**4.8 Applications and Models**

**Objective: To Solve Real Life Problems Involving Right Triangles and Harmonic Motion**

**Example: (exactly on test, skip in notes unless they ask for more)**

A safety regulation states that the max angle of elevation for a rescue ladder is . A fire department’s longest ladder is 110 feet. There is a cat that needs to be rescued from a tree, and the cat is 105 feet off the ground. Are they able to successfully rescue the cat or do they need to find another ladder?

***So the max height it can reach is not high enough to get to the cat, so unless maybe a tall firefighter can reach the cat from the top of the ladder they’ll need to find a slightly longer ladder.***

**Example:**



You are standing about 600 feet from the state capital. The angle of elevation to the top of the dome (base of the podium of the sower) is . How tall is the sower (with podium included) if the angle of elevation to the top of the sower’s head is ?



**Definition of Simple Harmonic Motion**

A point that moves on a coordinate line is said to be simple harmonic motion if its distance, d, from the origin at the time, t, is given by either:

Where a and are real numbers such that . The motion has amplitude of |a|, period , and frequency

Amplitude = maximum displacement from equilibrium

Period = time for one complete cycle

Frequency = number of cycles per second

[page 354 for visual]

**Example:**

A ball is bouncing up and down on a spring. Suppose that 12 inches is the max distance the ball moves vertically (up or down) from its equilibrium (rest) position. Suppose the time it takes for the ball to move from its max displacement (above zero) to its min displacement (below zero) is 6 seconds.

Assuming perfect elasticity, no friction, and no air resistance, the ball would continue to move in a uniform motion. Find the amplitude, period, and frequency.

Amplitude = |12| = **12**

Period = 6 seconds 🡪 period

Frequency = cycles per second

**Example:**

**Given the equation for simple harmonic motion:**

Find the maximum displacement, frequency, the value of d when t = 9,

and the least positive value of t for which d = 0

Maximum Displacement

**Given by the amplitude which is 4**

**-or-**

**Graph: find the max (from y = 0 🡪 equilibrium)**

Frequency

**-or-**

**Graph: time to complete one cycle**

Value of d when t = 9

**-or-**

**Trace to t = 9**

Least positive value of t for which d = 0

sin is 0 at 0,

so 0, solve for t… 0,

Therefore the least is 0.

-or-

Use the Root button

**Homework**

Pg 357 #5, 17, 19, 21, 24, 33, 51, 54-56, 62-63