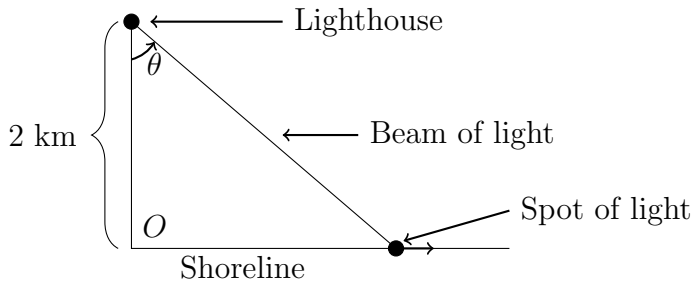
Questions

1. The sun is setting. The angle of its elevation is decreasing at $\frac{\pi}{4}$ radians per hour. How fast is the shadow cast by a building of height 50 meters lengthening, when the angle of elevation of the sun is $\frac{\pi}{6}$? (Hint: draw a picture!)

2. (Textbook, Section 4.6, qn 52) A lighthouse is 2km from the long, straight shore of a coastline, as shown in the picture below.



(a) Find the rate of change of the distance of the spot of light from the point O with respect to the angle θ.

(b) Find the rate of change the distance of the spot of light from O with respect to the angle θ in each of the following cases. Convert your answers to meters per degree.

i. When the angle θ is $\frac{\pi}{6}$.

ii. When the distance of the spot of light from O is 4 km. (Hint: you do *not* need to find the value of the angle θ! Use a trig identity instead!)

3. A revolving beacon in a lighthouse makes one revolution every 15 seconds. The beacon is 200 ft away from the nearest point P on a straight shoreline.

   (a) Find the rate at which the beacon revolves in radians per second. (No calculus here!)

   (b) Find the rate at which a ray of light from the lighthouse moves along the shore at a point 400 ft from P along the shoreline. Draw a picture first!

   (Note: the picture is quite similar to the one in question 2 but while there, you were finding $\frac{dx}{d\theta}$, here you're trying find $\frac{dx}{dt}$.)

4. (Textbook, Section 4.6, qn 51) A train is moving East at 0.8 km/min along a long straight track. A movie camera, 0.5km to the South of the track, is focused on the train. Let the distance from the camera to the front of the train be z km. Let the distance from the nearest point to the camera on the track to the front of the train be x km.

   (a) Draw a well-labeled picture of this situation.

   (b) How fast is the camera rotating when the train is 1 km from the camera?