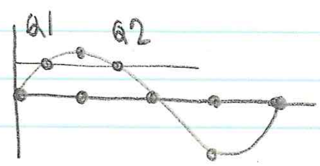


c) Strategy: find $\angle B$ using sine law
then find $\angle C$ (angles in Δ add to $180°$)
use sine law to find c.

$$\frac{\sin B}{12} = \frac{\sin 40°}{10}$$

$$\sin B = \frac{12 \sin 40°}{10}$$

$$= 0.77134$$



Acute Δ

$B = 50°$ or $180° - 50°$
$= 130°$

Obtuse Δ

$C = 180 - 50° - 40°$
$= 90°$

$C = 180° - 130° - 40°$
$= 10°$

$$\frac{c}{\sin 90°} = \frac{10}{\sin 40°}$$

$$c = \frac{10 \sin 90°}{\sin 40°}$$

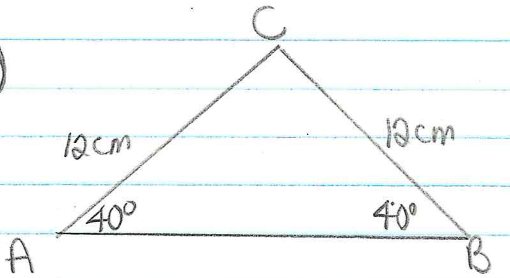
$$= 15.6 \text{ cm}$$

$$\frac{c}{\sin 10°} = \frac{10}{\sin 40°}$$

$$c = \frac{10 \sin 10°}{\sin 40°}$$

$$= 2.7 \text{ cm}$$

d)



one sol^n ... it's an isosceles Δ

$\therefore \angle B = 40°$

$\angle C = 180° - 40° - 40°$

$= 100°$

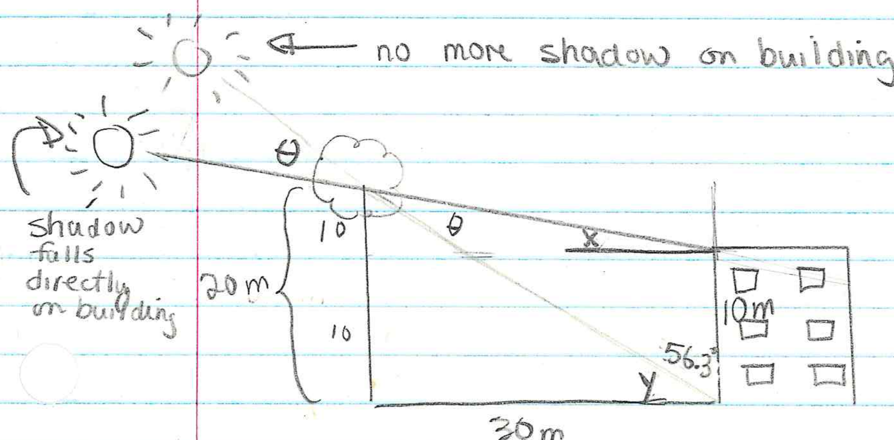
e)

$$\frac{c}{\sin 100°} = \frac{12}{\sin 40°}$$

$$c = \frac{12 \sin 100°}{\sin 40°}$$

$$= 18.4 \text{ cm}$$

#18



angle of elevation increases 15°/h

Strategy - find x and y

then find θ

divide θ by 15° to find # of hours

$\tan x = \frac{10}{30}$

$x = \tan^{-1}\left(\frac{10}{30}\right)$

$= 18.4°$

$\tan y = \frac{20}{30}$

$y = \tan^{-1}\left(\frac{20}{30}\right)$

$= 33.7°$

$\theta = 180° - 56.3° - 18.4° - 90°$

$= 15.3°$

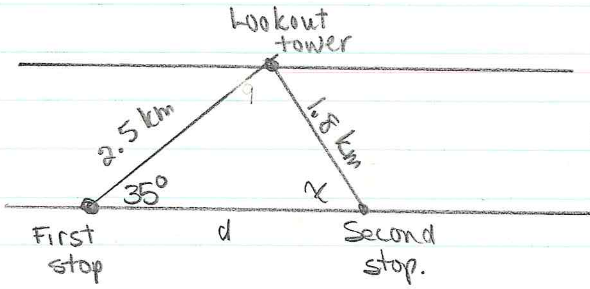
time $= \frac{15.3°}{15}$

$= 1.02$ hours

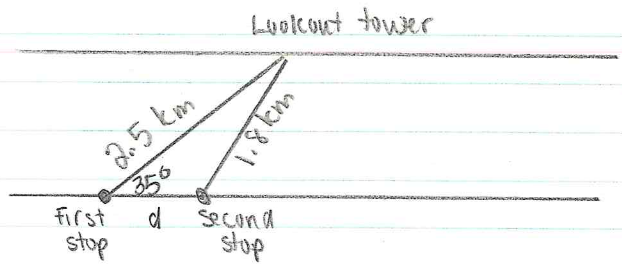
$= 1$ hour $+ 1.2$ minutes

#21

a)



OR



The opp. side is shorter than the adjacent side so there are two ways to draw the picture.

b)

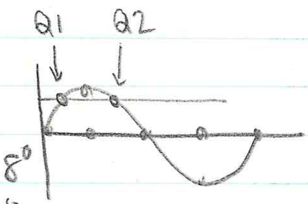
$$\frac{\sin x}{2.5} = \frac{\sin 35^\circ}{1.8}$$

$$\sin x = \frac{2.5 \sin 35^\circ}{1.8}$$

$$= 0.7966$$

$$x = 52.8^\circ \quad \text{or} \quad 180^\circ - 52.8^\circ$$

$$= 127.2^\circ$$



c) 52.8° will result in the longer distance between Enrico's first and second stop. See diagram.

d)

$$\frac{d}{\sin 92.2^\circ} = \frac{1.8}{\sin 35^\circ}$$

$180^\circ - 35^\circ - 52.8^\circ$

$$d = \frac{1.8 \sin 92.2^\circ}{\sin 35^\circ}$$

$$= 3.1 \text{ km}$$

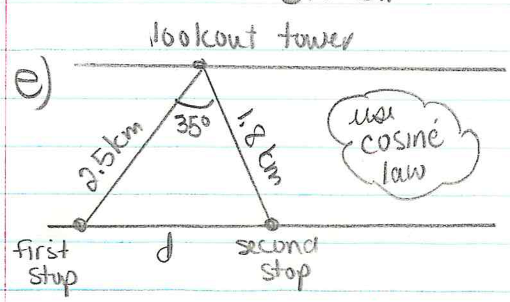
$$\frac{d}{\sin 17.8^\circ} = \frac{1.8}{\sin 35^\circ}$$

$180^\circ - 35^\circ - 127.2^\circ$

$$d = \frac{1.8 \sin 17.8^\circ}{\sin 35^\circ}$$

$$= 0.96 \text{ km}$$

e)



use cosine law

$$d^2 = 2.5^2 + 1.8^2 - 2(2.5)(1.8)\cos 35^\circ$$

$$= 6.25 + 3.24 - 7.37$$

$$= 2.12$$

$d = 1.46$ km ← pos because distance is pos.