MATH 144 Exam 02. Spring 2024

Please work each question completely, on your own, showing all necessary steps.

1. (10 pt) $f(x) = \dfrac{12x^{100}}{4x^{99}} 2^x \ln(\csc(x))$

   $f'(x) =$

2. (10 pt) $f(x) = \arcsin\left(\dfrac{\cos(x)}{x^2}\right)$

   $f'(x) =$

3. (10 pt) $f(x) = e^{\sec^2(\ln(|x|)\cdot x^2)}$

$f'(x) =$

4. (15 pt) $f(x) = \sqrt{3x^4 - 2x^2 + \sin^2\left(\dfrac{x^3 - 3x + 1}{x - 2}\right)}$

$f'(x) =$

5. (15 pt) Maria brings a cup of coffee to Calculus class. She accidentally knocks it over in excitement for understanding the chain rule (understandable). The coffee is pooling in a perfect disk whose surface area is expanding at a rate of $2\frac{\text{cm}^2}{\text{sec}}$. At what rate is the radius of the disk changing when the surface area of the spilled coffee is 7 cm^2?

6. (15 pt) Two people are at an elevator. At the same time one person starts to walk away from the elevator at a rate of 2 ft/sec and the other person starts going up in the elevator at a rate of 7 ft/sec. What rate is the distance between the two people changing 15 seconds later?

Bonus ≤ 5

Suppose that $x = x(t),\ y = y(t)$ are functions of time giving the position in the plane of a particle. Furthermore, you are told the x, y-coordinates of the particle are related by $3y^2 = 2x^3 + 44xy + 1$. If x is increasing with respect to time within the first 2 seconds of measurement, is $\frac{dy}{dt}$ greater than or less than $\frac{dx}{dt}$ the point (1,1)? Show all of the calculus supporting your answer.