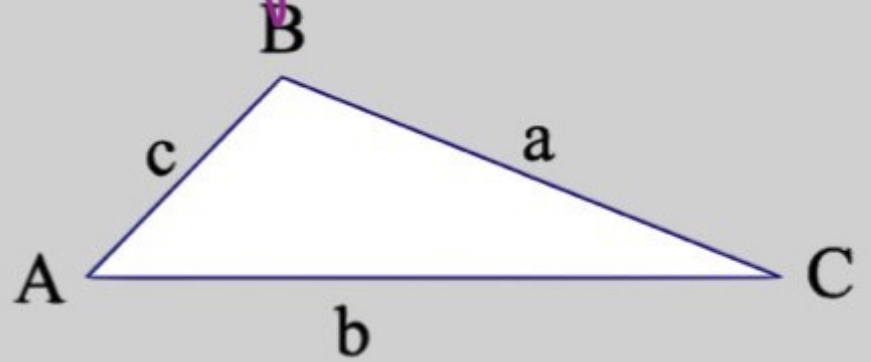# 10.2 Law of Cosines

LAW OF COSINES *given sides are always "a" & "b"

$$c^2 = a^2 + b^2 - 2 \cdot a \cdot b \cdot \cos C$$

side & opposite angle are on
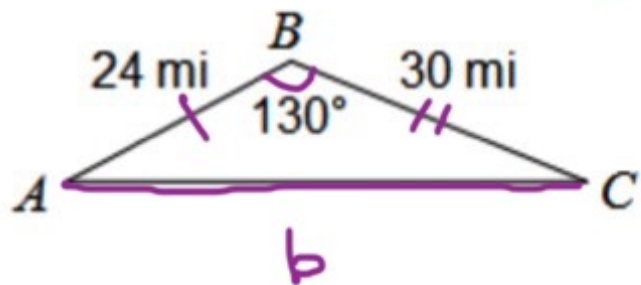opposite sides of equation

SAS   OR   SSS
 ↓   ↓
find side   find angle

N. Find AC. SAS → use cosines
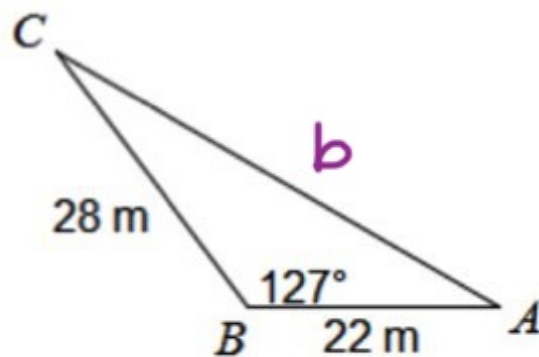
B

24 mi   30 mi
130°

A   C

b

$$b^2 = 24^2 + 30^2 - 2(24)(30)\cos 130°$$

Plug into calculator on one line

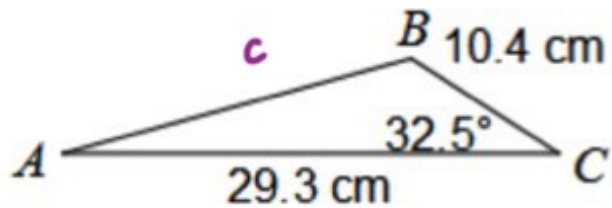$$\sqrt{b^2} = \sqrt{2401.61}$$

$$b = 49.01 \text{ mi}$$

O. Find AC.

C

b

28 m

127°
B   22 m   A

$$b^2 = 28^2 + 22^2 - 2(28)(22)\cos 122°$$

$$\sqrt{b^2} = \sqrt{2009.44}$$

$$b = 44.83 \text{ m}$$

P. Find *AB*.

B 10.4 cm
c
32.5°
A   C
29.3 cm

$c^2 = 29.3^2 + 10.4^2 - 2(29.3)(10.4)\cos 32.5°$

$\sqrt{c^2} = \sqrt{452.65}$

$\boxed{c = 21.28 \text{ cm}}$

Q. Find *DF*.

D
8 yd
e
34°
F   E
7 yd
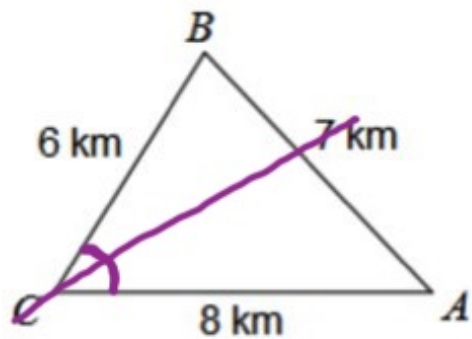
$e^2 = 7^2 + 8^2 - 2(7)(8)\cos 34°$

$\sqrt{e^2} = \sqrt{20.15}$

$\boxed{e = 4.49 \text{ yd}}$

R. Find $m\angle C$.

$$7^2 = 6^2 + 8^2 - 2(6)(8)\cos C$$
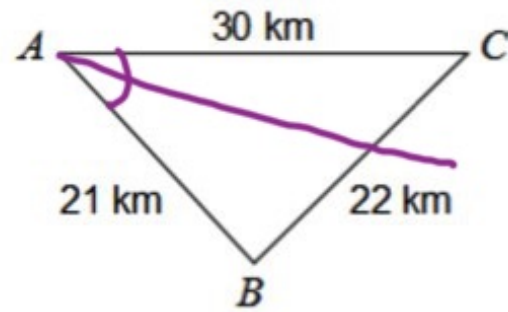
$$49 = 100 - 96\cos C$$

$$-100 \qquad -100$$

$$\frac{-51}{-96} = \frac{-96\cos C}{-96}$$

$$\cos^{-1}(\cos C) \overset{\cos^{-1}}{=} (0.531)$$

$$\boxed{C = 58°}$$

S. Find $m\angle A$.

$$22^2 = 21^2 + 30^2 - 2(41)(30)\cos C$$

$$484 = 1341 - 1260\cos C$$

$$-1341 \quad -1341$$

$$\frac{-857}{-1260} = \frac{-1260\cos C}{-1260}$$

$$\cos^{-1}(\cos C) \overset{\cos^{-1}}{-} (0.680)$$
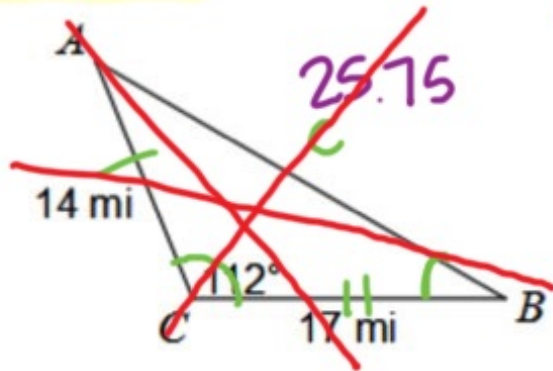
$$\boxed{C = 47°}$$

Use the Law of Sines AND the Law of Cosines to find each measure indicated. If there is not enough information, write NEI.

T. Find $m\angle B$.

14 mi, 112°, 17 mi, 25.75

SAS → use cosines to find c

$$c^2 = 14^2 + 17^2 - 2(14)(17)\cos 112°$$
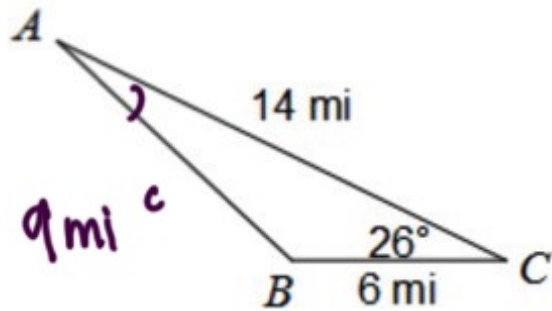
$$\sqrt{c^2} = \sqrt{663.3}$$

$$c = 25.75 \text{ mi}$$

Use law of sines to find B

$$\frac{14}{1} \cdot \frac{\sin B}{14} = \frac{\sin 112°}{25.75} \cdot \frac{14}{1}$$

$$\sin^{-1}(\sin B = 0.504) \rightarrow \boxed{B = 30°}$$

U. Find $m\angle A$.

A

14 mi

9 mi c

$26°$

B   6 mi   C

$c^2 = 6^2 + 14^2 - 2(6)(14)\cos 26°$

$\sqrt{c^2} = \sqrt{81.00}$

$c = 9\text{ mi}$

$\dfrac{6}{1} \cdot \dfrac{\sin A}{6} = \dfrac{\sin 26°}{9} \cdot \dfrac{6}{1}$

$\sin^{-1}(\sin A) = \sin^{-1}(0.292)$

$\boxed{A = 17°}$

LAW OF SINES	LAW OF COSINES
$\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$ $\Bigg\vert$ $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} \cdot \dfrac{c}{\sin C}$ find angle find side	$c^2 = a^2 + b^2 - 2ab \cos C$
Use when: ASA $\Big\rangle$ find a side AAS SSA → find an angle	Use when: SSS → find angle SAS → find side