

## 14.2- The Law of Cosines

### Law of Cosines

In any triangle  $\triangle ABC$ , the law of cosines states the following:

#### SIDES:

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cos B$$

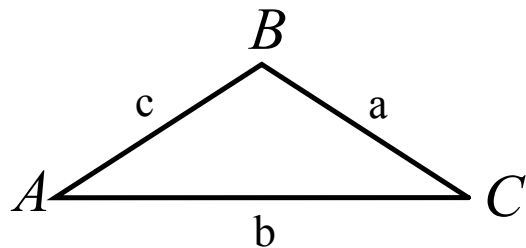
$$c^2 = a^2 + b^2 - 2ab \cos C$$

#### ANGLES:

$$A = \cos^{-1} \left( \frac{a^2 - b^2 - c^2}{-2bc} \right)$$

$$B = \cos^{-1} \left( \frac{b^2 - a^2 - c^2}{-2ac} \right)$$

$$C = \cos^{-1} \left( \frac{c^2 - a^2 - b^2}{-2ab} \right)$$

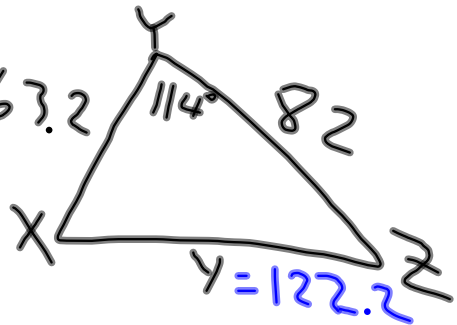


Find the indicated measure, to the nearest tenth, for  $\triangle XYZ$ .

a. Given  $x = 82$ ,  $z = 63.2$ ,  $Y = 114^\circ$ , find  $y$ .

$$y^2 = 63.2^2 + 82^2 - 2(63.2)(82)\cos 114^\circ$$

$$y = 122.2$$

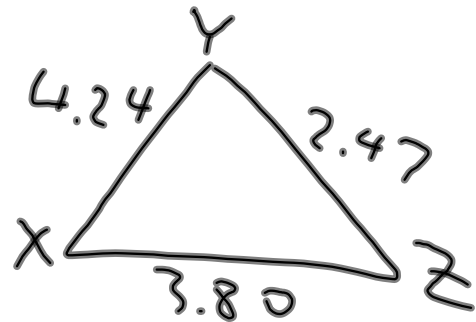


Find the indicated measure, to the nearest tenth, for  $\triangle XYZ$ .

b. Given  $x = 2.47$ ,  $y = 3.80$ ,  $z = 4.24$ , find  $X$ .

$$X = \cos^{-1} \left( \frac{2.47^2 - 4.24^2 - 3.8^2}{-2(4.24)(3.8)} \right)$$

$$X = 35.2^\circ$$



Solve  $\triangle XYZ$ . Give answers to the nearest tenth.

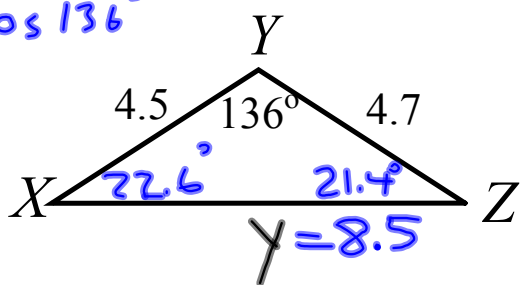
$$y^2 = 4.5^2 + 4.7^2 - 2(4.5)(4.7)\cos 136^\circ$$

$$y = 8.5$$

$$\frac{\sin X}{4.7} = \frac{\sin 136^\circ}{8.5}$$

$$X = \sin^{-1}\left(\frac{4.7 \sin 136^\circ}{8.5}\right)$$

$$X = 22.6^\circ$$



## Solving a Triangle

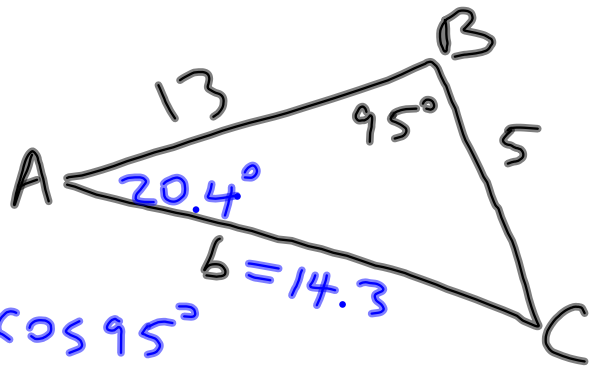
Given: Use:

SSS	law of cosines, then law of sines
SSA	law of sines (ambiguous)
SAA	law of sines
ASA	law of sines
SAS	law of cosines, then law of sines
AAA	not possible

# Homework

Pg. 899-901 #10-16 even, 22-32 even, 44-50 even

10)



$$b^2 = 13^2 + 5^2 - 2(13)(5)\cos 95^\circ$$

$$b = 14.3$$

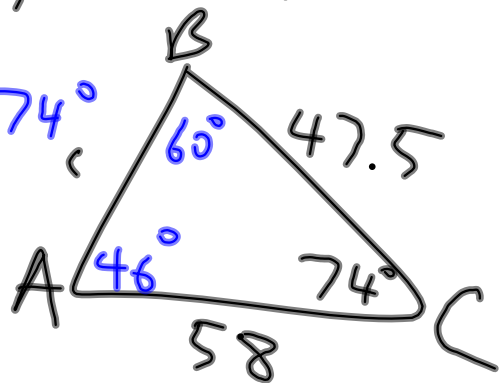
$$\frac{\sin A}{5} = \frac{\sin 95^\circ}{14.3}$$

$$A = \sin^{-1}\left(\frac{5\sin 95^\circ}{14.3}\right) = 20.4^\circ$$

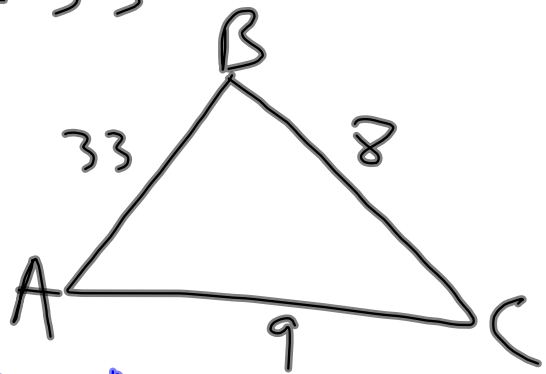
$$16) a = 47.5, b = 58, C = 74^\circ$$

$$c^2 = 58^2 + 47.5^2 - 2(58)(47.5)\cos 74^\circ$$

$$c = 64$$



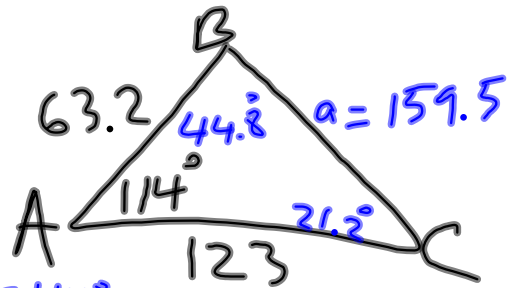
$$20) a=8, b=9, c=33$$



$$8^2 = 33^2 + 9^2 - 2(33)(9)\cos A$$

$$A = \cos^{-1} \left( \frac{(8^2 - 33^2 - 9^2)}{(-2 \times 33 \times 9)} \right) = \text{ERROR}$$

28) SAS

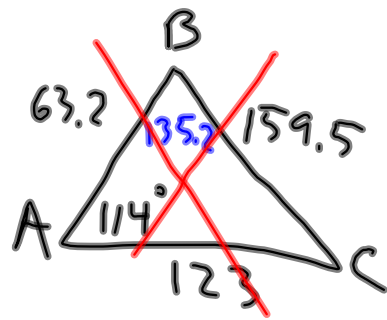


$$a^2 = 63.2^2 + 123^2 - 2(63.2)(123) \cos 114^\circ$$

$$a = 159.5$$

$$\frac{\sin B}{123} = \frac{\sin 114^\circ}{159.5}$$

$$B = \sin^{-1} \left( \frac{123 \sin 114^\circ}{159.5} \right) = 44.8^\circ$$



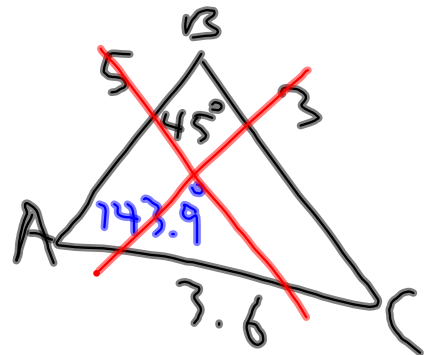
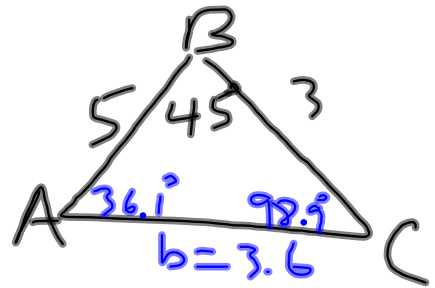
30) SAS

$$b^2 = 5^2 + 3^2 - 2(5)(3)\cos 45^\circ$$

$$b = 3.6$$

$$\frac{\sin A}{3} = \frac{\sin 45^\circ}{3.6}$$

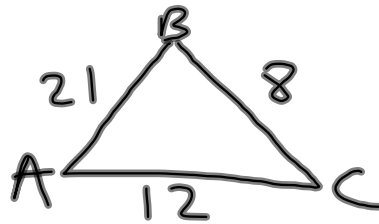
$$A = \sin^{-1}\left(\frac{3\sin 45^\circ}{3.6}\right) = 36.1^\circ$$



32) SSS

$$A = \cos^{-1} \left( \frac{8^2 - 21^2 - 12^2}{-2(21)(12)} \right)$$

A = Error



Not Possible

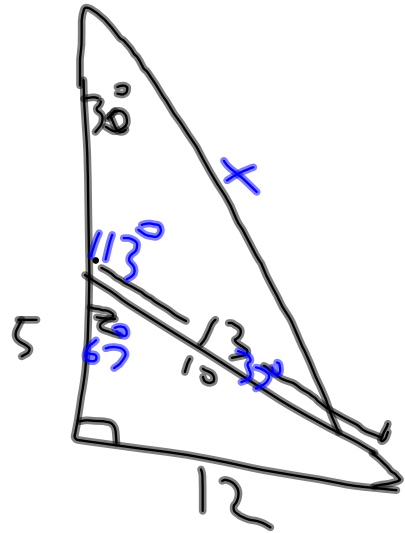
46)

$$12^2 = 5^2 + 13^2 - 2(5)(13)\cos z$$

$$z = \cos^{-1}\left(\frac{(12^2 - 5^2 - 13^2)}{(-2)(5)(13)}\right) = 67^\circ$$

$$\left[ \frac{x}{\sin 113^\circ} = \frac{10}{\sin 30^\circ} \right] \sin 113^\circ$$

$$x = \frac{10 \sin 113^\circ}{\sin 30^\circ} = 18.4 \text{ ft.} \approx 18 \text{ ft.}$$



50)

$$A = \cos^{-1} \left( \frac{5^2 - 6^2 - 9^2}{-2(6)(9)} \right)$$

$$A = 31.6^\circ$$

$$\frac{\sin B}{9} = \frac{\sin 31.6^\circ}{5}$$

$$B = \sin^{-1} \left( \frac{9 \sin 31.6^\circ}{5} \right) = 70.6^\circ$$

