

Midterm Exam #2

Math 273

April 10, 2003

Name _____

Do all of your work on the blank paper provided. At the end of the exam, hand in your answers with this cover sheet. Include your name on all pages of your exam.

§1 Calculation

1. Differentiate

a. $f(x) = e^2 + e^x + \sin x + \ln x + \sin^{-1} x$

b. $f(x) = x^2 \sin x$

c. $f(x) = \frac{x^2 + 4x + 3}{\cos x}$

2. Differentiate

a. $f(x) = \tan^2(\cos 2x)$

b. $f(x) = \sqrt{x + \sqrt{x + \sqrt{x}}}$

c. $f(x) = x^x$

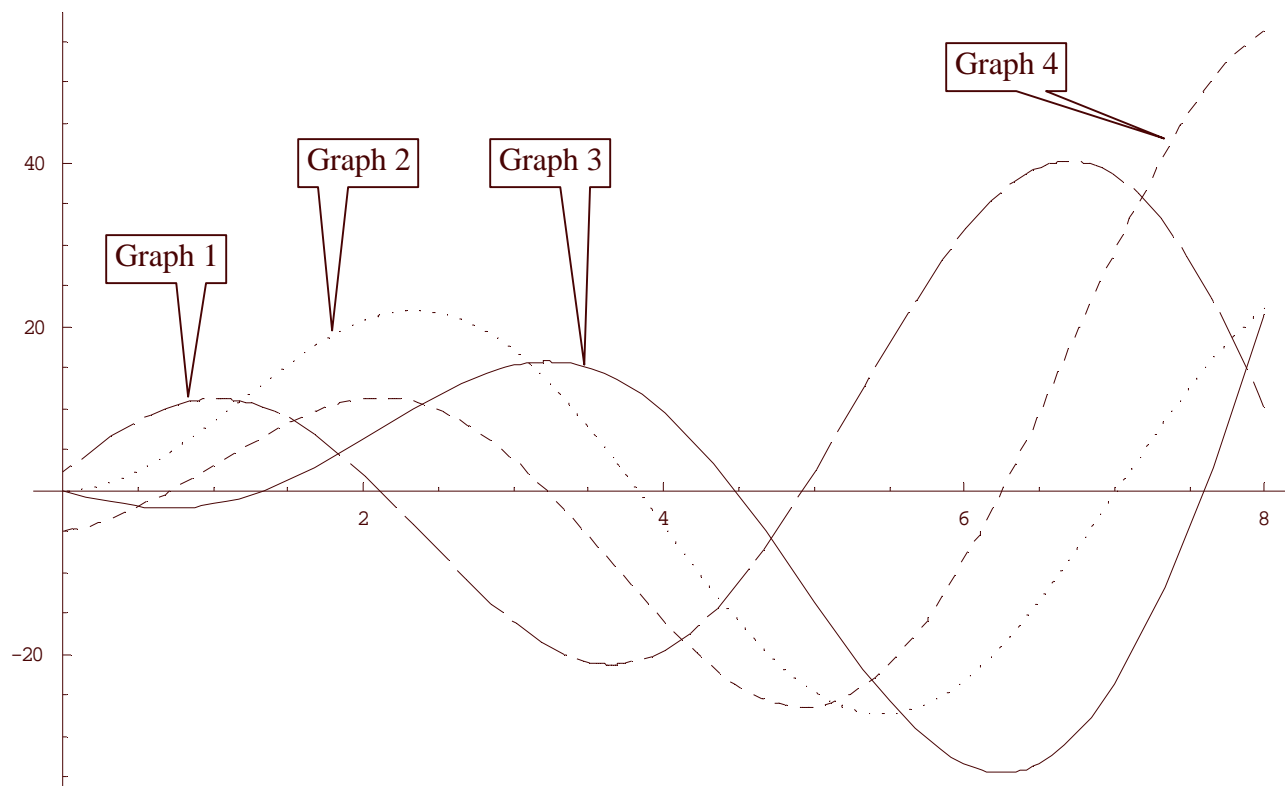
3. Find the equation of the tangent line to $y = \frac{8}{\sqrt{4+3x}}$ at $(4, 2)$.

4. Find the equation of the tangent line to $y^2 = x^3(2-x)$ at $(1, 1)$.

§2 Comprehension

5. What is the precise definition of the derivative of a function? Give two interpretations of the derivative.
6. Is every differentiable function continuous? If this is true, prove it; if not, then provide a counterexample. Is every continuous function differentiable? If this is true, prove it; if not, then provide a counterexample.

7. Below are the graphs of a function $f(x)$, its derivatives $f'(x)$, $f''(x)$, and the function $g(x)$. Identify each.



§3 Application

8. The position of a particle is given by the equation $s(t) = t^3 - 6t^2 + 9t$, where the time t is measured in seconds, and the position s is measured in meters.
- What is the velocity at time t ?
 - When is the particle at rest?
 - When is the particle moving forward?
 - What is the total distance the particle travels during the first five seconds?
9. A ladder 10 feet long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 2 feet per second, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is six feet from the wall?
10. A runner runs around a circular track of radius 300 ft at a constant speed of 20 ft/s. The runner's friend is 500 ft from the center of the track. How fast is the distance between the friends changing when they are 400 feet apart?