Instructions
The following questions use the same skills as the basic assignment. However, you might not be told explicitly which rate of change to compute. You have to determine this from the wording of each problem.

1. Question Details
Water is poured into a conical tank at a constant rate of 8 cubic feet per minute. The tank is 12 feet deep and has a radius of 4 feet at the top as shown. The shaded region is the water. Its volume is

\[ V = \frac{1}{27} \pi h^3 \]

At the instant when \( h = 7.0 \) feet, how quickly is the height of the water increasing? Round your answer to two decimal places.

2. Question Details
A driveway perpendicular to a highway leads to a farmhouse located 0.6 km away.

An automobile travels past the farmhouse at a rate of 55 km/h. The distance the automobile has moved past the driveway, \( x \), and the angle between the road and the line of sight between a farmer at the house and the car, \( \theta \), are related by

\[ x = 0.6 \tan(\theta) \]

How quickly is the farmer turning his head when the automobile is 4.4 km past the intersection of the highway and the driveway? Round your answer to two decimal places and use correct units.
3. Question Details

The speed of sound, \( v \), in air is a function of the temperature, \( T \), of the air:

\[
v = 331.4 + 0.6(T - 273)
\]

with \( v \) in meters per second and \( T \) in kelvins (WebAssign abbreviation K).

Suppose the rate of change of air temperature is -0.11 K/min.

1. Find the rate of change of the speed of sound with respect to time.

2. Find the rate of change of the speed of sound with respect to temperature.

Give exact answers with correct units.

4. Question Details

For a falling object, the total energy (kinetic plus potential) is always constant. The formula for this is:

\[
\frac{1}{2}mv^2 + mgh = E
\]

1. \( m \) is the object's mass. Constant.
2. \( g = 9.81 \text{ m/s}^2 \). Constant.
3. \( h \) is the object's height, a function of time, \( t \).
4. \( v \) is the object's velocity, a function of time, \( t \).
5. \( E \) is total energy. Constant.

Compute \( \frac{d}{dt} \) of both sides of the total energy equation.

Use the fact that \( \frac{dh}{dt} = v \) to find the rate of change of velocity.

Be accurate to 2 decimal places and include correct units.

\[
\frac{dv}{dt} = \boxed{\text{ }}
\]

5. Question Details

Suppose that \( x^2 + y^2 = 100 \). In this problem:

- \( y \) measures the height of an object in feet.
- \( x \) measures the position of a second object in feet.
- \( x \) and \( y \) are both positive.
- \( t \) is time in seconds.
- \( \frac{d^2x}{dt^2} = -2 \text{ ft/s}^2 \).

Find \( \frac{d^2y}{dt^2} \) when \( y = 5 \text{ ft} \) and \( \frac{dx}{dt} = 1.5 \text{ ft/s} \).

**Hint:** You can find values for \( x \) and \( \frac{dy}{dt} \) in your solution for Problem 1 from 8-1 Basic Hw.

Be accurate to 2 decimal places and include correct units.

\[
\boxed{\text{ }}
\]
Code: Yes
Author: Velasquez, Elena (elenavelasquez@boisestate.edu)
Last Saved: Aug 15, 2017 10:56 AM MDT
Group: BSU Calculus
Randomization: Person
Which graded: Last