

Discussion Problems 5 (Tue., Feb. 20)

1. Find the equation of the tangent line to the graph of the function $y = f(x)$ at the point $(1, 0)$ if the function satisfies the equation

$$x \cdot f(x)^2 + \ln(x + f(x)) = x^3 - \cos(xf(x))$$

2. Differentiate: (a) $f(x) = \frac{\arctan x}{\ln(3x + 1)}$, (b) $f(x) = \arctan((\sin x)^{1/3})$.
3. A 6 ft. tall woman is walking towards a 15 ft. streetlight. At one instant, she is 10 ft. from the base of the streetlight and is walking at the speed of 2 ft./sec. How fast is the length of her shadow changing at that instant?
4. Car B is 30 miles directly East of Car A, and begins moving West at 90 mph. At the same time, Car A begins moving North at 60 mph. At what rate is the distance between them changing after $t = \frac{1}{5}$ hours? After $t = \frac{1}{3}$ hours?
5. A rectangular reservoir has a $10\text{m} \times 10\text{m}$ base and height 3m. A reservoir in the shape of inverted cone has height 10m and radius of the base 5m. Water is flowing from the square reservoir into the conical one. Initially, the square reservoir is full and the conical empty. At one point, the level of water in the conical reservoir is measured to be 2m and is increasing at the rate of 1m/sec. Find the rate at which the water is decreasing in the rectangular reservoir.
6. Assume that a baseball is projected directly upward from the ground with an initial velocity of 112 ft/s. Assuming acceleration due to gravity is -32 ft/sec^2 , write the equation for the height of the ball above ground after t seconds. In how many seconds does the ball strike the ground?