- 1. For some f(x), $f'(x) = x^2 + 2x 8$. Find where f(x) is increasing and where it is decreasing.
- 2. For some f(x), $f'(x) = x^2 + 2x 8$. Find where f(x) is concave up and and where it is concave down.
- 3. For some f(x), $f'(x) = -10x^2 + 60x 50$. Find the x coordinates of all first order critical points and use the first derivative test to determine what kind of critical point at each x.
- 4. For some f(x), $f'(x) = -10x^2 + 60x 50$. Find the *x* coordinates of all first order critical points and use the second derivative test to determine what kind of critical point at each x.
- 5. Given $f(x) = (x^2 + 7x + 1) \cdot \sqrt{5x^2 + x}$ find $\frac{df}{dx}$ at x = 1.
- 6. A company estimates that the cost in dollars of producing x units of a certain product is $C(x) = \frac{x^2}{5} + 6x + 1000$. Find the production level that minimizes average cost. Hint: find average cost, find all critical numbers for average cost, use the first or 2nd derivative test to determine that the CNs correspond to a minimum.
- 7. Find the slope of the tangent line to the graph of $3xy^2 + 4y = 10$ at the point (2, 1).
- 8. Find $\frac{df}{dx}$ by using the limit definition of the derivative. $f(x) = x^2$
- 9. Find the following limits:

(a)
$$\lim_{x \to \infty} \frac{x-3}{2x^2+2x+3}$$

(b) $\lim_{x \to 3} \frac{9-x^2}{3-x}$

Find $\frac{df}{dx}$ for the following functions, **Please Do Not Simplify** answers:

- 10. $f(x) = (x^3 + x + 1)/(x^3 + 1)$
- 11. $f(x) = (x^3 + x + 1) \cdot (x^3 + 1)$
- 12. $f(x) = (x^2 + x)^{1/3}$
- 13. $f(x) = \ln(x^2 + x)$
- 14. $f(x) = e^{x^2 + x}$
- 15. Use implicit differentiation to find $\frac{dy}{dx}$ when $y^2 + x = x^2 + x^3y^4$
- 16. Use the chain rule to find $\frac{dy}{dx}$ if $y = u^3 3u^2 + 1$ and $u = x^2 + 2$
- 17. Given $f(x) = e^{2x} + ln(3x) + \sqrt{(4x+1)}$ find the differential of f(x).
- 18. Given the cost to produce one unit is 1.00 and the demand relation is given by p = 10 .1q. Find the following and **Box Your Answers**:

- profit function P(q)
- marginal profit $MP = \frac{dP}{dq}$
- find the production level that maximizes the profit by setting the slope of the profit function to zero and solving for q_{max} .
- find the price that should charged to maximize the profit p_{max} .
- find the maximum profit P_{max}
- 19. A store has been selling skateboards at the price of **\$46** per board, and at this price, skaters have been buying **66** boards a month. The owner of the store wants to raise the price and estimates that for each **\$2** increase in price, **4** fewer boards will be sold each month. Each board costs the store **\$24**.
 - (a) Find the linear demand function that gives p as a function of q, the quantity sold.
 - (b) Find the profit function as a function of \boldsymbol{q} .
 - (c) At what price p should the store sell the boards in order to maximize profit?
- 20. For $f(x) = x^3 9x^2$ find the locations of any inflection points. Use f''(x) to show that the points you found actually are inflection points.
- 21. $f(x) = (x 1)^3 + 1$ Find the location of any critical points and use the first derivative test to determine what kind of critical point.
- 22. $f(x) = \frac{x}{(x+1)^2}$ Use the second derivative test to determine what kind of critical point it has.
- 23. For $f(x) = x^4 6x^2 + 10$, use f'' determine where the graph of f(x) is concave up and where it is concave down.
- 24. For some f(x), $f'(x) = \frac{(2x-x^2)}{(x-3)}$ use f' determine where the graph of f(x) is increasing, and where it is decreasing.
- 25. Write the geneneral form of the Power Rule, Exponential Rule and Log Rule for differentiation.