

GUIDELINES FOR PREPARING FOR SCC's MAT220 GATEWAY EXAM

The Gateway Exam for MAT220 contains problems from the following list of topics.

- I. Rules for differentiation for any function.
- II. Differentiation that focuses on algebraic simplification/manipulation.
- III. Use the formal definition of the derivative (as the limit of a difference quotient) to obtain the derivative for polynomial, rational, and radical (square root) functions.
- IV. Find equation of a tangent line/local linearization.
- V. Numerical estimates of the derivative: using tabular data for a function or using a function whose derivative is not easily evaluated.
- VI. Given a graph of f , discuss characteristics of the first and second derivative of a function, f , such as intervals where $f' > 0$, $f' < 0$, and points where $f' = 0$ or f' DNE. Extend same ideas to f'' also.
- VII. Interpretation of meaning and notation for f , and its first and second derivative.

The Gateway Exam is a pencil & paper proficiency exam covering major topics in the MAT220 Calculus & Analytical Geometry classes at Scottsdale Community College. **No calculator or any other resource may be used on the exam.** Students must show all appropriate work and give answers containing exact quantities.

THE GATEWAY EXAM WILL BE GIVEN IN CLASS ON 3/28/12

- 1) Given the function $f(x)$, **use derivative rules** to find $f'(x)$. You need **not** simplify your answer.

$$f(x) = (x^2 + 2x + 3) e^{2x}$$

- 2) $f(x) = kx^5 + \tan(x) - 2e^x + k$. Find $f'(x)$ (k is a constant). You need **not** simplify your answer.

- 3) $f(x) = \frac{3x^2 - 2}{x^2 + 1}$. Find $f'(x)$. You need **not** simplify your answer.

- 4) Find y' given: $y = \sqrt[3]{\cos^2 x + x^2}$. You need **not** simplify your answer.

5) Do **one** of the following. You **must show all steps**. $x > 1$.

a. Show that the derivative of $f(x) = \sqrt{\frac{x-1}{x+1}}$ is $f'(x) = \frac{1}{(x+1)\sqrt{x^2-1}}$.

b. *or* show that the derivative of $g(x) = \ln(x + \sqrt{1+x^2})$ is $g'(x) = \frac{1}{\sqrt{1+x^2}}$.

6) Use the **limit definition of the derivative** to find the derivative of the function:

$$f(x) = 7x^2 - x - 1.$$

- 7) Let L be the *tangent line* to the graph of $y = x^2 + 1$ at the point where $x = 3$. Does L pass through the point $(0, -10)$? You must provide a sound mathematical reason for your conclusion.

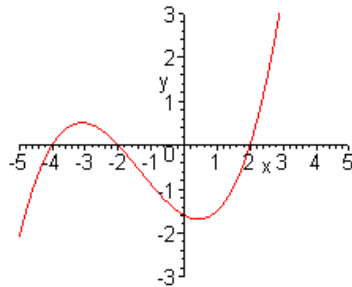
8)

Time ' t ' (seconds)	1	2	3	4	5
Position ' s ' (meters)	10	12.4	15.1	18.2	22.1

a) Estimate $s'(t)$ at $t = 3$ seconds by computing a central (symmetric) difference quotient utilizing the data above (you must **include units** for your result):

b) Estimate $s''(t)$ at $t = 3.5$ seconds by computing a central (symmetric) difference quotient utilizing the data above (you must **include units** for your result):

- 9) **Multiple Choice.** The graph of a function $f(x)$ is given below. It is known that $f(x)$ has zeros at $x = -4$, $x = -2$, and $x = 2$.
- a. Which of the following statements is supported by the graph of $f(x)$ that is given below (circle the letters of all that apply).
- A) $f(-3) = 0$ B) $f'(-3) = 0$ C) $f''(-3) = 0$ D) **None of these**
- b. Which of the following statements is most likely true about $f(x)$ given that the graph of $f(x)$ is below (circle the letters of all that apply).
- A) $f(-1) = 0$ B) $f'(-1) = 0$ C) $f''(-1) = 0$ D) $f'(2) = 0$
- c. Which of the following statements is supported by the graph of $f(x)$ that is given below (circle the letters of all that apply).
- A) $f''(-4) > 0$ B) $f''(-4) = 0$ C) $f''(-4) < 0$ D) **None of these**



- 10) Suppose that $P(x)$ represents the amount of *profit* a company will earn in millions of dollars as a function of how much money they spend on advertising x in thousands of dollars.
- a) Interpret the statement $P(34) = 12$ in the context of the problem. In your explanation use everyday language (i.e., express yourself in a way that a typical citizen would understand).
- b) Interpret the statement $P'(15) = 2$ in the context of the problem. In your explanation use everyday language (i.e., express yourself in a way that a typical citizen would understand).