Similar Triangles
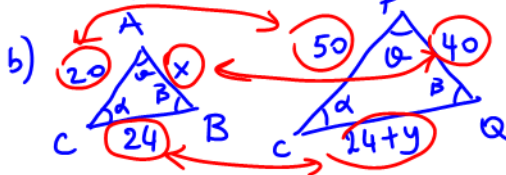
1. If AB is parallel to PQ,
   a) how do you know that $\triangle CAB \sim \triangle CPQ$?
   b) determine the length of x and y.

a) Since $\overline{AB} \parallel \overline{PQ}$, $\angle A = \angle P$ and $\angle B = \angle Q$
   $\angle C$ is a common angle for both triangles;
   we have AAA condition with different side lengths.

b) $\frac{x}{40} = \frac{2Q}{5Q}$ → $\boxed{x=16}$
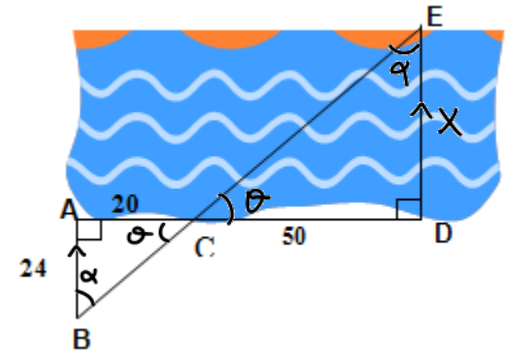
$x = \frac{40 \cdot 2}{5}$

$\frac{24}{24+y} = \frac{2Q}{5Q}$

$120 = 48 + 2y$

$72 = 2y$
$\boxed{36 = y}$

2. Leron is attempting to swim across a river. He needs to find out the distance across, so he draws the following scale diagram and determines the measurements on it. Using the diagram shown, determine how far it is across the river to the nearest metre.

$\triangle ABC \sim \triangle DEF$

$\frac{x}{24} = \frac{5Q}{2Q}$

$2x = 24 \cdot 5$

$\boxed{x = 60}$

∴ It's 60m across the river.

3. Calculate the height of GI Joe's roof.

Area $\triangle FGH = \frac{13 \cdot h}{2}$ or $\frac{12 \cdot 5}{2}$
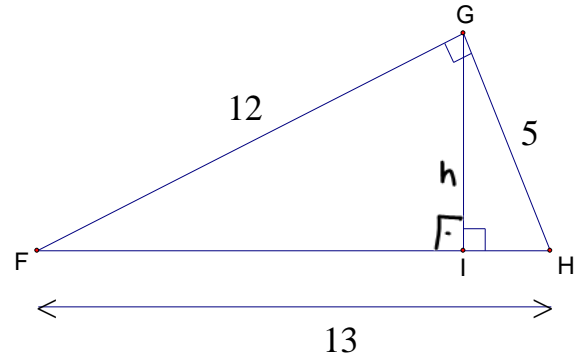
they must be equal

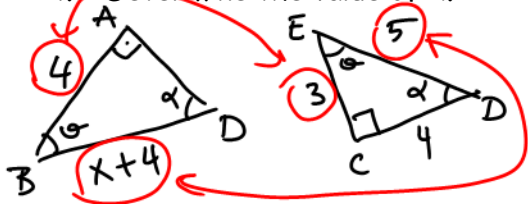$\frac{13h}{2} = \frac{60}{2}$

$\frac{26h}{26} = \frac{120}{26}$

$h = \frac{120}{26} = \frac{60}{13}$ $\boxed{\therefore h = \frac{60}{13}}$

4. Determine the value of x.
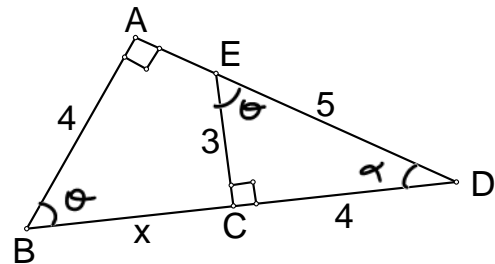
$\triangle ABD \sim \triangle CED$

$\frac{x+4}{5} = \frac{4}{3}$

$3(x+4) = 20$

$3x + 12 = 20$

$\frac{3x}{3} = \frac{8}{3}$

$\boxed{x = 8/3}$

5. A 6 m ladder is leaning against a vertical wall with its foot 3.5 m away from the wall. Another ladder 7.5 m long is leaning against the wall, parallel to the first ladder. What distance is the foot of the second ladder from the wall?

similar triangles AAA

$$\frac{x}{3.5} = \frac{7.5}{6}$$

$$x = \frac{7.5(3.5)}{6}$$

$$\boxed{x \doteq 4.4}$$

Trigonometric Ratios - *Sine, Cosine, and Tangent*

6. Label the hypotenuse (hyp), opposite (opp) and adjacent (adj) sides for marked angles.

7. State the 3 primary trig ratios using the hint below

SOH

$$\sin\theta = \frac{O}{H}$$

CAH

$$\cos\theta = \frac{A}{H}$$

TOA

$$\tan\theta = \frac{O}{A}$$

8. State the **three primary trig ratios** for the indicated angle in the following triangles.

$$\sin\beta° = \frac{O}{H} = \frac{16}{20} = \frac{4}{5}$$

$$\cos\beta° = \frac{A}{H} = \frac{12}{20} = \frac{3}{5}$$

$$\tan\beta° = \frac{O}{A} = \frac{16}{12} = \frac{4}{3}$$

20 m   12 m   β   16 m

$$\sin\beta° = \frac{O}{H} = \frac{12}{13}$$

$$\cos\beta° = \frac{A}{H} = \frac{5}{13}$$

$$\tan\beta° = \frac{O}{A} = \frac{12}{5}$$

13   β   5   A   12   C

Solving for Unknown Angle Using Trig Ratios

9. Find the indicated angle to the nearest degree.

SOH   CAH   TOA

TOA

TOA

$$\tan x = \frac{5}{8}$$

$$\tan^{-1}\left(\frac{5}{8}\right) = x \quad \boxed{x \doteq 32°}$$

SOH

$$\sin x = \frac{4}{17}$$

$$\sin^{-1}\left(\frac{4}{17}\right) = x$$

$$x \doteq 14°$$

CAH

$$\cos x = \frac{5}{13}$$

$$\cos^{-1}\left(\frac{5}{13}\right) = x$$

$$\boxed{x = 67°}$$

10. Solve the following triangle. Round each side length to the nearest unit and angles to the nearest degree.

$$\alpha + 30 + 90 = 180$$
$$\boxed{\alpha = 60°}$$

$$\tan 30° = \frac{O}{A}$$
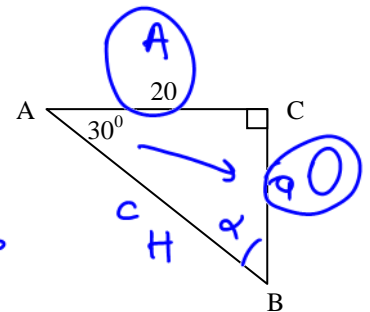
$$\tan 30° = \frac{a}{20}$$

$$a = 20 \cdot \tan 30°$$

$$a \doteq 11.5$$

$$\cos 30° = \frac{A}{H}$$

$$\cos 30° = \frac{20}{c}$$

$$c = \frac{20}{\cos 30°}$$

$$c \doteq 23°$$

11. Captain Jack is navigating his ship to Port Harbour, which is directly north of the ship's location. To compensate for an easterly current, he aims for a point on shore that is 5 km west of Port Harbour. Assuming that the point on shore is 20 km from his position now, at what bearing must Jack head his ship? **Bearing:** Clockwise angle from NORTH.
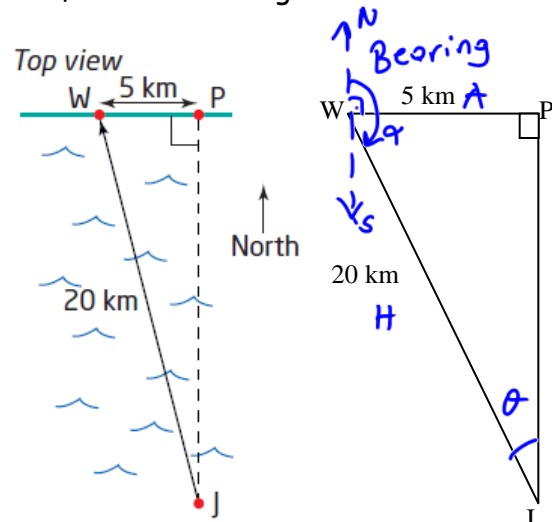
Top view

$$\cos \alpha = \frac{5}{20}$$
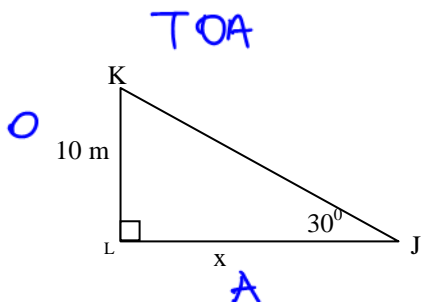
$$\cos^{-1}\left(\frac{1}{4}\right) = \alpha$$

$$\alpha \doteq 75.5°$$

Bearing $= 90 + 75.5$

$$\boxed{= 165.5°}$$

Solving for Unknown Side Length Using Trig Ratios

9. In $\triangle JKL$ find the length of x

TOA
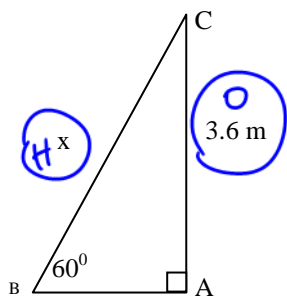
$$\tan 30° = \frac{10}{x}$$

$$x = \frac{10}{\tan 30°}$$

$$\boxed{x = 17.3}$$

10. In $\triangle ABC$ find the length of x
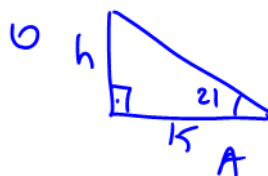
SOH

$$\sin 60° = \frac{3.6}{x}$$

$$x = \frac{3.6}{\sin 60°}$$

$$\boxed{x = 4.2}$$

From a point on the ground 15 feet from the foot of a tree, the angle of elevation of the top of the tree is 21°. Find to the nearest foot, the height of the tree.

$$\tan 21 = \frac{h}{15}$$

$$h = 15 \cdot \tan 21$$

$$\boxed{h \doteq 6 \text{ feet}}$$