1.2

Grade & Angle of Elevation

Topics:

1. Pythagorean Theorem

2. Tangent Ratio

3. Grade and Pitch

Jun 27-10:03 AM

Key Terms

*grade

* tangent ratio

* angle of elevation

* pythagorean theorem

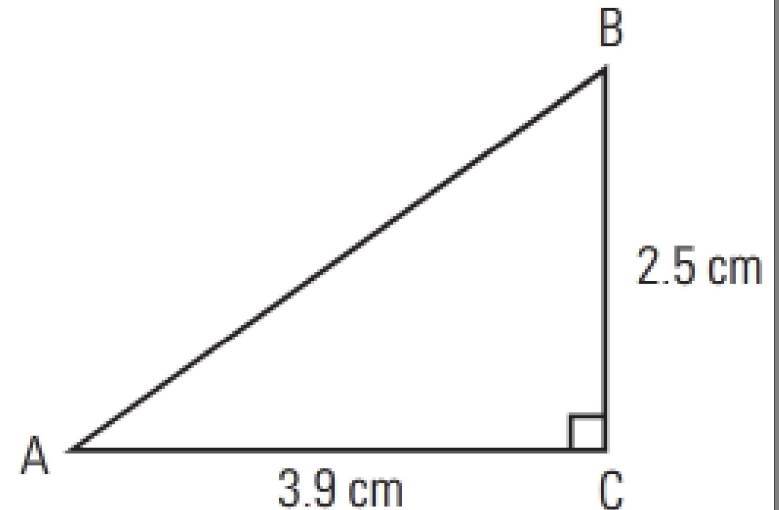* angle of depression

* drop

Pythagorean Theorem

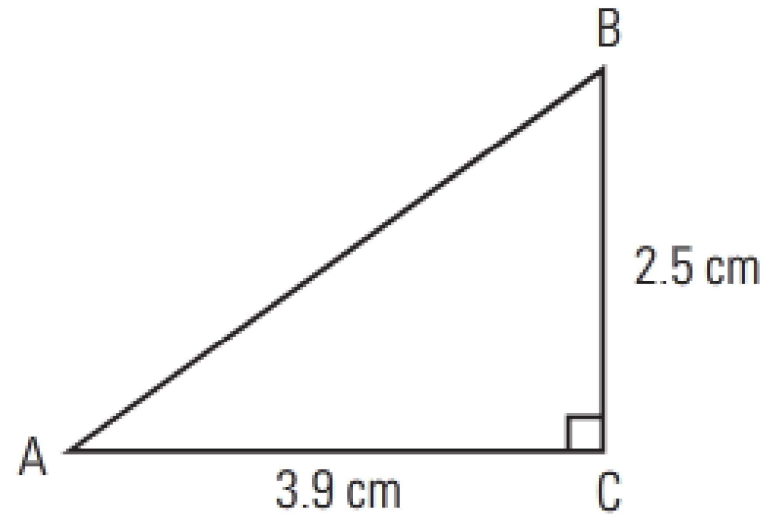- must be a rt. triangle
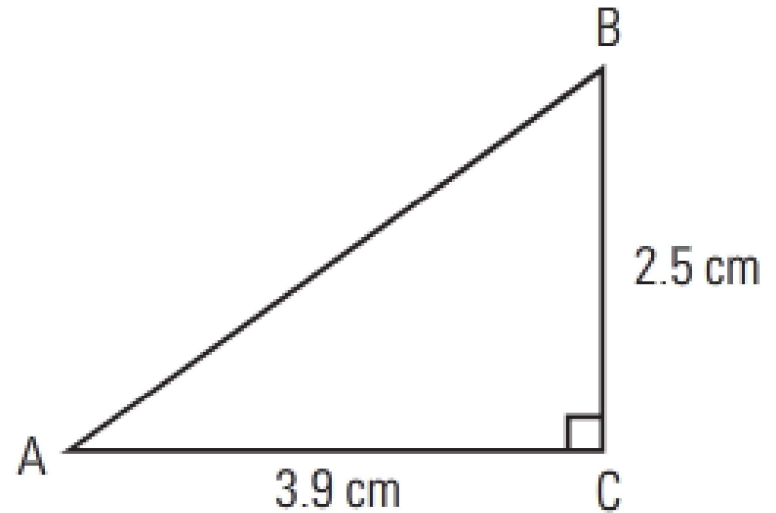
- must be given two sides

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

B

2.5 cm

A

3.9 cm   C

Which side is the hypotenuse?

Use the diagram to determine the hypotenuse

Tangent Ratio

$$\tan \theta = \frac{o}{a}$$

B

2.5 cm

A

3.9 cm

C

$$\theta =$$

Which side is the opposite, adjacent, and hypotenuse?

Sep 9-8:26 AM

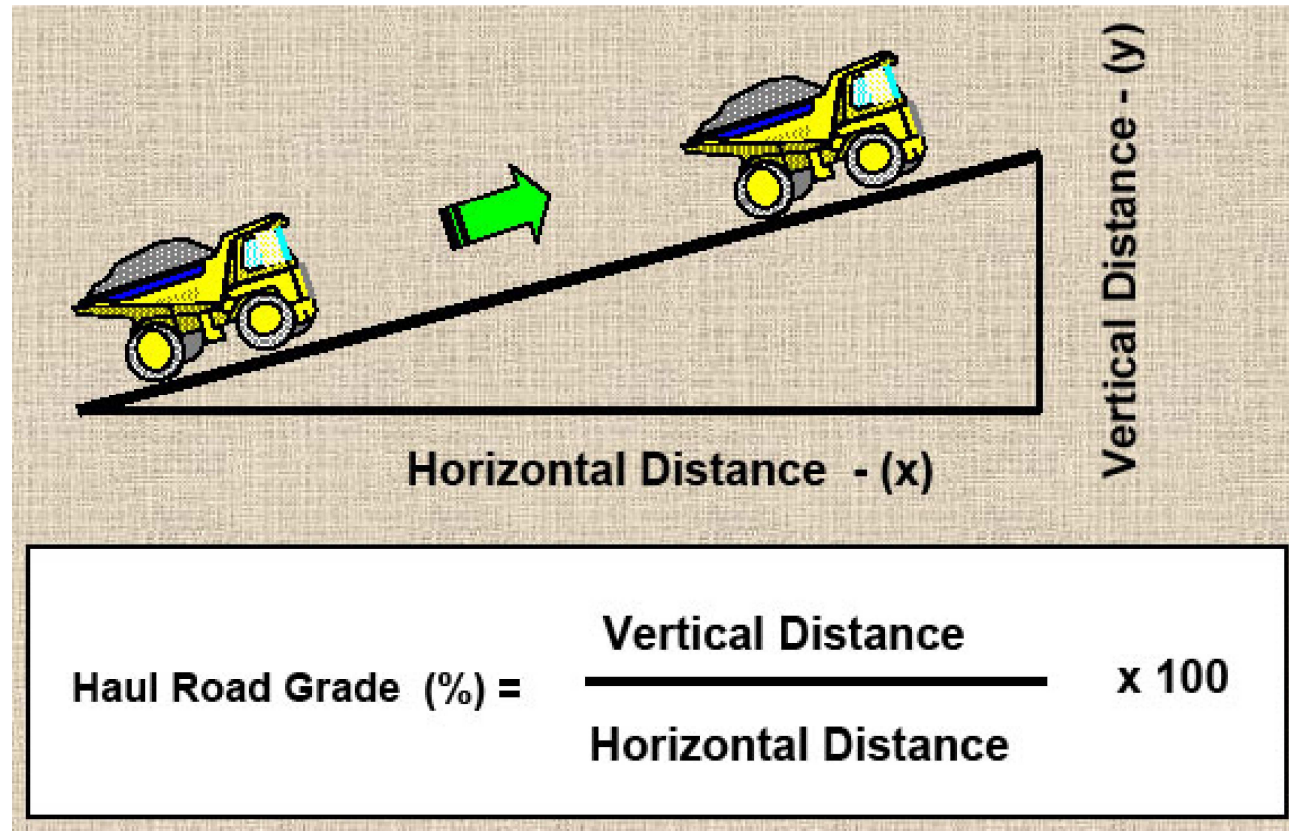# Grade and Angle of Elevation

Sep 9-8:15 AM

This sign is used to show that the road has a slope to it. This slope is called its grade.

The steeper the slope, the higher the percentage.

To convert slope to percentage grade, multiply the slope by 100.
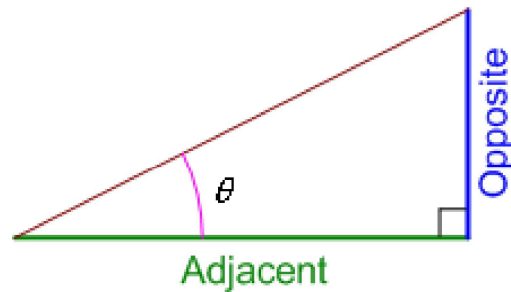
Be careful though, the rise and run
need to both be measured
in the same units.

Sep 9-8:16 AM

Vertical Distance - (y)

Horizontal Distance - (x)

Haul Road Grade (%) = $\dfrac{\text{Vertical Distance}}{\text{Horizontal Distance}}$ x 100

$$\text{percent grade} = \dfrac{\text{rise}}{\text{run}} \ \text{x } 100$$

Sep 9-8:17 AM

Another way to find the percent grade is to use trigonometry.

$$\text{Tan } \theta = \frac{\text{Opposite}}{\text{Adjacent}}$$

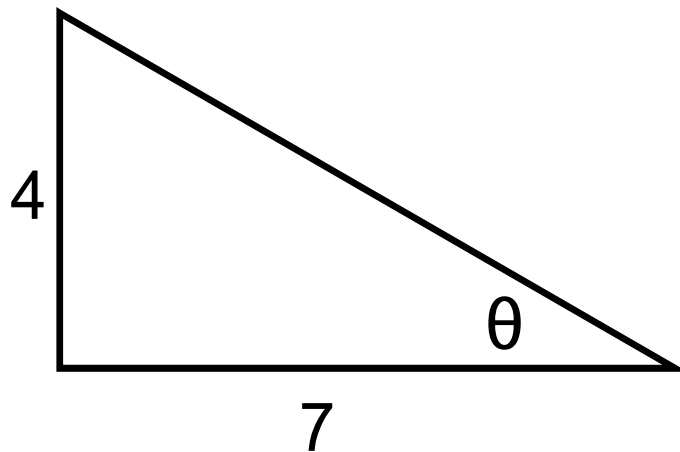The slope is equal to the tangent of the angle of elevation.

tanθ x 100 = percent grade

If we don't know the angle, we can find it using the inverse tan function. (tan-1)

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

Sep 9-8:17 AM

Example 1
Calculate the slope, % grade and the angle of elevation for the following triangle.
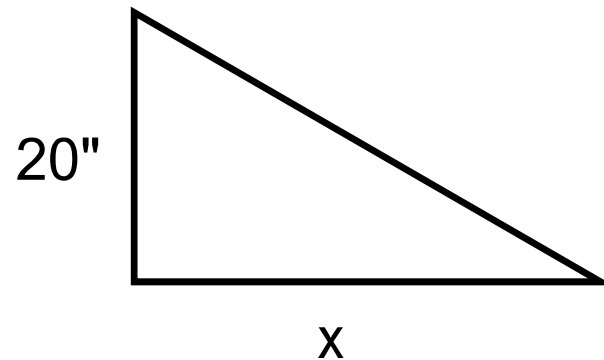
Slope

4

7

θ

Angle of Elevation

% Grade

Example 2

You are hired to build a 1:6 ramp to a doorway that is 20" off the ground. Calculate the length of the ramp in order to achieve the required slope and the angle of elevation of the ramp.

Step 1: Calculate the run.

20"

X

Example 3

Heckman Pass is a very steep section of highway. It rises 900 m over a run of 5 km. What is the percent grade of this section?

Example 4

Make sure your Calculator is in Degree Mode.

Brad needs to unload a quad from the box of his truck. He places an aluminum ramp against the truck bed at a slope of 7:40. What is the angle of elevation of the ramp?

Sep 9-8:19 AM

Example 5

The slope of a driveway must have a minimum angle of depression of 1^0 to allow surface water to drain away from the house. If the end of the driveway is 8 m from the house, how many centimeters does the driveway need to drop to maintain proper drainage?

Example 6

Josette wants to build a skateboard ramp with a 20% grade so that the top of the ramp is level with a rail that is 30 cm high.
How long does the ramp need to be?
Round your answer to the nearest cm.

30 cm

Assignment

Workbook page

Sec 1.2 Assignment

Workbook
Practice Your New Skills
Pages 32 - 35
Questions # 1 - 8

Additional Questions # 3, 5 & 6