Math 111 EXAM II, Spring, 2022

Read each problem carefully. Show all your work for each problem! No Calculators! For tangent lines, both point-slope and slope-intercept forms are acceptable.

1. (14) Find dy/dx for the following:

$$(a)\ \ y = 1 + \sqrt{x} + x^3 \qquad (b)\ \ y = \sec(x^2)\tan(x^2).$$

2. (a) (7) Find the second derivative of $y = \ln\left(\frac{2}{e^{x^2}}\right)$.

   (b) (7) Let $f(x) = x^3 + x^5,\ x > 0$. Find the value of df^{-1}/dx at $x = 2 = f(1)$.

3. (a) (8) Find the slope of the curve $x^2y = y^3 + 3$ at the point (2, 1).

   (b) (8) Find dy/dx

$$y = \frac{1 - \cos(2x)}{1 + \cos(2x)}$$

4. (a) (8) At time $t \geq 0$, the position of a body moving along the s-axis is $s = 3 - 2t + e^t$. Determine the time when the body changes direction. What are the body's position and acceleration at this time?

   (b) (8) Find dy/dx and simplify your expression:

$$y = \arcsin(x) + \arcsin(\sqrt{1 - x^2}), \quad (x > 0).$$

5. (a) (8) Find $y'(x)$:

$$y = \arctan(2^x).$$

   (b) (8) Find the equation of the tangent line to the curve $x^y = e^x$ at $x = e$.

6. (a) (7) Suppose $u(x)$ is differentiable at $x = 3$ and $u(3) = 9, u'(3) = -4$. Find the following derivative at $x = 3$.

$$\frac{d}{dx}\left(x^2\sqrt{u}\right)$$

   (b) (7) Find all points (x, y) on the graph of $y = x/(x - 4)$ with tangent lines perpendicular to the line $y = 4x + 3$.

7. (10) The area of an expanding circle is increasing at a rate of 12 in^2/s. How fast is the radius increasing when the circumference is 4 in?