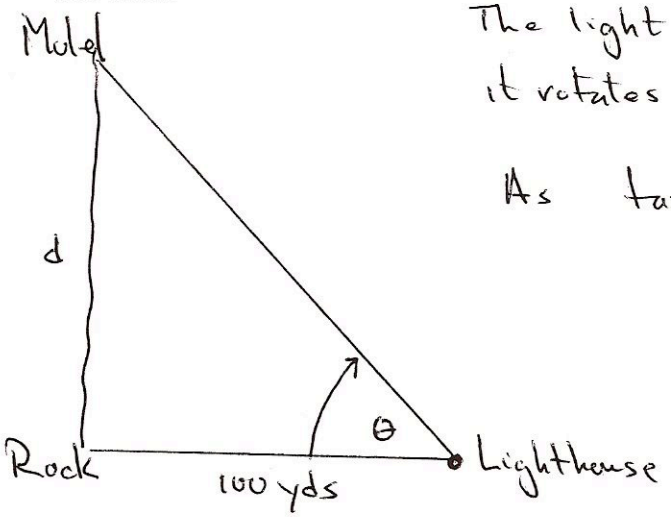
NAME: Solution

HOMEWORK FOR WORKSHEET 3 MATH 1300 DUE February 1, 2008

1. A lighthouse stands 100 yards offshore; on the shore at the spot closest to the lighthouse sits the notorious mermaid rock. Due north of mermaid rock is the exclusive That's-No-Mermaid-It's-A-Whale Motel. The lighthouse light rotates twice a minute. If the beam of light from the lighthouse takes 5 seconds to travel along the shore from mermaid rock to the motel, how far is the motel from the rock?

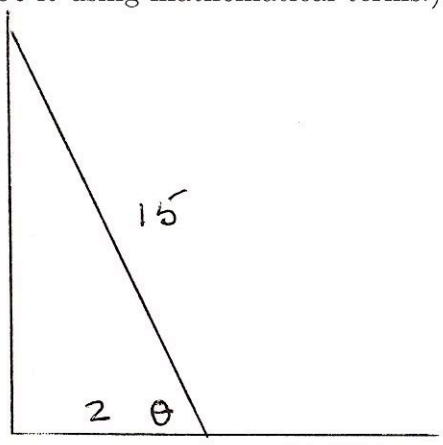


The light rotates 720°/minute, so in 5 seconds it rotates $\frac{720}{12} = 60^\circ$. Therefore $\theta = 60^\circ$.

As $\tan 60^\circ = \sqrt{3} = \frac{d}{100}$ we have

$d = 100\sqrt{3}$ yds.

2. A 15-foot long ladder is leaning against a wall with its base 2 feet from the wall. What can you say about the angle the ladder makes with the floor? (If you cannot calculate the angle at least describe it using mathematical terms.)



(Not to scale)

θ is the angle having

$\cos\theta = \frac{2}{15}$

In other words (symbols)

$\theta = \cos^{-1}\left(\frac{2}{15}\right)$

or

$\theta = \arccos\left(\frac{2}{15}\right)$

3. The bottom of the ladder in problem 2 starts to slide away from the wall at the constant rate of 1 foot per second.

a. When will the ladder make a 60° angle with the ground?

$\theta = 60^\circ$ when $\cos\theta = \frac{1}{2}$.

So $\frac{\text{distance to wall}}{15} = \frac{1}{2} \Rightarrow$ distance to wall $= 7\frac{1}{2}$ ft

This take $5\frac{1}{2}$ seconds.

a. When will the ladder make a 45° angle with the ground?

$\theta = 45^\circ$ when $\cos\theta = \frac{\sqrt{2}}{2}$

So $\frac{\text{distance to wall}}{15} = \frac{\sqrt{2}}{2} \Rightarrow$ distance to wall $= 7.5\sqrt{2}$ ft

This take $7.5\sqrt{2} - 2$ seconds (or about 8.6 seconds)