

Worksheet 2 Solution - Math 165

Name: _____

Show all work to receive credit for each problem. All work must be *organized* and *legible*. Give exact answers, not decimal approximations. This assignment is worth 10 points and is due **Monday, February 12** in class.

1. Find $\frac{d^2p}{dt^2}$ if $p = \tan^2(7t)$.

$$\begin{aligned}\text{Solution: } \frac{dp}{dt} &= 14 \tan(7t) \sec^2(7t) \\ \Rightarrow \frac{d^2p}{dt^2} &= 98 \sec^2(7t) \sec^2(7t) + 98 \tan(7t)(2 \sec(7t) \tan(7t) \sec(7t)) \\ &= 98(\sec^4(7t) + 2 \tan^2(7t) \sec^2(7t))\end{aligned}$$

2. Find the equation of the tangent line to the curve $x^2y + \sin(y) = 2\pi$ at the point $(1, 2\pi)$.

$$\text{Solution: } \frac{dy}{dx} = \frac{-2xy}{x^2 + \cos(y)} \Rightarrow m = \frac{-4\pi}{2} = -2\pi \Rightarrow y - 2\pi = -2\pi(x - 1)$$

3. Assume $\frac{ds}{dx} = -2$, $\frac{dr}{ds} = -1$, $\frac{dp}{dt} = 3$, and $\frac{dx}{dt} = 4$. Calculate $\frac{dr}{dt}$.

$$\text{Solution: } \frac{dr}{dt} = \frac{dr}{ds} \frac{ds}{dx} \frac{dx}{dt} = 8$$

4. An object moves along a line with position $s(t) = \frac{1}{12}t^4 - t^3 + 4t^2 + t - \frac{4}{3}$ at time t seconds. Determine the velocity of the object at all times when its *acceleration* is zero.

$$\begin{aligned}\text{Solution: } s'(t) &= \frac{1}{3}t^3 - 3t^2 + 8t + 1 \Rightarrow s''(t) = t^2 - 6t + 8 = (t-4)(t-2) = 0 \Rightarrow t = 2 \\ \text{or } t &= 4, \text{ and } s'(2) = \frac{23}{3}, s'(4) = \frac{19}{3}\end{aligned}$$