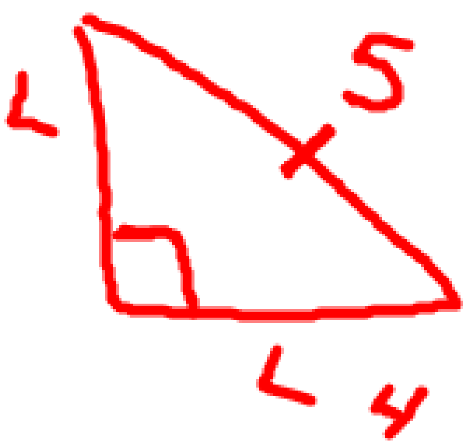
Graduationg class of 2023!

Chapter 2: Trigonometry

BUILDING ON

- Applying the Pythagorean Theorem
- Solving problems using properties of similar polygons
- Solving problems involving ratios



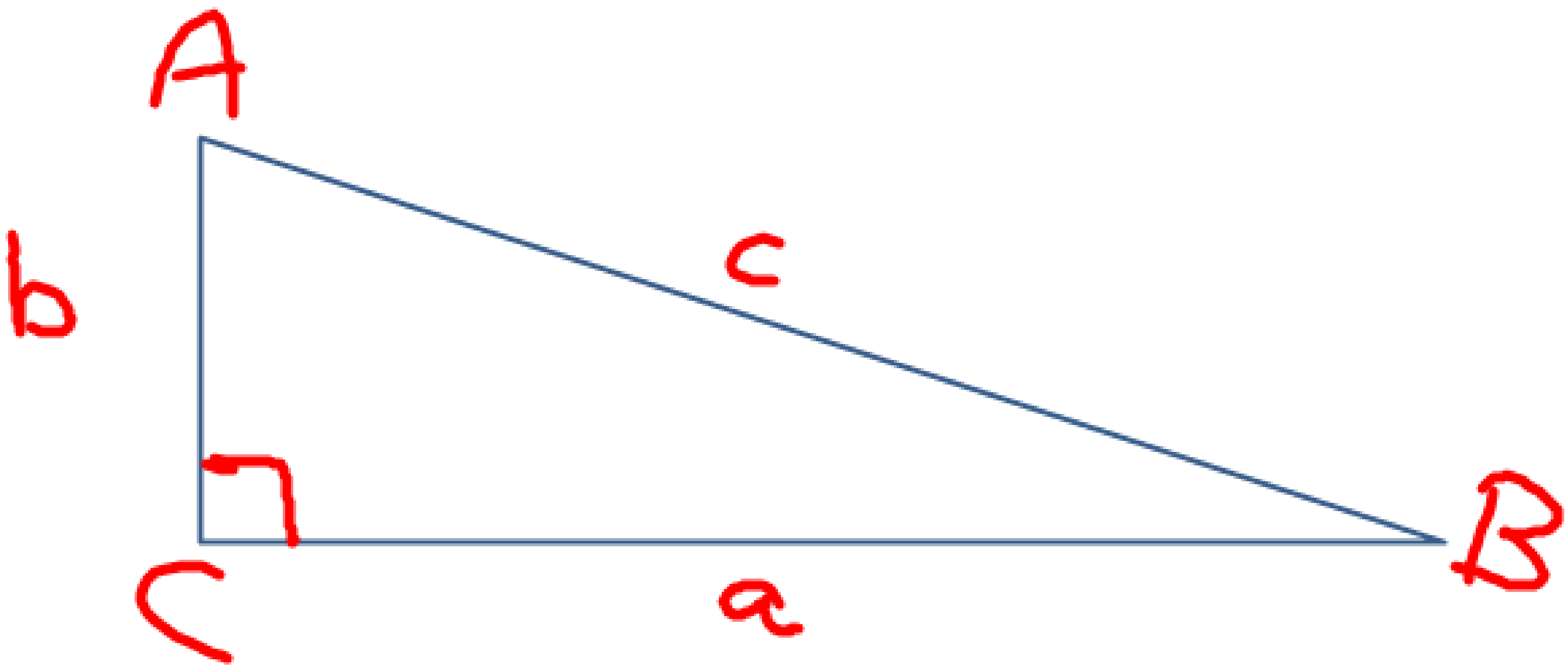
BIG IDEAS

- In a right triangle,
- The ratio of any two sides remains constant even if the triangle is enlarged or reduced
- You can use the ratio of the lengths of two sides to determine the measure of one of the acute angles
- You can use the length of one side and the measure of an acute angle to determine the length of another side of the triangle

Labeling a Right Triangle

Important terminology

$\overline{AB}$

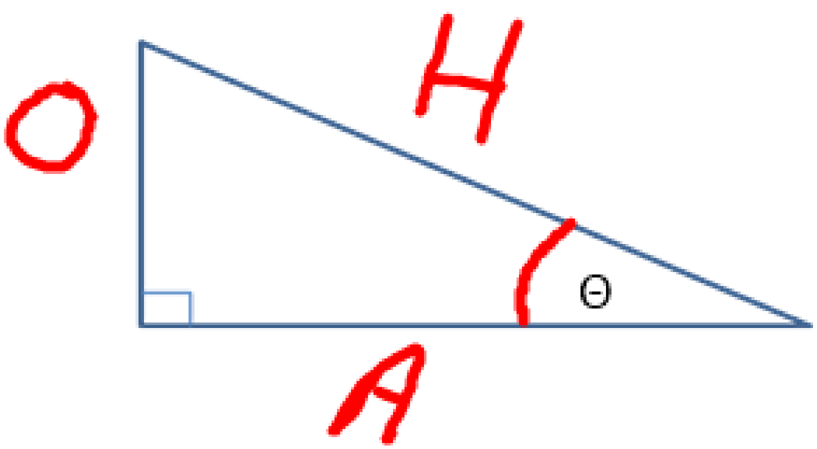


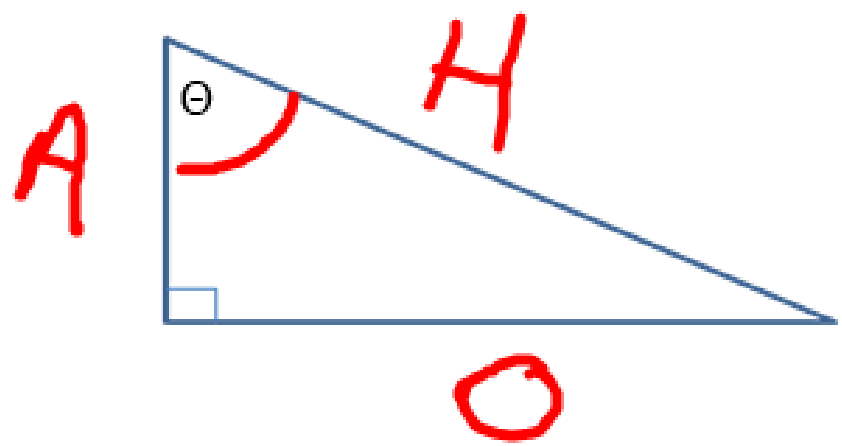
Opposite, Adjacent, Hypotneuse

θ

Labeling a triangle using:

Hypotenuse
Opposite
Adjacent





Getting Started

- *For **right triangles** there are relationships between the sides, and the angles*

- *These relationships can remembered by:*

$\boldsymbol{SOH}$ $$\boldsymbol{Sin\theta = \frac{Opp}{Hyp}}$$

$\boldsymbol{CAH}$ $$\boldsymbol{Cos\theta = \frac{Adj}{Hyp}}$$

$\boldsymbol{TOA}$ $$\boldsymbol{Tan\theta = \frac{Opp}{Adj}}$$

2.1 The Tangent Ratio

Lesson Focus

- Develop the **tangent ratio** and relate it to the angle of inclination of a line segment

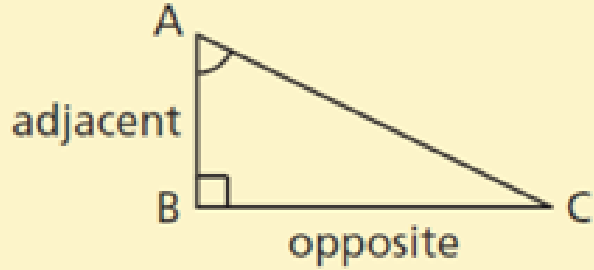
$$SOH$$
$$CAH$$
$$TOA$$

The Tangent Ratio

The Tangent Ratio

If $\angle A$ is an acute angle in a right triangle, then

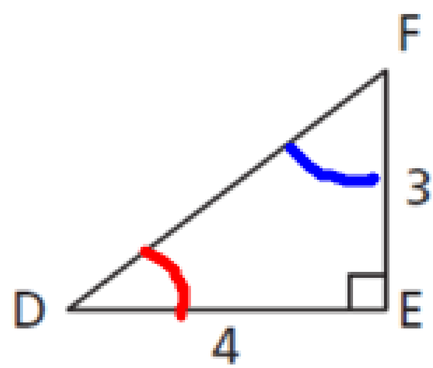
$$\tan A = \frac{\text{length of side opposite } \angle A}{\text{length of side adjacent to } \angle A}$$



$$\tan\theta = \frac{opposite}{adjacent}$$

Example

Determine tan D and tan F.

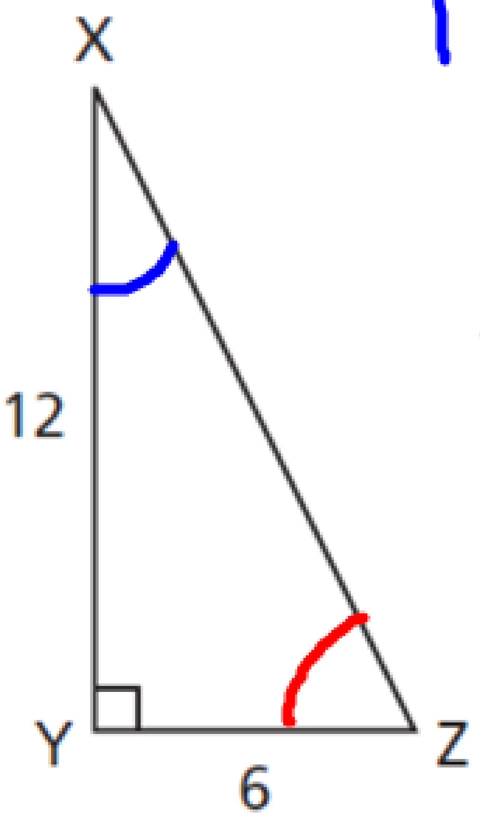


$$\tan\theta = \frac{opposite}{adjacent}$$

$$\tan D = \frac{3}{4} \qquad \tan F = \frac{4}{3}$$

Example – Your Turn

Determine tan X and tan Z.



$$\tan X = \frac{6}{12} = 0.50$$

$$\tan Z = \frac{12}{6} = \underline{2.00}$$

Find Angles Using Tan

- *Use the **inverse trig ratio** to find the angle:*

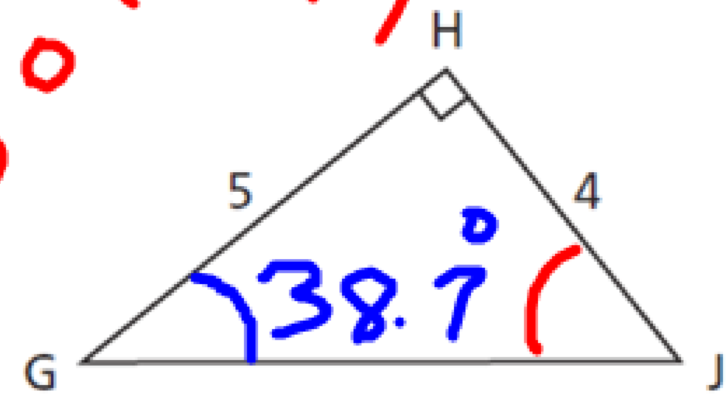
$$\theta = \tan^{-1}\ (\frac{opposite}{adjacent})$$

$\tan J = \frac{5}{4}$ Example

$\cancel{\tan^{-1}}(\cancel{\tan} J) = \tan^{-1}(5/4)$

Determine the measures of ∠G and ∠J to the nearest tenth of a degree.

$J = 51.3^\circ$



$\tan G = \frac{4}{5}$

$\cancel{\tan^{-1}}(\cancel{\tan} G) = \tan^{-1}(4/5)$

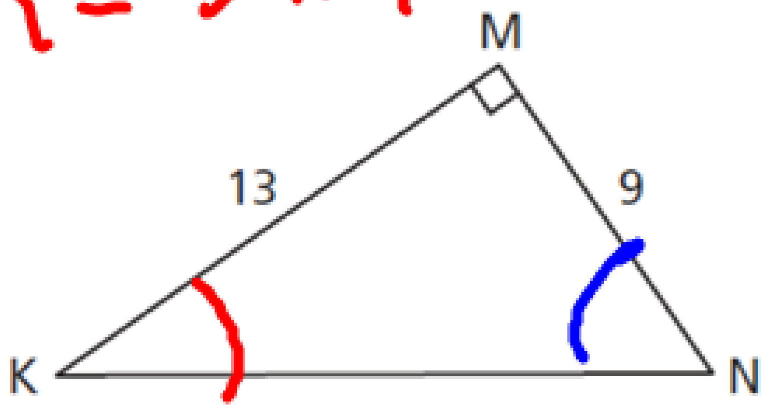
$G = \tan^{-1}(4/5)$

$G = 38.7^\circ$

Example – Your Turn

Determine the measures of ∠K and ∠N to the nearest tenth of a degree.

$K = 34.7^{\circ}$



$\tan K = \frac{9}{13}$

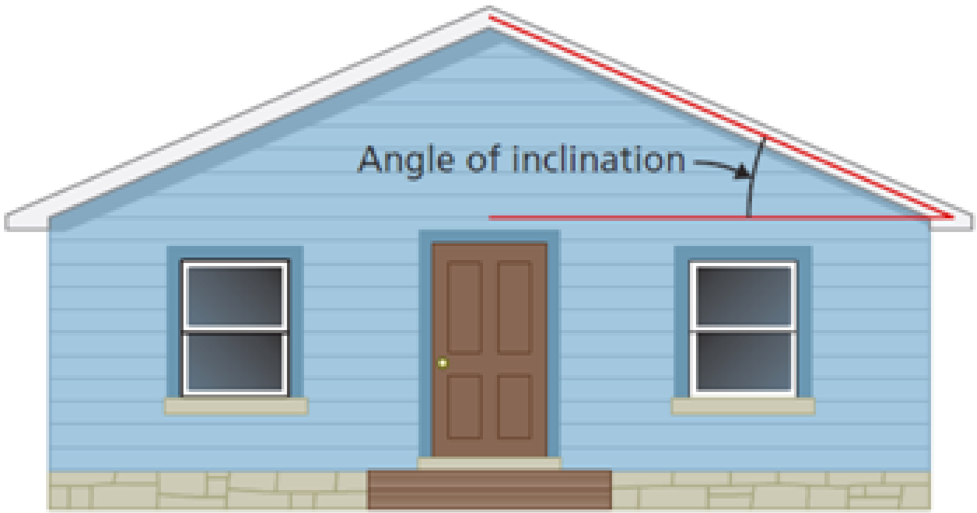
$K = \tan^{-1}(9/13)$

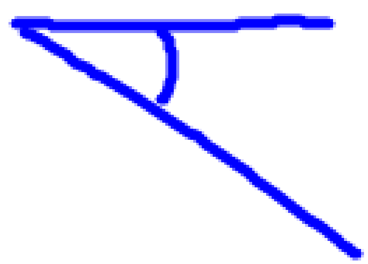
$\tan N = \frac{13}{9}$

$N = \tan^{-1}(13/9)$

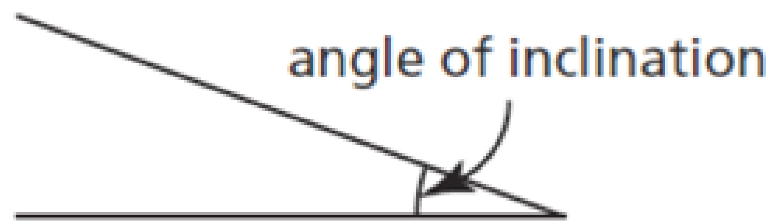
$N = 55.3^{\circ}$

Angle of inclination



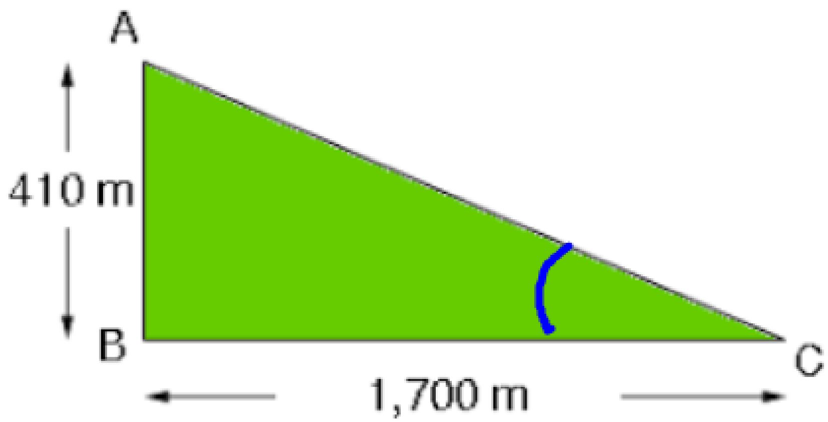


The **angle of inclination** of a line or line segment is the acute angle it makes with the horizontal.



Example:

Determine the angle of incline to the nearsest degree.



$$\tan C = \frac{410}{1700}$$

$$C = \tan^{-1}\left(\frac{410}{1700}\right) = 13.6^\circ$$

In mathematics we need to be problem solvers!

Homework

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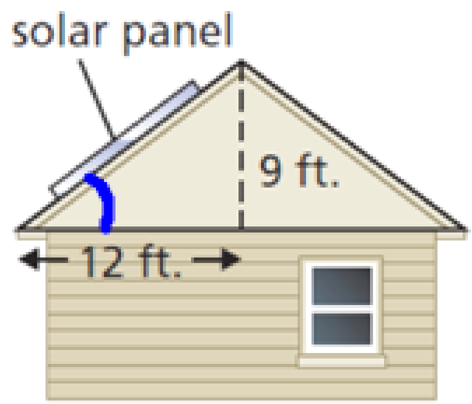
 # 3 (right tan ratio for both acute angles), 4, 8, 10

Example

This house is not suitable for solar panels.

South-facing solar panels on a roof work best when the **angle of inclination** of the roof, that is, the angle between the roof and the horizontal, is approximately equal to the latitude of the house.

The latitude of Fort Smith, NWT, is approximately 60°. Determine whether this design for a solar panel is the best for Fort Smith. Justify your answer.

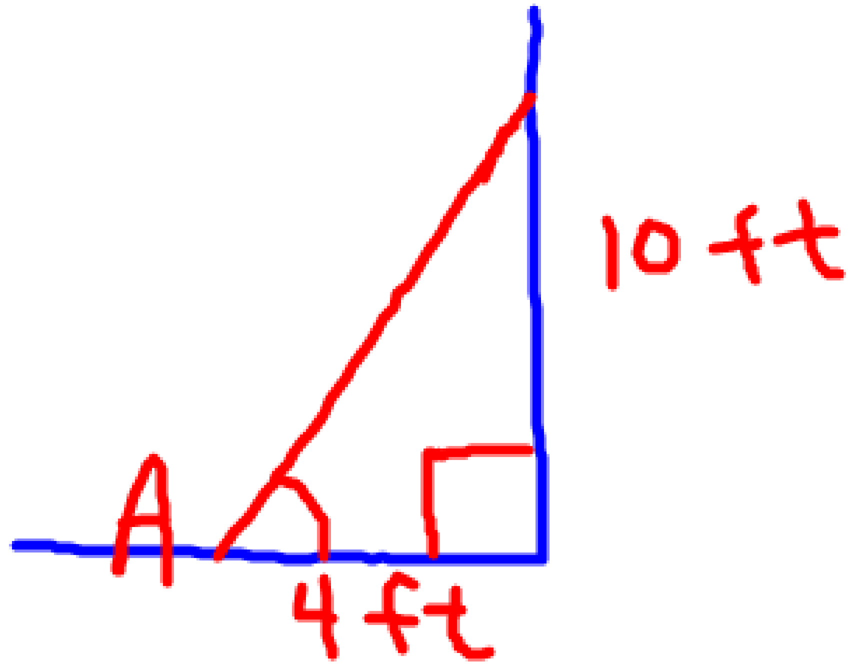


$$\tan A = \frac{9}{12}$$

$$A = \tan^{-1}\left(\frac{9}{12}\right) \simeq 37^\circ$$

Example

a) A ladder leans against the side of a building. It reaches 10ft up the side of the building. The bottom of the ladder rests 4ft from the base of the wall. What angle, to the nearest degree, does the ladder make with the ground?



$$\tan A = \frac{10}{4}$$

$$A = \tan^{-1}(10/4)$$

$$A = 68^\circ$$

b) *How long is the ladder?*

b) $l^2 = (10)^2 + (4)^2$

$l^2 = 116$

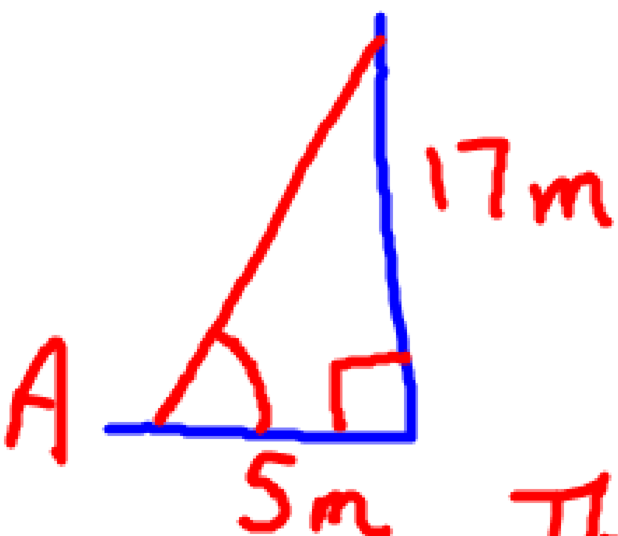
$l = \pm\sqrt{116}$

$l = 10.7\,ft$

The ladder is 10.7ft long.

Example – Your Turn

A support cable is anchored to the ground 5m from the base of a telephone pole. The cable is attached 17m up the side of the telephone pole. What angle, to the nearest degree, does the cable make with the ground?



$\tan A = \frac{17}{5}$

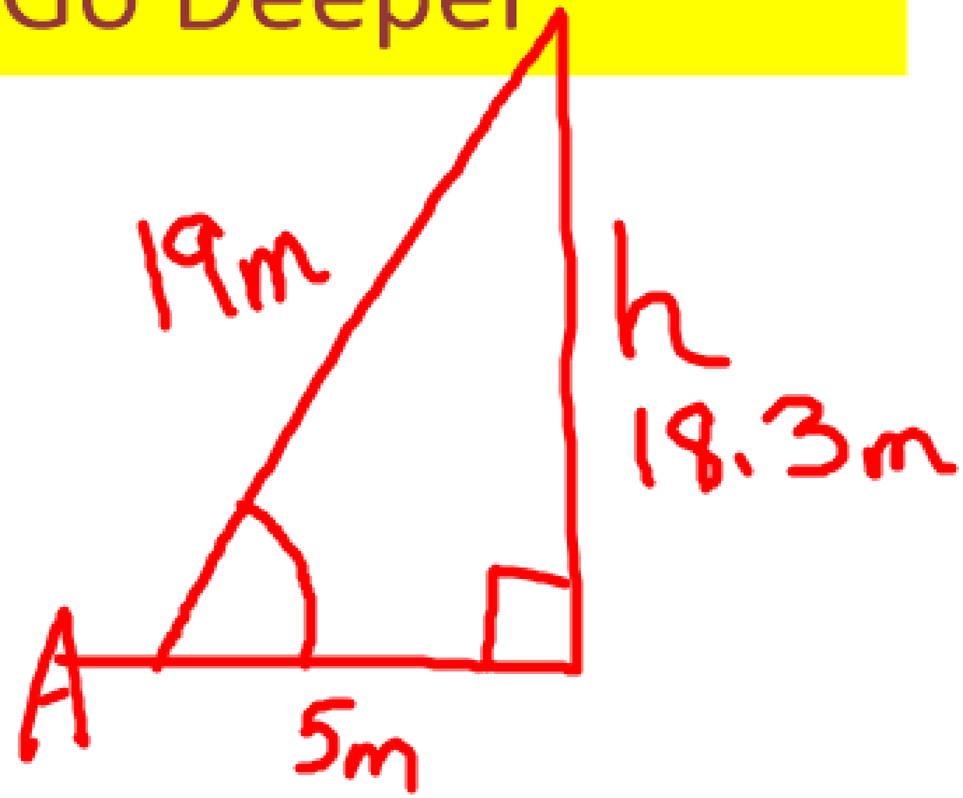
$A = \arctan\left(\frac{17}{5}\right)$

$A = 74^\circ$

The angle cable makes with ground is 74°.

Example – Go Deeper

A support cable is anchored to the ground 5 m from the base of a telephone pole. The cable is 19 m long. It is attached near the top of the pole. What angle, to the nearest degree, does the cable make with the ground?



$$(19)^2 = (5)^2 + (h)^2$$

How could we use **tangent** to solve this?

$$361 = 25 + h^2$$
$$336 = h^2$$
$$h = \pm 18.3$$

$$\tan A = \frac{18.3}{5}$$

$$A = \tan^{-1}\left(\frac{18.3}{5}\right)$$

$$A = 75^\circ$$

Homework

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 # 12, 13*, 14, 18, 21(Need to know what an iscoceles triangle is.)**