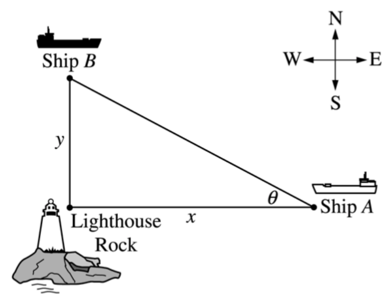
Extra Practice on Related Rates

1. Sand pouring from a chute forms a conical pile whose height is always equal to the diameter. If the height increases at a constant rate of 5 feet per minute, at what rate is sand pouring from the chute when the pile is 10 feet high?

2. A conical water tank with vertex down has a radius of 10 feet at the top and is 24 feet high. If water flows into the tank at a rate of 20 cubic feet per minute, how fast is the depth of the water increasing when the water is 16 feet deep?

3. A 10-foot plank is leaning against a wall. If at a certain instant the bottom of the plank is 2 feet from the wall and is being pushed toward the wall at a rate of 6 inches per second, how fast is the acute angle that the plank makes with the ground increasing?

4. Ship A is traveling due west toward Lighthouse Rock at a speed of 15 kilometers per hour (km/hr). Ship B is traveling due north away from Lighthouse Rock at a speed of 10 km/hr. Let x be the distance between Ship A and Lighthouse Rock at time t, and let y be the distance between Ship B and Lighthouse Rock at time t, as shown in the figure above.



   (a) Find the distance, in kilometers, between Ship A and Ship B when $x = 4$ km and $y = 3$ km.

   (b) Find the rate of change, in km/hr, of the distance between the two ships when $x = 4$ km and $y = 3$ km.

   (c) Let θ be the angle shown in the figure. Find the rate of change of θ, in radians per hour, when $x = 4$ km and $y = 3$ km.

Answers:

1. 125π ft^3 / min 2. $\dfrac{9}{20\pi}$ ft / min 3. $\dfrac{\sqrt{6}}{48}$ radian / sec

4. (a) 5 km (b) -6 km / hr (c) $\dfrac{17}{5}$ radians / hr