Name:

MATH 192 Exam 1

Show all work to receive credit. No calculators are permitted on this exam.

1. Compute but DO NOT SIMPLIFY

a) the derivative of $3x^4 - 4x + 1$;

b) $f'(1)$ if $f(x) = \dfrac{3x^2 + 2x}{x^3 + 1}$;

c) $\dfrac{d}{dx}\left(-4\sqrt{x^3} + x^2\right)$ at $x = 1$;

d) $\dfrac{dy}{dx}$ if $y = u^3 + u$ and $u = 2 - \dfrac{1}{x}$.

2. Let $y = \frac{1}{3}x^3 - 3x + 2$.

a) Find the equation of the tangent line to the graph of f at $x = 3$.

b) Find all points at which the tangent line to the graph is horizontal.

c) Find the average rate of change of y between $y = 1$ and $y = 2$.

d) Find the (instantaneous) rate of change of y at $y = 1$.

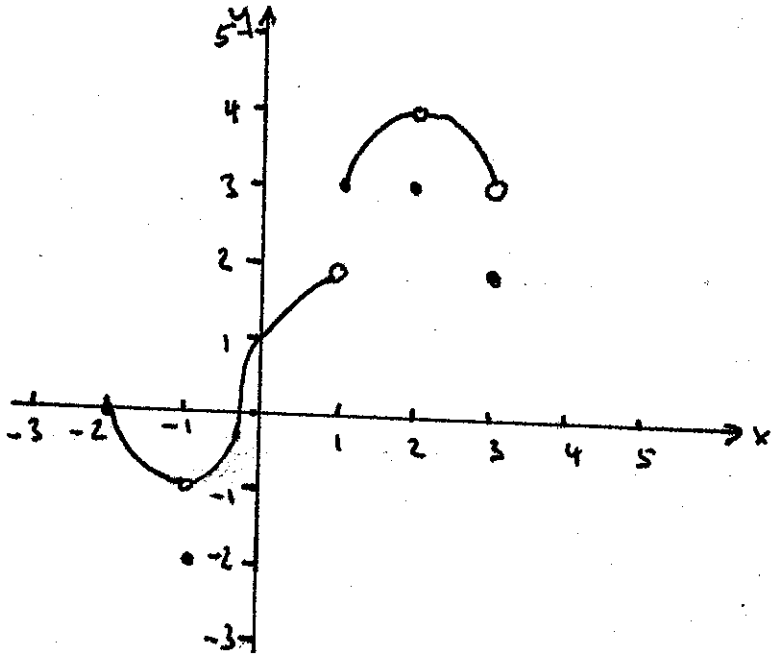
3. Consider the table of data sent by a coworker concerning the number of workers in the Bison and the time spent waiting for an order. (The □ stands for a value that was smudged and unreadable when you got it.)

Number of workers	order wait time (minutes)
3	10
6	7.3
10	4
15	□

a) Using the first and third data points, and assuming a linear relationship, find an equation giving the length of wait as a function of number of workers.

b) You know your coworker used the first and last data points to form another linear model, and you also know that model predicts a wait of 2 minutes if there are 12 workers on duty. What was the unreadable data point?

4. Answer the following based on the graph of f shown.



a) Find the range of f in interval notation;

b) find $f(0)$;

c) find $\lim_{x \to 1^-} f(x)$;

d) find $\lim_{x \to 2} f(x)$.

e) Is f continuous at $x = 2$? Briefly explain why or why not.

5. a) Find the equilibrium point or points for the given demand and supply functions: $D(p) = \frac{4}{p}$, $S(p) = 3p + 4$. Here supply and demand are in hundreds of units and price p is in dollars.

b) Explain the meaning of the point(s) you found in part a).

c) For the demand function of part a), what is the mathematical domain? What is the domain that makes sense for this mathematical model?