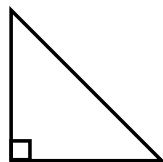


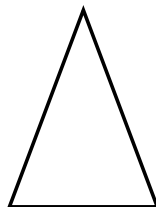
4.4 Problems in Two Dimensions

Review

Right triangle problems \longrightarrow SOH CAH TOA



Oblique triangle problems $\begin{cases} \longrightarrow \text{Sine Law} \\ \longrightarrow \text{Cosine Law} \end{cases}$



Sine law

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Used when:

- i) two sides and an opposite angle are known
- ii) two angles and one side are known

Cosine Law

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

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

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

Used When:

- two sides and a contained angle are known

$$\cos A = \frac{a^2 - b^2 - c^2}{-2bc}$$

$$\cos B = \frac{b^2 - a^2 - c^2}{-2ac}$$

$$\cos C = \frac{c^2 - a^2 - b^2}{-2ab}$$

Used When:

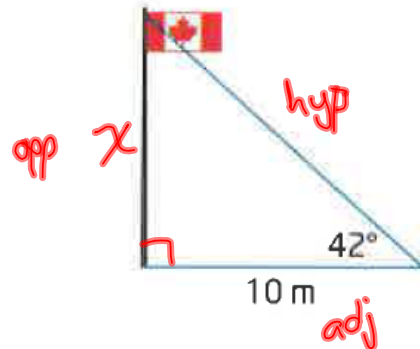
- all three sides are known

Example 1: Jonathan needs a new rope for his flagpole but is unsure of the length required. He measures a distance of 10m away from the base of the pole. From this point, the angle of elevation to the top of the pole is 42° . What is the height of the pole, to the nearest tenth of a metre?

$$\tan 42 = \frac{x}{10}$$

$$x = 10 \cdot \tan 42$$

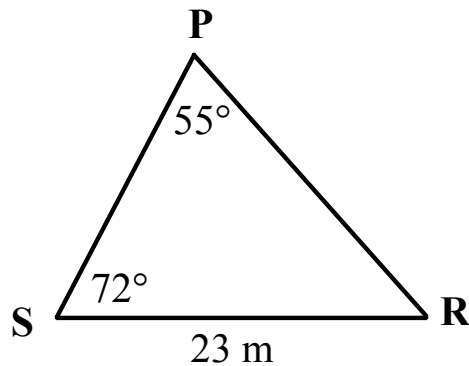
$$x = 9.0 \text{ m}$$



The height of the flagpole is 9 meters.

Example 2: Pam, Steven and Rachel are standing on a soccer field. Steven and Rachel are 23m apart. From Steven's point of view, the other two are separated by 72° . From Pam's point of view, the others are separated by an angle of 55° .

a) Sketch a diagram



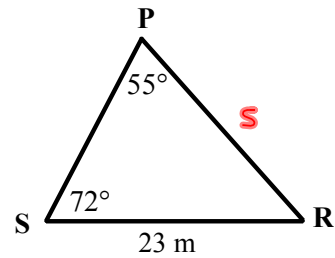
b) Determine the distance from Pam to Rachel.

$$\frac{s}{\sin S} = \frac{p}{\sin P}$$

$$\frac{s}{\sin 72} = \frac{23}{\sin 55}$$

$$s = \frac{23 \cdot \sin 72}{\sin 55}$$

$$s = 26.7$$



The distance from Pam to Rachel is 26.7 meters.

Example 3: A drive belt wraps around three pulleys as shown. Find the perimeter of the drive belt to the nearest tenth of a cm.

$$x^2 = (14.5)^2 + (16)^2 - 2(14.5)(16) \cos 35$$

$$x^2 = 86.16345$$

$$x = 9.3 \text{ cm}$$

$$\begin{aligned} \text{Perimeter} &= 9.3 + 14.5 + 16 \\ &= 39.8 \text{ cm} \end{aligned}$$



The perimeter of the drive belt is 39.8 cm.

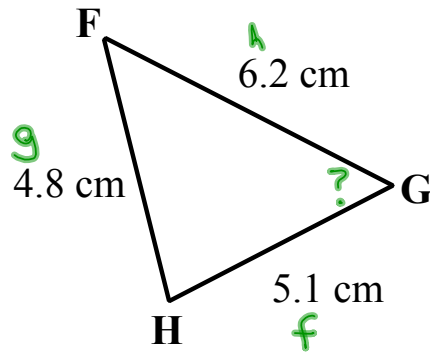
Example 4: Find the measure of angle G

$$\cos G = \frac{g^2 - h^2 - f^2}{-2hf}$$

$$\cos G = \frac{4.8^2 - 6.2^2 - 5.1^2}{-2(6.2)(5.1)}$$

$$\cos G = 0.6548$$

$$\angle G = 49.1^\circ$$



Complete Worksheet