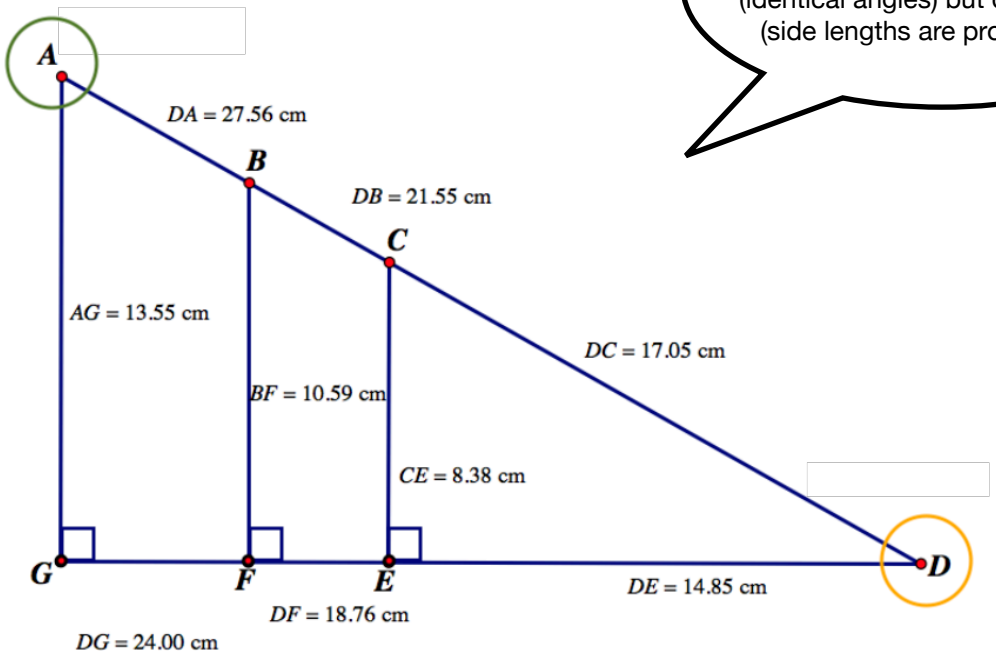
Sine and Cosine Ratios

* Remember, similar triangles have the same shape (identical angles) but different size (side lengths are proportional).

Example 1



Triangle	**Opposite Length Looking From… $\angle D$**	**Hypotenuse Length**	**Sine ratio opposite ÷ hypotenuse**
CED	8.38	17.05	0.491
BFD			
AGD			

What do you notice about the ratio of *opposite* ÷ *hypotenuse* for these similar* triangles?

Triangle	**Adjacent Length Looking From… $\angle D$**	**Hypotenuse Length**	**Cosine ratio adjacent ÷ hypotenuse**
CED			
BFD			
AGD			

What do you notice about the ratio of *adjacent* ÷ *hypotenuse* for these similar* triangles?

Summary

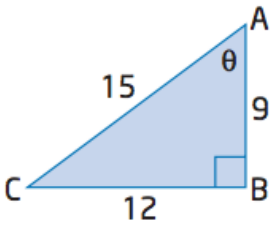
Given a triangle:

Example 2

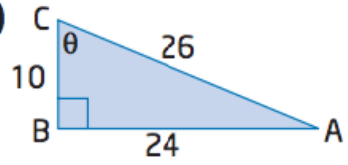
For each triangle shown below:

- identify the sine ratio from the angle marked θ
  - (for short, we'd say "find sin θ")
- identify the cosine ratio from the angle marked θ
  - (for short, we'd say "find cos θ")
- identify the tan ratio from the angle marked θ
  - (for short, we'd say "find tan θ")

a)



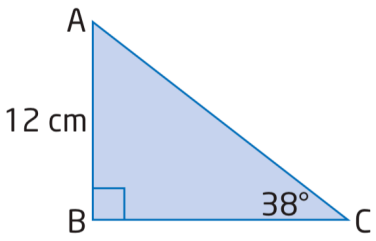
b)



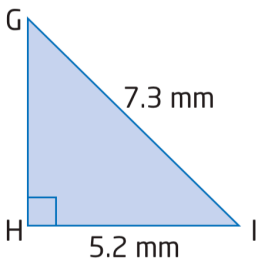
Example 3

Solve each triangle (find the measure of all angles and side lengths).

a)



b)



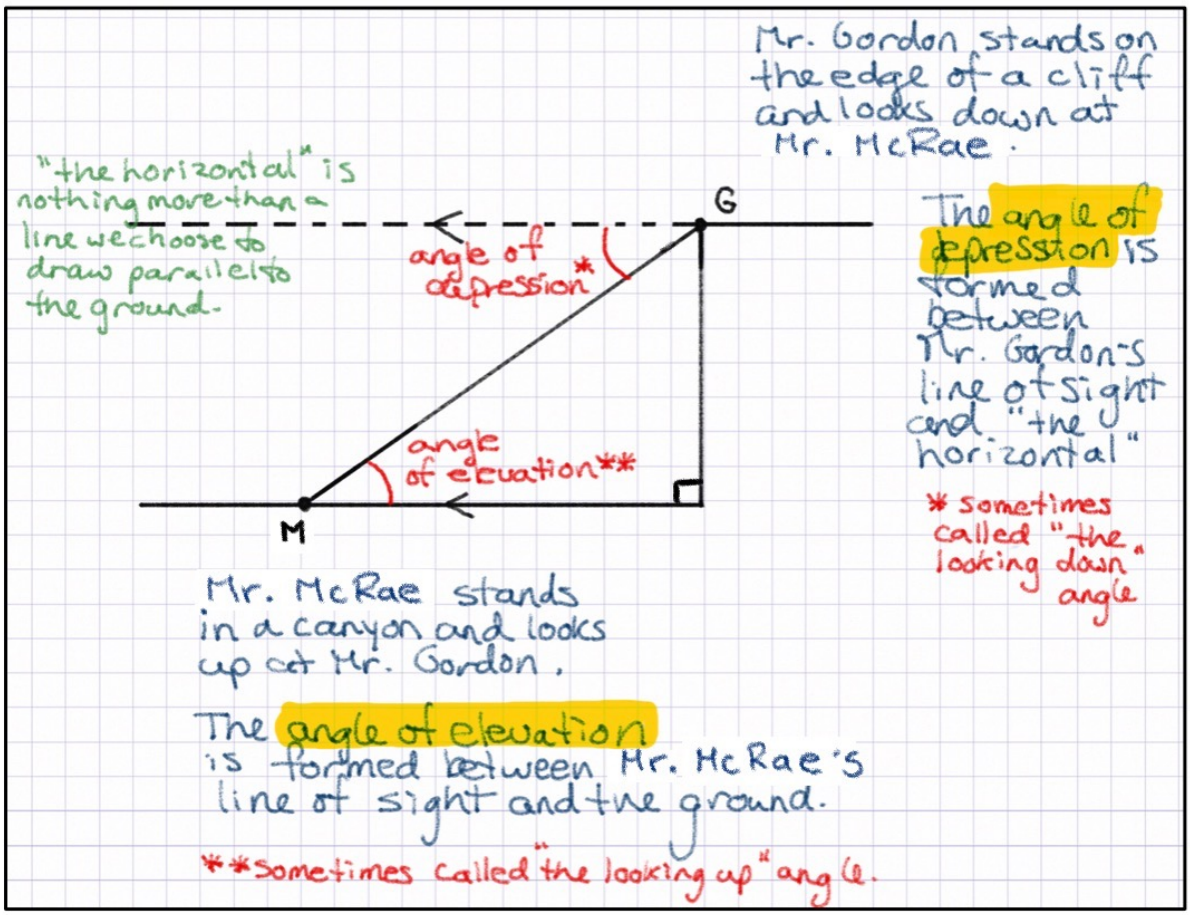
Terminology

NOTE

In some trigonometry questions, you will encounter the terms *angle of elevation* and *angle of depression*. Consider the example at right for an explanation.

Whenever you encounter the terms *angle of elevation* and *angle of depression* the same diagram shape holds true.

Also note that since “the horizontal” (the dotted line) is parallel to the ground, it means that the two angles are equal (by “Z” pattern or alternate angles).

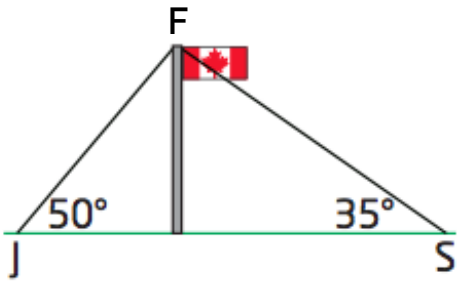


Opportunity to Learn

1. Jack and Sangita are facing each other on opposite sides of a flagpole.

   Two guy wires (wires that support the flagpole) extend from Jack and Sangita's positions, respectively, to the top of the flagpole.

   If Jack is standing 8.3 metres from the base of the flagpole, how long is each guy wire?



2. A special type of aircraft is designed to fly at the very low height of 20 m. To measure such a small altitude, two spotlights are mounted on the aircraft:

   - one on the nose, pointing straight down
   - another mounted on the tail of the aircraft, 10 m away

   Find the angle at which the second light needs to be set, with respect to the body of the aircraft, so that the beams will meet 20 m below the aircraft.

3. Theresa and Branko are competing in a series of outdoor challenges that will eventually lead them to a hidden treasure. Each clue they find helps them find a new clue. Theresa is getting ready to climb a steep cliff to find their next clue at the Lookout Point. She has two options:

   - Option A: Climb straight up the cliff, and then jog over to Lookout Point.
   - Option B: Climb directly to Lookout Point along the diagonal shown.

   She is awaiting instructions from Branko, who is positioned directly facing Lookout Point at a distance of 30 m from the base of the cliff.

   From Branko's point of view, Lookout Point is at an angle of elevation of 68°. He also observes that the diagonal path up the cliff makes a 73° angle with the ground. Branko knows that Theresa can climb at a speed of 1.0 m/s and jog at a speed of 5.0 m/s after a climb.

   It is a tight race and seconds count.

   Which option should Branko tell Theresa to take: A or B?