Grade 7/8 Math Circles

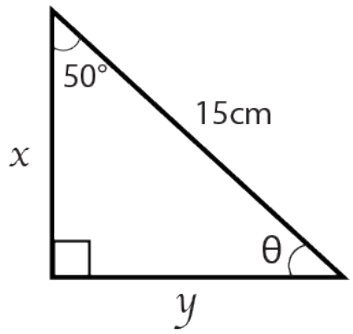
March 20/21/22/23, 2023

Trigonometry - Problem Set

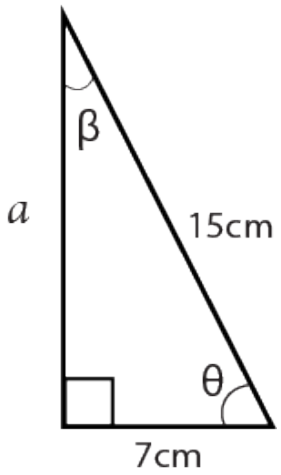
1. Determine the value of the following trigonometric ratios. Round to four decimal places.
   (a) $\sin\theta, \cos\theta$ if $\theta = 180°$
   (b) $\tan\theta, \cos\theta$ if $\theta = 225°$
   (c) $\sin\theta, \csc\theta$ if $\theta = 15°$
   (d) $\cot\theta, \sec\theta$ if $\theta = 98°$

2. Determine θ given the following trigonometric ratios using a calculator. Round to two decimal places.
   (a) $\sin\theta = 0.9659$
   (b) $\tan\theta = -3.7321$
   (c) $\sec\theta = -1.0642$
   (d) $\cos\theta = 1$

3. Solving for any missing angles and/or side lengths:
   (a) Triangle 1



(b) Triangle 2

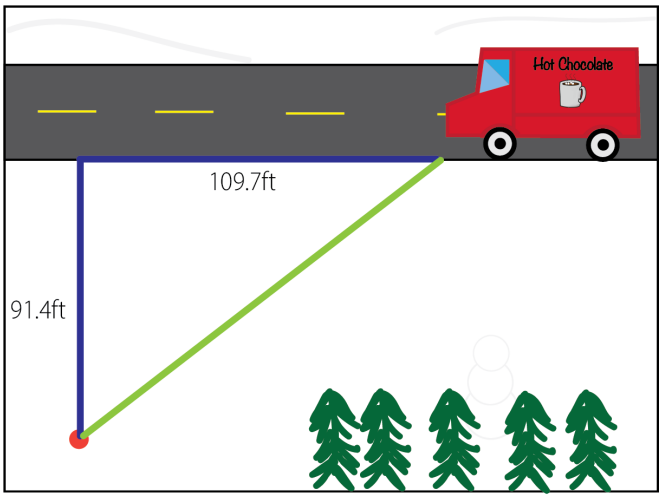


4. A few math students want to get to the top of MC, which is 20 meters tall.

   (a) If they have a ladder that is 30 meters long how far do they need to place it from the base of the building? Round your answer to two decimal places.

   (b) Draw a diagram representing this problem. Given your answer in part (a), determine the measure of the two missing angles in your diagram. Round your answer to the nearest hundredth of a degree.

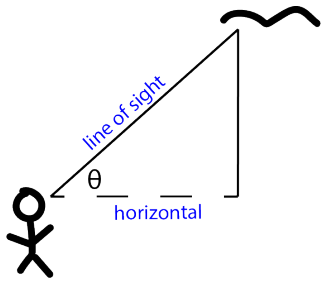
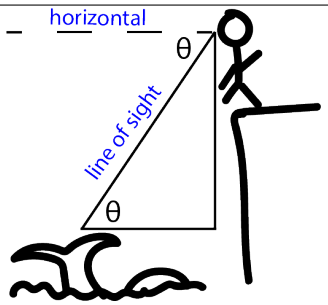
5. Two friends, Charlie and Daniel, are playing in the snow. They decide to go and get hot chocolate, but take different paths to get to the Hot Chocolate Truck. Charlie thinks it will be faster if he goes to the road in a straight line and then walks along the road to the truck. Daniel thinks it will be faster if he cuts diagonally through the snow.



(a) Looking only at the distance, who will get to the Hot Chocolate Truck faster?

(b) If the speed of walking through the snow is 1.5ft/second and the speed of walking on the road is 5ft/second, does your answer to part (a) change?

6. In this word problem we will be looking at **angles of elevation** and **angles of depression**, which are angles between a person's line of sight and the horizontal line (from where they are). It works the same if you have an object instead of a person.

Angle of Elevation	Angle of Depression
Angle measured *above* the horizontal	Angle measured *below* the horizontal
	

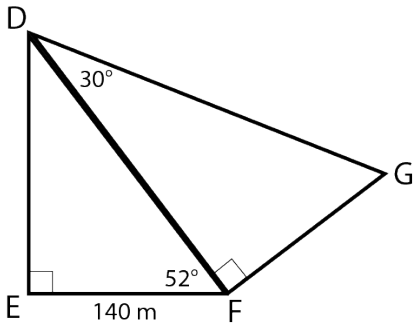
A cliff is 72 m high, and a boat travelling towards the cliff is 80 m from the base of the cliff.

(a) Determine the angle of depression from the cliff to the boat, to the nearest tenth of a degree.

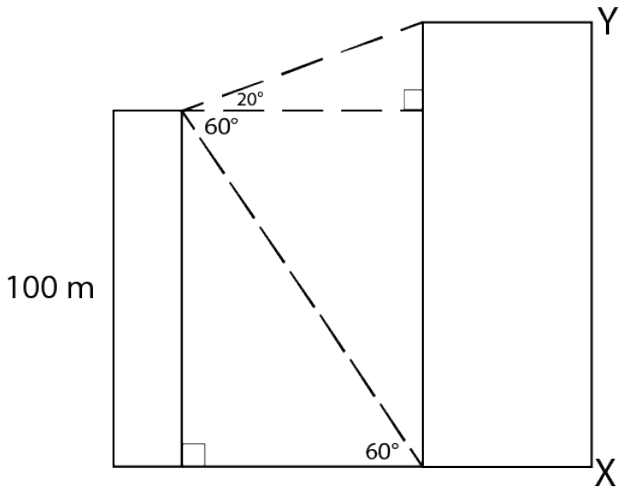
(b) If the angle of depression from the cliff to the boat had to be 50°, how much closer would the boat have to move towards the cliff? Round your answer to the nearest tenth of a meter.

7. Find the length of the following to the nearest tenth of a meter:

(a) Side DG of this shape:



(b) Side XY of this shape:



8. Prove the following:

(a) $\sin\theta = \cos\theta \tan\theta$

(b) $\sin\theta \tan\theta + \cos\theta = \frac{1}{\cos\theta}$

(c) $\frac{1}{\cos^2\theta} = \tan^2\theta + 1$