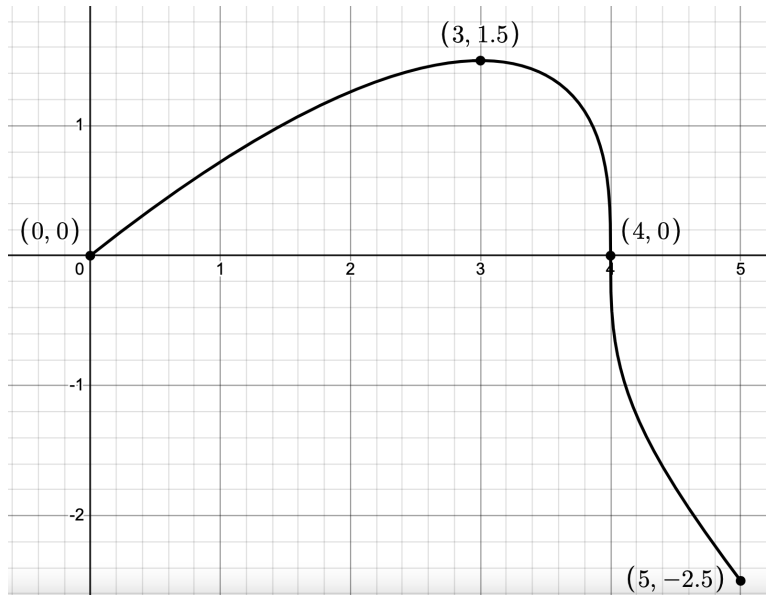


MATH 2500: TEST 02 (100 points.)

NAME: _____

DIRECTIONS: To receive full credit, make sure your work is neat and complete.

1. Use the graph of $y = f(x)$ below to answer the following questions and explain your reasoning.



- (a) Where is $f(x) = 0$? Explain.
- (b) Where is $f'(x) = 0$? Explain.
- (c) What kind of tangent line does the graph appear to have at $(4, 0)$?
- (d) Is f differentiable at $x = 4$? Explain.

2. Let $f(x) = \sqrt{3x - 5}$.

(a) Use the limit definition of derivative: $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ to find a formula for $f'(x)$.

(b) Check your answer to part (a) using the derivative properties developed in class.

(c) Use part (a) to help you find the equation of the tangent line to $y = f(x)$ at $(3, 2)$.

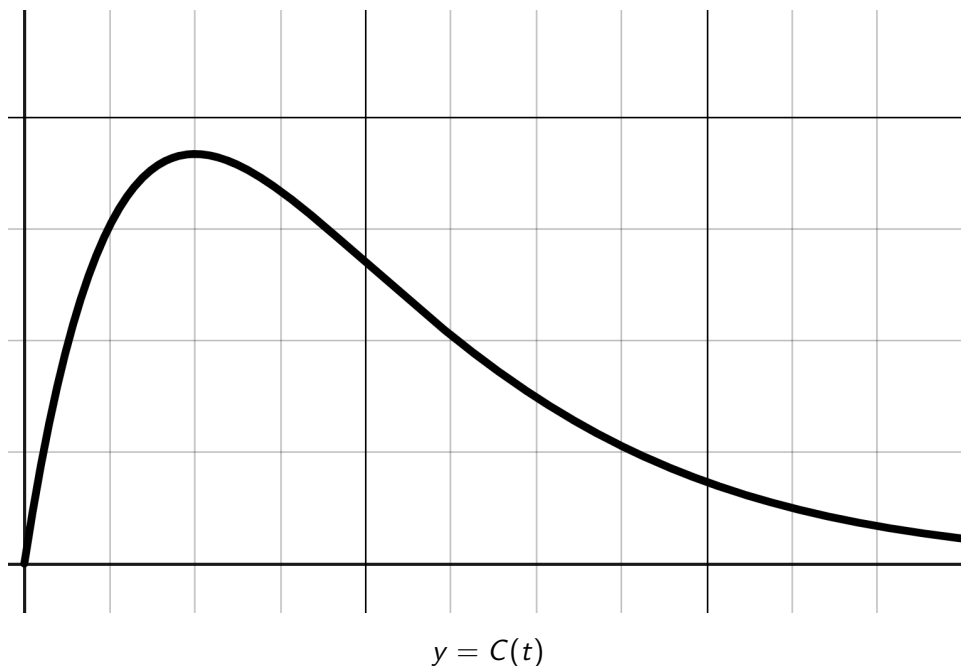
3. Find and simplify the indicated derivatives.

(a) For $f(x) = \frac{3x}{x^2 - 1}$, find $f'(x)$.

(b) For $y = \frac{8}{\sqrt[4]{2t+1}}$, find $\frac{dy}{dt}$.

(c) $D_\theta^2 [\sec(2\theta)]$

4. The graph of the function C below plots the concentration of a medication in blood plasma t hours after the medication is administered to the patient.



- (a) On the graph, indicate where $C'(t) = 0$.

What is the significance of this point in terms of concentration and time?

- (b) When does the concentration seem to be increasing the fastest? Explain using the graph.

- (c) What appears to be $\lim_{t \rightarrow \infty} C(t)$? What does this mean in terms of time and concentration?

5. Suppose a ball is thrown into the air and its height off of the ground $s(t)$, in feet, t seconds after it is tossed into the air is given by: $s(t) = -16t^2 + 64t$.

(a) Find expressions for the velocity of the ball, $v(t)$, and the acceleration of the ball, $a(t)$.

(b) i. Find $v(1)$ and $a(1)$.

ii. Is the ball speeding up or slowing down when $t = 1$? Explain.

(c) How fast is the ball traveling when it strikes the ground?

6. Let C be the graph of the equation: $x^{2/3} + y^{2/3} = 2$.

(a) Use implicit differentiation to find and simplify an expression for $\frac{dy}{dx}$ in terms of x and y .

(b) Find the equation of the tangent line at $(x, y) = (1, -1)$.

7. A cylindrical water tank has a height of 49.25 inches and a base **diameter** of 23 inches. If water is discharged at a rate of 1.2 gallons per minute, find the rate at which the height of the water inside the water heater is falling, in inches per minute, rounded to three decimal places. Recall: the volume V of a cylinder with height h and base **radius** r is: $V = \pi r^2 h$ and there are 231 cubic inches in a gallon.

HINT: Make sure to sketch the situation and identify what and what is not changing with time ...