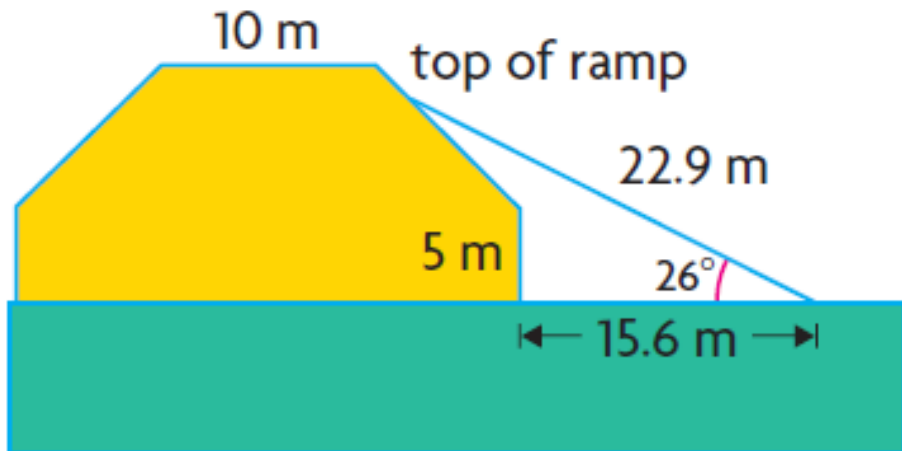
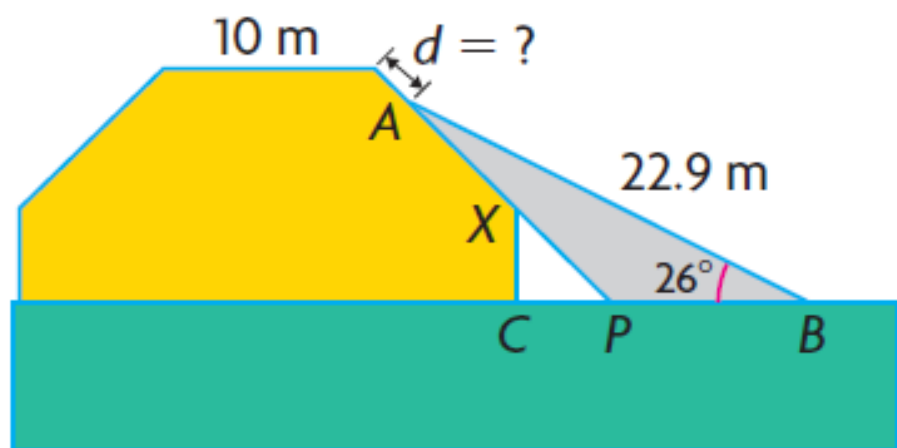


## 5.7 - The Cosine Law

A barn whose cross-section resembles half a regular octagon with a side length of 10m needs some repairs to its roof. The roofers place a 22.9m ramp against the side of the building, forming an angle of  $26^\circ$  with the ground. The ramp will be used to transport the materials needed for the repair. The base of the ramp is 15.6m from the side of the building.

- How far, to the nearest tenth of a metre, is the top of the ramp from the flat roof of the building?





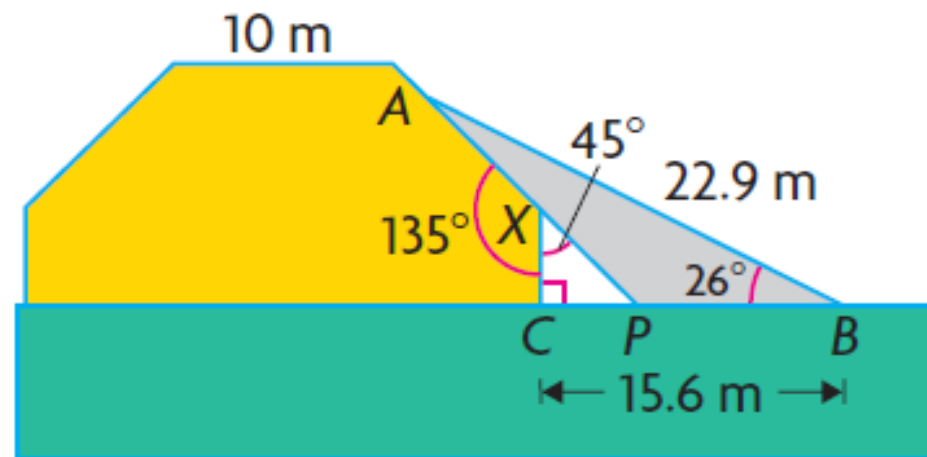
$$\angle AXC + \angle CXP = 180^\circ$$

$$135^\circ + \angle CXP = 180^\circ$$

$$\angle CXP = 180^\circ - 135^\circ$$

$$= 45^\circ$$

$\therefore \triangle XCP$  is a  $45^\circ - 45^\circ - 90^\circ$  special triangle.

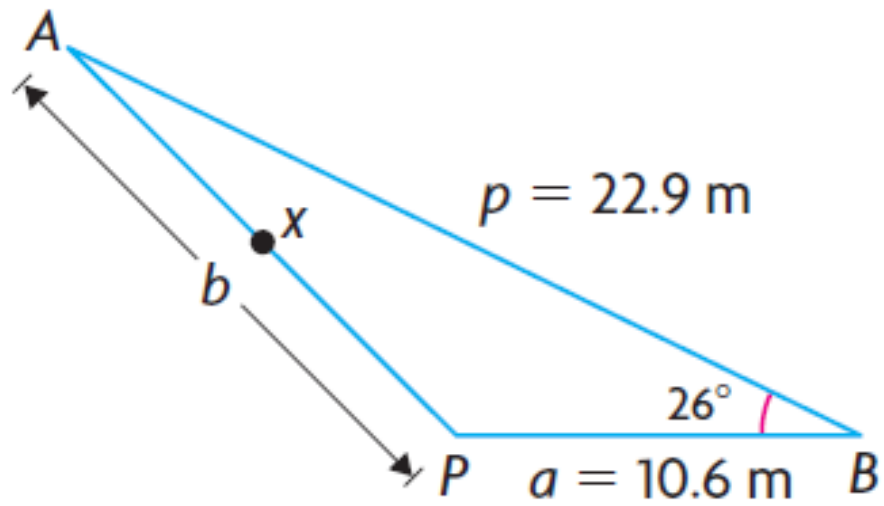


$$CP + PB = 15.6$$

$$5 + PB = 15.6$$

$$PB = 15.6 - 5$$

$$= 10.6 \text{ m}$$



$$b^2 = a^2 + p^2 - 2ap \cos B$$

$$b^2 = (10.6)^2 + (22.9)^2 - 2(10.6)(22.9)\cos 26^\circ$$

$$b^2 = 200.42 \text{ m}^2$$

$$b = \sqrt{200.42}$$

$$b \doteq 14.16 \text{ m}$$

$$XP = 5\sqrt{2}$$

$$AX + XP = b$$

$$AX + 5\sqrt{2} = 14.16$$

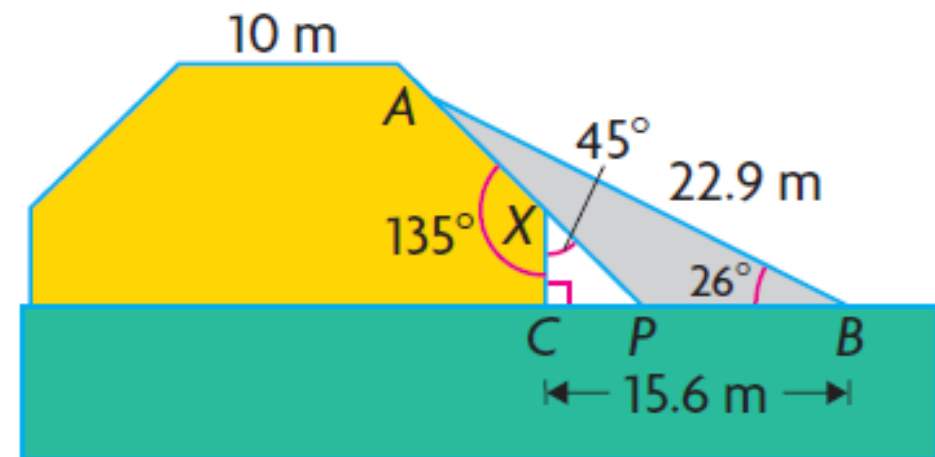
$$AX = 14.16 - 5\sqrt{2}$$

$$\doteq 7.09 \text{ m}$$

$$\text{required distance} = 10 - AX$$

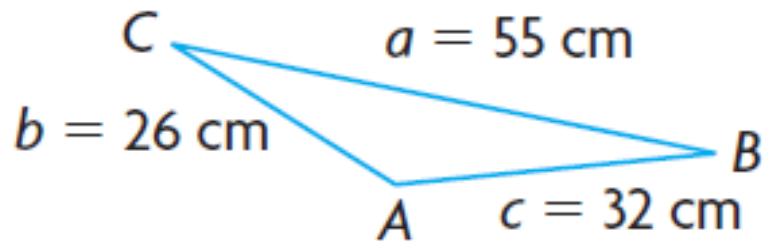
$$= 10 - 7.09$$

$$\doteq 2.9 \text{ m}$$



## Example #2

- In Triangle ABC, determine angle A to the nearest degree if  $a = 55$  cm,  $b = 26$  cm, and  $c = 32$  cm.



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

$$55^2 = 26^2 + 32^2 - 2(26)(32) \cos A$$

$$\cos A = \frac{55^2 - (26^2 + 32^2)}{-2(26)(32)}$$

$$\angle A = \cos^{-1} \left( \frac{55^2 - (26^2 + 32^2)}{-2(26)(32)} \right)$$

$$\angle A \doteq 143^\circ$$

Given  $\triangle ABC$ ,  $\angle A$  is about  $143^\circ$ .

# In Summary...

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

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

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

