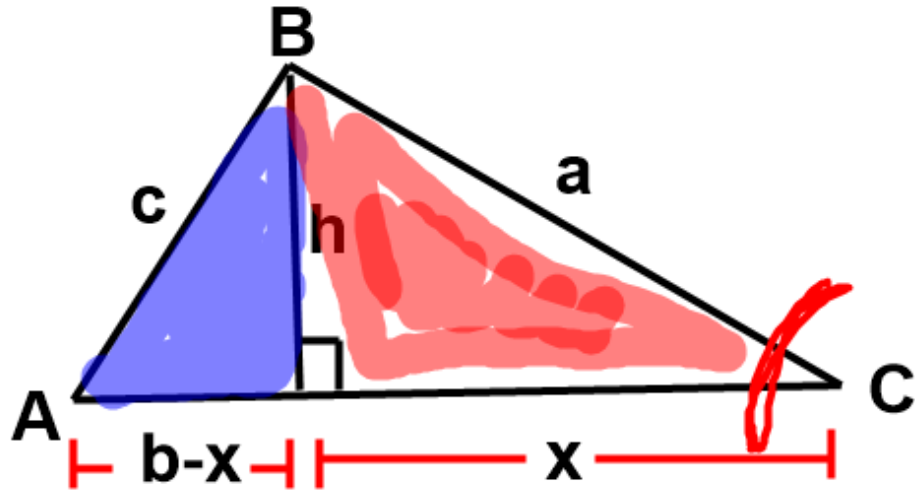


Lesson 11.4: Law of Cosines



$$a^2 = x^2 + h^2$$

$$h^2 = a^2 - x^2$$

$$\cos C^\circ = \frac{x}{a}$$

$$x = a \cos C^\circ$$

$$c^2 = h^2 + (b-x)^2$$

$$c^2 = h^2 + b^2 - 2bx + x^2$$

$$c^2 = a^2 - x^2 + b^2 - 2bx + x^2$$

$$c^2 = a^2 + b^2 - 2bx$$

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

Law of Cosines

(12)



$$\frac{\sin(84)}{35} = \frac{\sin(69)}{x}$$

$$x = \frac{35 \sin(69)}{\sin(84)} \approx 32.9 \text{ mi}$$

$$\frac{\sin(84)}{35} = \frac{\sin(27)}{y}$$

$$y = \frac{35 \sin(27)}{\sin(84)}$$

$$y \approx 16 \text{ miles}$$

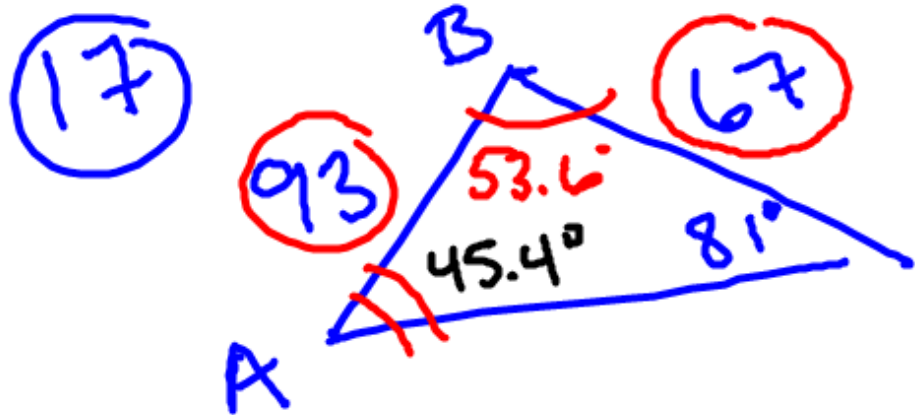
Find x .



$$\frac{\sin C}{7} = \frac{\sin(37)}{5}$$

$$C = \sin^{-1}\left(7 \frac{\sin(37)}{5}\right) \approx 57.4^\circ$$

$$X = 180 - 57.4 - 37 = \boxed{85.6^\circ}$$



$$\frac{\sin A}{67} = \frac{\sin(81)}{93}$$

$$\sin A = \frac{67 \sin(81)}{93}$$

$$A = \sin^{-1}\left(\frac{67 \sin(81)}{93}\right)$$

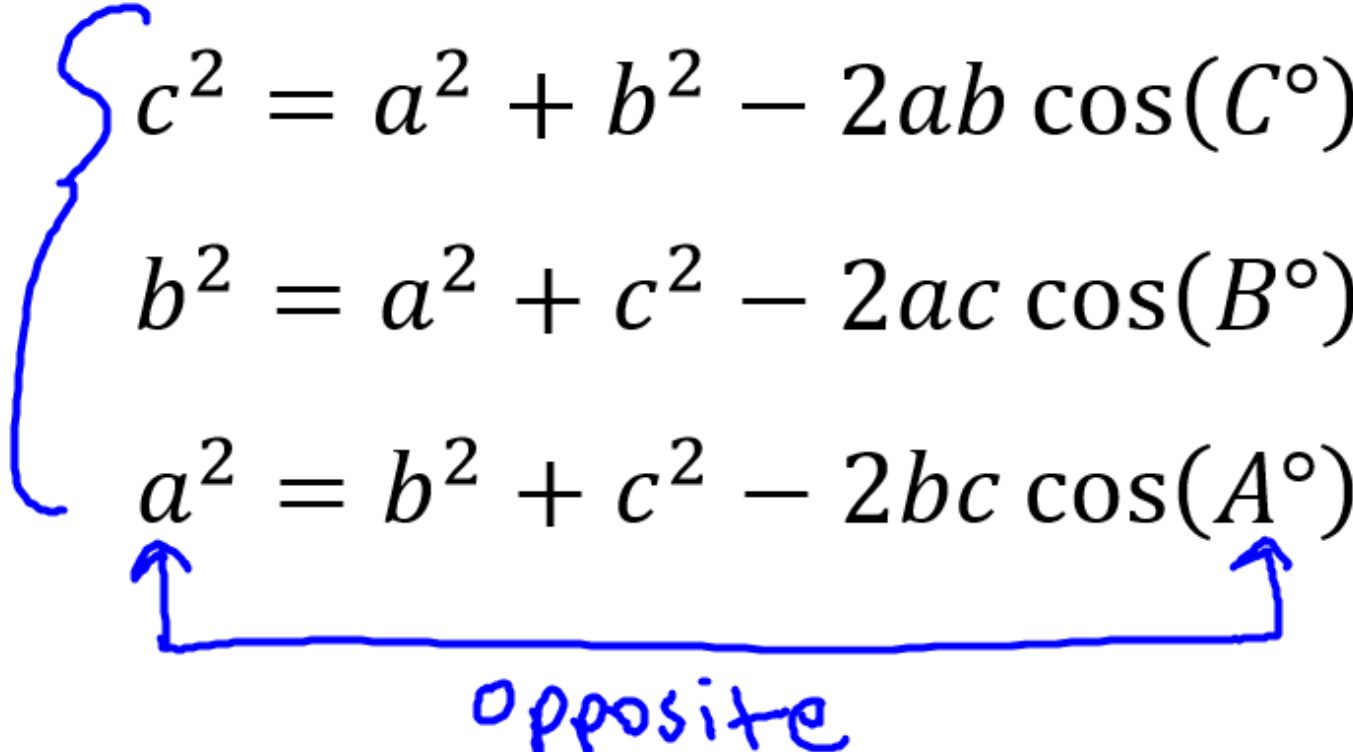
$$A \approx 45.4^\circ$$

$$\frac{1}{2} (93)(67) \sin(53.6)$$

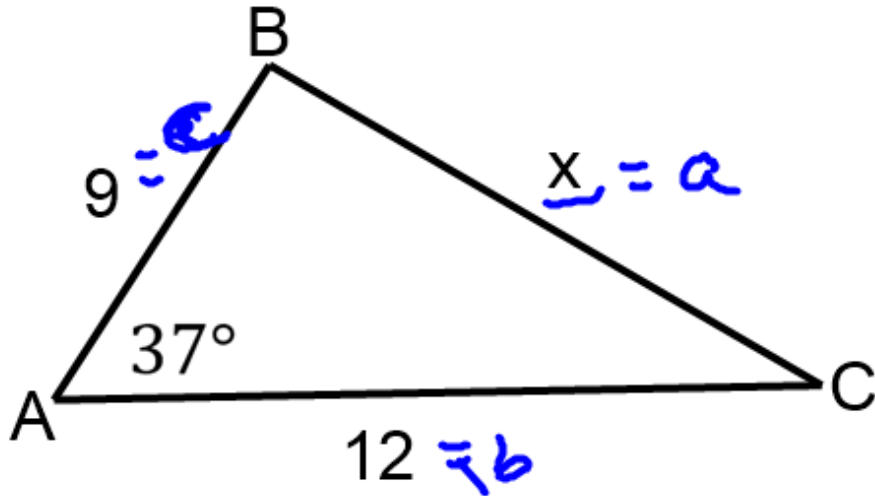
$$\approx 2507.6$$

Law of Cosines

$$\left\{ \begin{array}{l} c^2 = a^2 + b^2 - 2ab \cos(C^\circ) \\ b^2 = a^2 + c^2 - 2ac \cos(B^\circ) \\ a^2 = b^2 + c^2 - 2bc \cos(A^\circ) \end{array} \right.$$


opposite

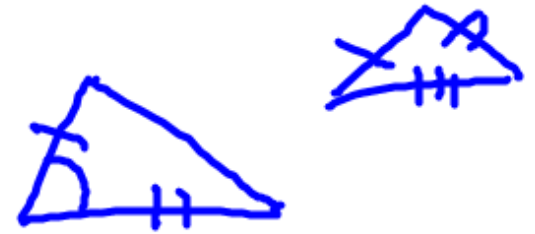
Solve for x.



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

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

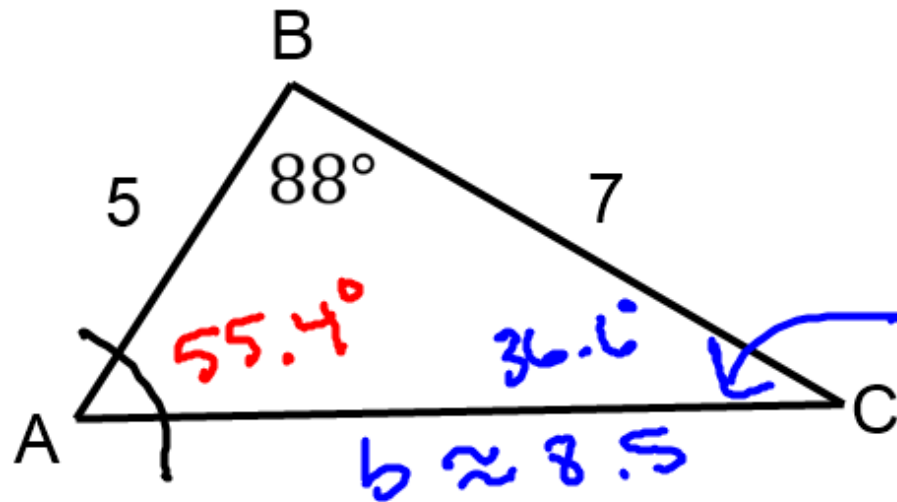
$$\cancel{a^2} = b^2 + c^2 - 2bc \cos(A^\circ)$$



$$\sqrt{x^2} = \sqrt{12^2 + 9^2 - 2(12)(9) \cos(37^\circ)}$$

$$x \approx 7.2$$

Find all missing values.



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

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

$$\star a^2 = b^2 + c^2 - 2bc \cos(A^\circ)$$

$$180 - 55.4 - 88$$

$$b^2 = \sqrt{7^2 + 5^2 - 2(7)(5) \cos(88)}$$

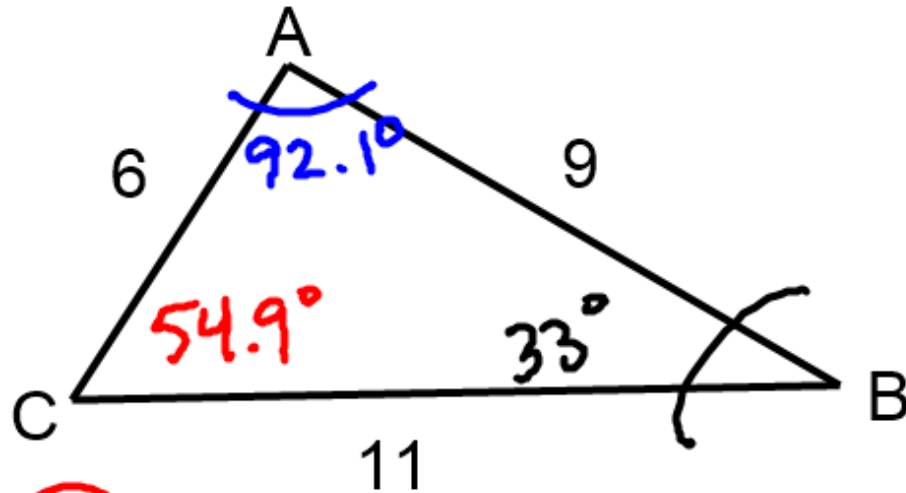
$$b \approx \boxed{8.5}$$

$$7^2 = (8.5)^2 + 5^2 - 2(8.5)(5) \cos A$$

$$\frac{7^2 - (8.5)^2 - 5^2}{-2 \cdot 8.5 \cdot 5} = \frac{-2(8.5)(5) \cos A}{-2 \cdot 8.5 \cdot 5}$$

$$\cos A = \frac{7^2 - 8.5^2 - 5^2}{-2 \cdot 8.5 \cdot 5} \rightarrow A = \cos^{-1} \left(\frac{7^2 - 8.5^2 - 5^2}{(-2 \cdot 8.5 \cdot 5)} \right)$$

Find all missing values



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

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

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

$$11^2 = 6^2 + 9^2 - 2(6)(9) \cos A$$

$$A = \cos^{-1} \left(\frac{11^2 - 6^2 - 9^2}{-2 \cdot 6 \cdot 9} \right) \approx 92.1^\circ$$

$$6^2 = 11^2 + 9^2 - 2(11)(9) \cos B$$

$$B = \cos^{-1} \left(\frac{6^2 - 11^2 - 9^2}{-2 \cdot 11 \cdot 9} \right) \approx 33^\circ$$

$$C = 180 - 92.1 - 33 = 54.9^\circ$$