Chapter 3: Trigonometry
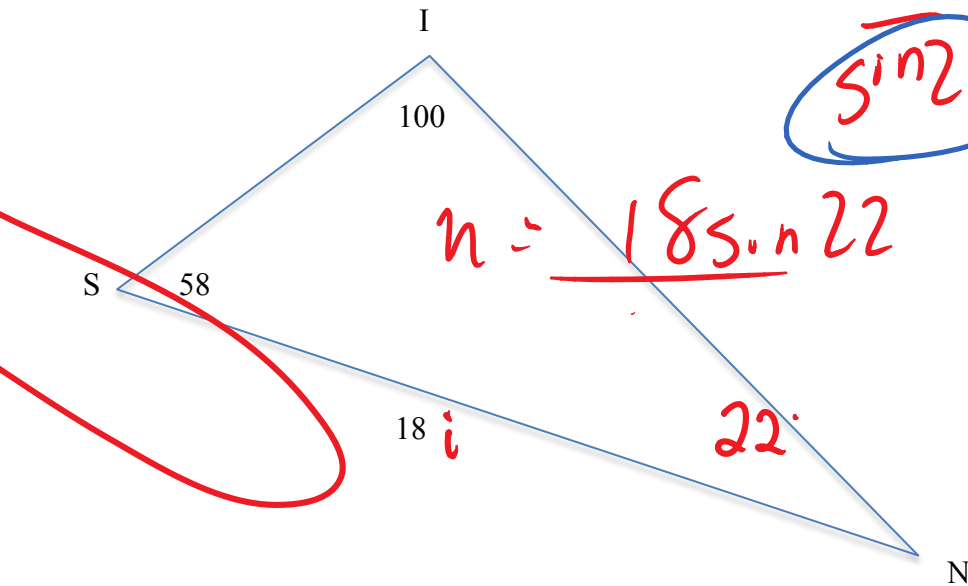
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

3.5 Sine Law Problems

**Example #1:** Find *n*

I

100

S   58

18 i

22·

N

$$\frac{n}{\sin 22} = \frac{18}{\sin 100}$$

$$n = \frac{18 \sin 22}{\sin 100}$$

$$n = 6.8$$

Example #2: A bridge has been built across a gorge. Lucas wants to bungee jump from the bridge. One of the things he must know, to make the jump safely, is the depth of the gorge. The bridge is 40 metres across. From one side the river is a 78 degree angle from the top, and from the other side the river is at a 56 degree angle from the top. Determine the depth of the gorge.
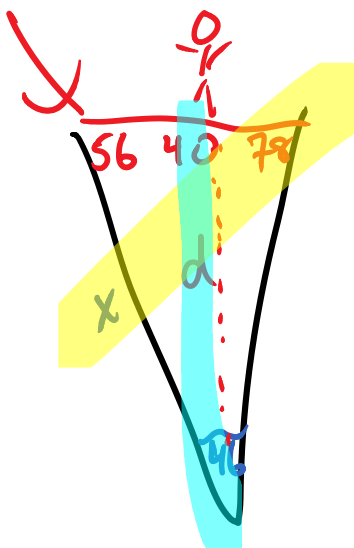
$$\frac{x}{\sin 78} = \frac{40}{\sin 46}$$

$$x = 54.4$$

Right triangle ... SOH CAH TOA

$$\sin 56 = \frac{d}{54.5}$$

$$54.5 \sin 56 = d = 45.1 m$$

56 40 78

x

d

46

Example #3: The captain of a small boat is delivering supplies to two lighthouses. He travels in the direction N30W for 9.0 km to get to the first lighthouse. Then he travels 12.0 km in the direction N70E to get to the second lighthouse. If he can see his original location in the direction S30W, how far away is he?
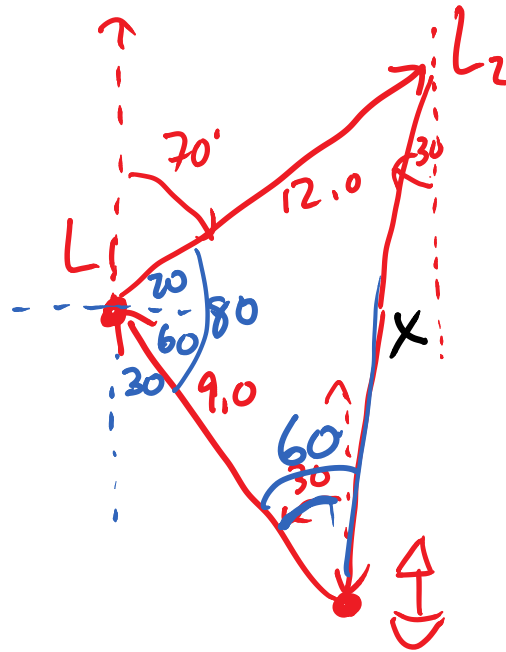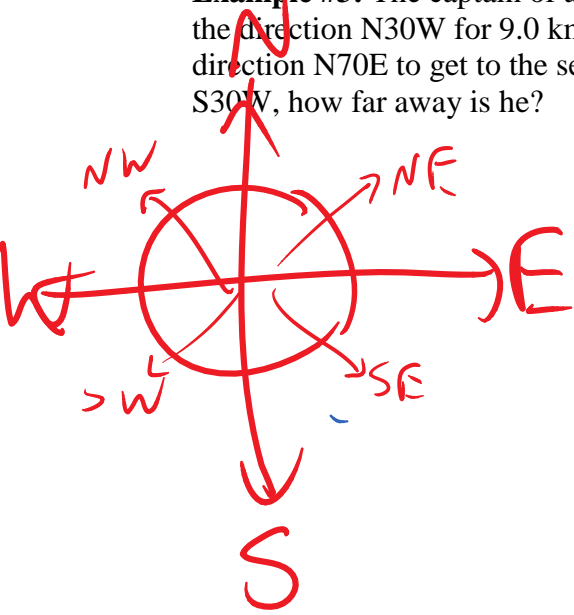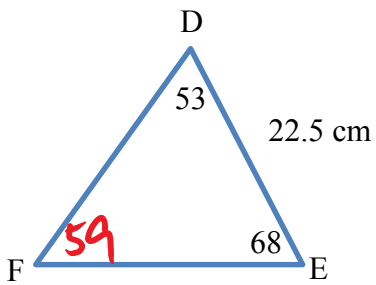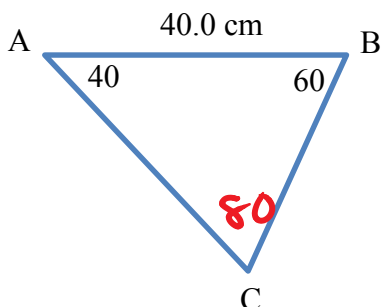
$$\frac{x}{\sin 80} = \frac{12}{\sin 60}$$

$$x = \frac{12 \sin 80}{\sin 60}$$

$$x = 13.6 \ km$$

Assignment:

Determine the missing side lengths to the nearest tenth of a unit and the missing angle measures to the nearest degree:

1a)

D

53

22.5 cm

59　　　68

F　　　　E

$$\frac{d}{\sin 53} = \frac{22.5}{\sin 59} \quad d = 21.0$$

$$\frac{e}{\sin 68} = \frac{22.5}{\sin 59} \quad e = 24.3$$

b)

40.0 cm

A　　　　B

40　　　60

80

C

$$\frac{b}{\sin 60} = \frac{40}{\sin 80} \quad b = 35.2$$

$$\frac{a}{\sin 40} = \frac{40}{\sin 80} \quad a = 26.1$$

2) An architect designed a house and must give more instructions to the builders. The rafters that hold up the roof are equal in length. The rafters extend one foot beyond the supporting wall. How long are the rafters (to the nearest inch)?

$$180 - 70 = 110 \div 2 = 55$$

70

55　　55

36'　　1'

$$\frac{x}{\sin 55} =$$
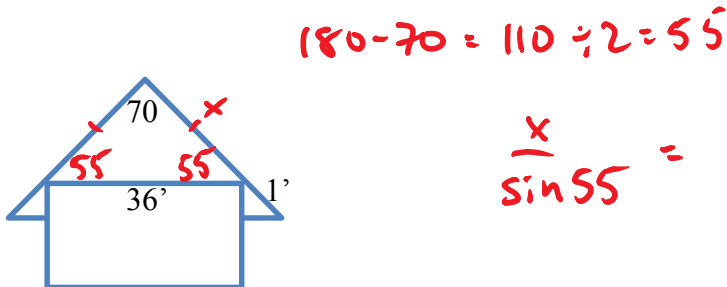
3) In $\triangle CAT$, $\angle C = 32$, $\angle T = 81$, and $c = 24.1\ m$. Solve the triangle and round answers to the nearest tenth.

A

67   24.1

32   81

C   T
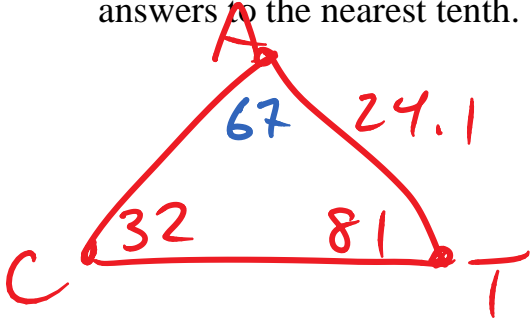
$A = 67$

$$\frac{t}{\sin 81} = \frac{24.1}{\sin 32} \qquad t =$$

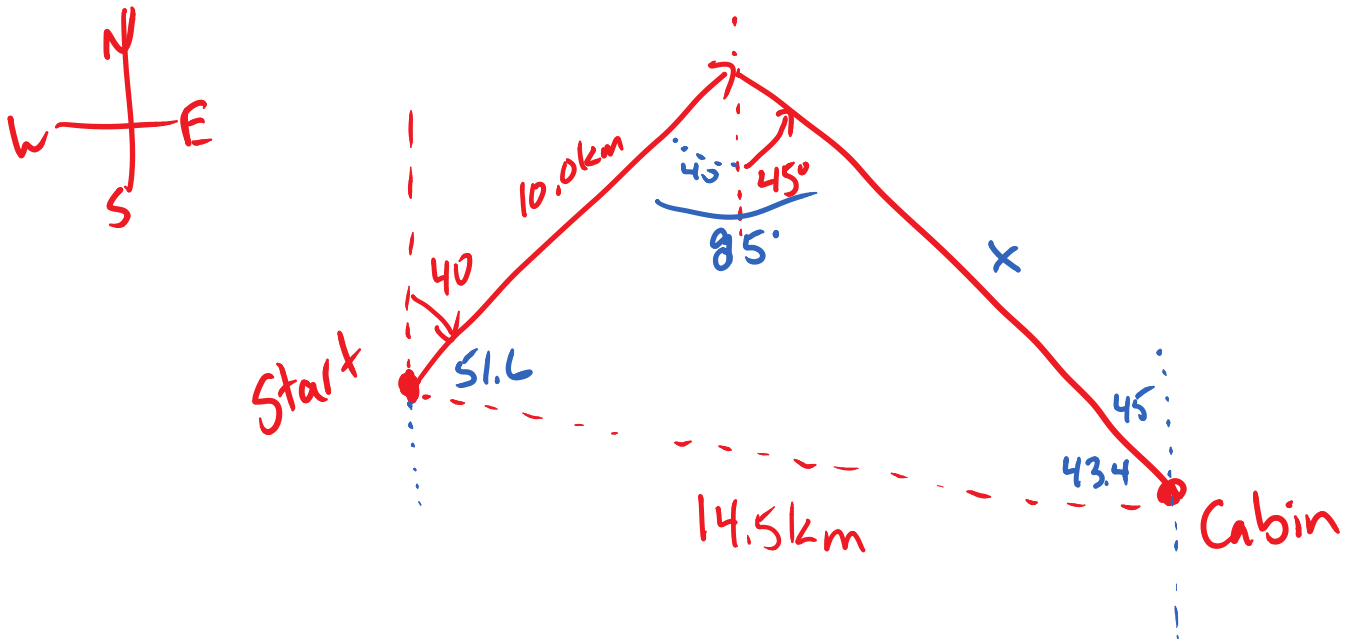$$\frac{a}{\sin 67} = \frac{24.1}{\sin 32} \qquad a =$$

4) Janice is sailing from Gimli on Lake Winnipeg to Grand Beach. She had planned to sail 26.0 km in the direction S71E; however, the wind and current pulled her off course. After several hours, she discovered that she had actually been sailing S79E. She checked her map and saw that she must sail S18W to reach Grand Beach. Determine, to the nearest tenth of a kilometer, the distance remaining to Grand Beach.

N

W   E

S

78 26

71

79 93

71 18

18
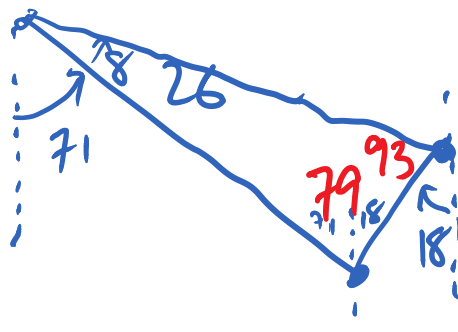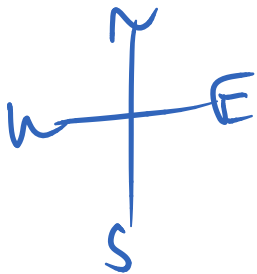
$$\frac{x}{\sin 8} = \frac{26}{\sin 93}$$

$$x =$$

5) Stella decided to ski to a friends' cabin. She skied 10.0 km in the direction N40E. She rested, then skied S45E and arrived at the cabin. The cabin is 14.5 km from her home, as the crow flies. Determine, to the nearest tenth of a kilometer, the distance she travelled on the second leg of her trip.
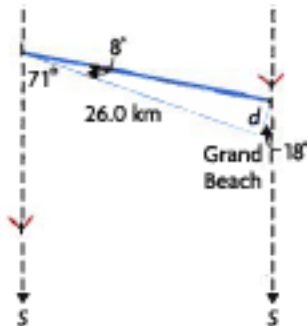
N
W — E
S

10.0km
45° 45°
85°
40
x
Start   51.6
45
43.4
14.5km   Cabin

$$\frac{\sin C}{10} = \frac{\sin 85}{14.5} \qquad C = 43.4°$$

$$\frac{x}{\sin 51.6} = \frac{14.5}{\sin 85} \qquad x = 11.4\ km$$

Answers
1) a) $d = 21.0$ cm ~~b) θ = 34~~
2) 32 ft 5 in
3) $a = 41.9$ m, $t = 44.9$ m, A = 67°
4) 3.6 km

8°
71°
26.0 km   d
Grand 18°
Beach
S   S

5) 11.4 km

Practice Quiz

1) Use the Sine Law to find the measure of angles B and C (assuming both are acute angles)

B

5.0 cm

50

A

6.5 cm

C
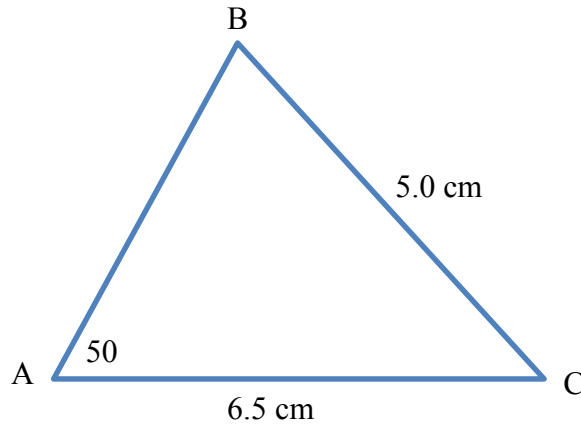
$$\frac{\sin B}{6.5} = \frac{\sin 50}{5.0} \qquad B = 84.8°$$

$$C = 180 - 50 - 84.8$$

$$= 45.2°$$

2) A telephone pole is supported by two wires on opposite sides. At the top of the pole, the wires form an angle of 60 degrees. On the ground, the ends of the wires are 15.0 m apart. One wire makes a 45 degree angle with the ground. How long are the wires and how tall is the pole? (nearest tenth of a metre)

60

x

y

45

75

15.0
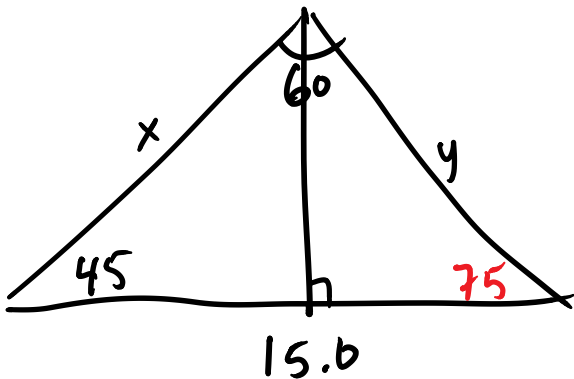
$$\frac{y}{\sin 45} = \frac{15}{\sin 60} \qquad y = 12.2 m$$

$$\frac{x}{\sin 75} = \frac{15}{\sin 60} \qquad x = 16.7 m$$

SOH CAH TOA

$$\sin 75 = \frac{h}{12.2} \qquad h = 11.8 m$$

Answers

1) B = 84.8   C = 45.2   2) wires = 12.1 m and 16.7 m   height = 11.8 m