NAME ________________ Solutions

Time: 10 minutes

Instructions. This quiz will be graded for accuracy, out of 10 points. Calculators, books, notes and suchlike aides to gracious living are not permitted. Make sure to show all your work for full credit.

Only ONE problem will be graded. Circle the problem you want graded below:

**Problem A**

1. (Problem A) A spherical balloon is being inflated so that its diameter is increasing at a constant rate of 2 cm/min. How quickly is the volume of the balloon increasing when the diameter is 10 cm? \( V = \frac{4}{3} \pi r^3 \)

\[ D = \text{diameter} \]
\[ r = \text{radius} \]
\[ V = \text{volume} \]

\[ V = \frac{4}{3} \pi r^3 \]

\[ V = \frac{4}{3} \pi \left( \frac{1}{2} D \right)^3 \]

\[ V = \frac{\pi}{6} D^3 \]

\[ \frac{dV}{dt} = \frac{4}{3} \pi D^2 \cdot \frac{dD}{dt} \]

\[ \frac{dV}{dt} = \frac{\pi}{2} \cdot (10)^2 \cdot (2) = 100 \pi \text{ cm}^3/\text{min} \]
2. **(Problem B)** A ladder 10 feet long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 1.5 feet per second, how quickly in radians per second is the angle between the ladder and the wall increasing when the bottom of the ladder is 8 feet from the wall?

\[
\text{Know: } \frac{dx}{dt} = 1.5 \text{ ft/sec}
\]

\[
\text{Want: } \frac{d\theta}{dt} \text{ when } x = 8
\]

\[
\sin(\theta) = \frac{x}{10}
\]

\[
\frac{d}{dt} \left( \sin(\theta) \right) = \frac{d}{dt} \left( \frac{x}{10} \right)
\]

\[
\cos \theta \cdot \frac{d\theta}{dt} = \frac{1}{10} \cdot \frac{dx}{dt}
\]

\[
\frac{d\theta}{dt} = \frac{1/10 \cdot \frac{dx}{dt}}{\cos \theta} = \frac{1/10 \cdot (1.5)}{6/10} = \frac{1}{4} \text{ rad/sec}
\]

**What is \( \cos \theta \) when \( x = 8 \)?**

\[
\theta
\]

\[
\cos \theta = \frac{6}{10}
\]

Pythagorean Triple