There are 8 questions and one bonus question on this exam, and you will have 70 minutes to take it. No calculators or notes are allowed, and the only scratch paper you may use is the paper provided. Each question is worth 10 points, and the bonus is 5 points.

If you are having difficulty with a problem, it may help to move on to another problem and come back later.

Please show all your work. An answer without supporting work will be assigned little to no points.
1. Consider the graph of this function, and answer the following questions:

\[ y = f(x) \]

(a) Find \( \lim_{x \to 1} f(x) \): \( \underline{3} \)

(b) Find \( f(-1) \): \( \underline{4} \)

(c) Find \( \lim_{x \to 2} f(x) \): \( \underline{3} \)

(d) Find \( \lim_{x \to 2} f(x) \): \( \underline{0} \)

(e) Find \( f(2) \): \( \underline{2} \)

(f) For which \( x \)-values is the graph of \( y = f(x) \) not continuous?

\[ x = -\frac{4}{1}, -1, 2 \]
2. Let \( f(x) \) be a function. Give the definition of the derivative of \( f(x) \).

\[
\frac{f'(x)}{x} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}
\]

3. Let \( f(x) = x^2 - 2x + 3 \). Using the definition of the derivative, find \( f'(x) \). To get credit for this question, you must use the definition, not the differentiation rules.

\[
f'(x) = \lim_{h \to 0} \frac{[(x+h)^2 - 2(x+h) + 3] - [x^2 - 2x + 3]}{h}
= \lim_{h \to 0} \frac{(x^2 + 2xh + h^2 - 2x - 2h + 3) + (-x^2 + 2x - 3)}{h}
= \lim_{h \to 0} \frac{2xh + h^2 - 2h}{h}
= \lim_{h \to 0} h(2x + h - 2)
= \lim_{h \to 0} 2x + h - 2
= 2x - 2
\]
4. For the rest of the problems on this exam you may use the differentiation rules.
   Let \( g(x) = 2x^3 + \sqrt{x} + \frac{1}{x} \). Find \( g'(x) \).

\[
\begin{align*}
g(x) &= 2x^3 + \sqrt{x} + x^{-1} \\
g'(x) &= 6x^2 + \frac{1}{2}x^{-\frac{1}{2}} - x^{-2}
\end{align*}
\]

5. Let

\[ r(x) = x^2 - 3x + \frac{12}{x} \]

What is the average rate of change of \( r(x) \) between the values \( x = 4 \) and \( x = 6 \)?

\[
\text{Ave. Rate} = \frac{r(4) - r(6)}{4 - 6}
\]

\[
\begin{align*}
r(4) &= 4^2 - 3 \cdot 4 + \frac{12}{4} \\
&= 16 - 12 + 3 \\
&= 7
\end{align*}
\]

\[
\begin{align*}
r(6) &= 6^2 - 3 \cdot 6 + \frac{12}{6} \\
&= 36 - 18 + 2 \\
&= 20
\end{align*}
\]

\[
\begin{align*}
r(4) - r(6) &= 7 - 20 \\
&= -13
\end{align*}
\]

\[
\begin{align*}
\text{Ave. Rate} &= \frac{-13}{4 - 6} \\
&= \frac{-13}{-2} = \frac{13}{2}
\end{align*}
\]
6. Define the function \( g(x) \) by

\[
g(x) = \frac{3x + 1}{2x - 3}
\]

Find the value of \( g'(2) \).

\[
g'(x) = \frac{(2x-3) \cdot 3 - (3x+1) \cdot 2}{(2x-3)^2}
\]

\[
= \frac{6x - 9 - 6x - 2}{(2x-3)^2}
\]

\[
= \frac{-11}{(2x-3)^2}
\]

\[
g'(2) = \frac{-11}{(2\cdot 2 - 3)^2}
\]

\[
= -11
\]

7. Find the equation of the tangent line to the curve \( g = f(x) \) at the value \( x_0 = 1 \), where

\( f(x) = 3x^2 - 6x + 7 \).

\[
f'(x) = 6x - 6
\]

\[
f'(1) = 6 \cdot 1 - 6 = 0
\]

\[
f'(1) = 3 \cdot 1 - 6 \cdot 1 + 7 = 4
\]

\[
(1, 4), \ m = 0
\]

\[
y = mx + b
\]

\[
y = 0 \cdot 1 + b
\]

\[
y = 4
\]
8. The cost for producing $x$ bootleg copies of “High School Musical 17: Geritheatrics!” is 

$$C(x) = 50 + 5x - .01x^2,$$

when $x$ is in the range $0 \leq x \leq 250$.

(a) What is the cost of producing 100 copies of High School Musical 17?

(b) What is the marginal cost to produce the 101st copy?

\[ C(100) = 50 + 5 \cdot 100 - .01(100^2) \]
\[ = 50 + 500 - .01(10000) \]
\[ = 50 + 500 - 100 = 450 \]

\[ C'(100) \]

Find $C'(x) = 5 - .02x$

\[ C'(100) = 5 - .02(100) \]
\[ = 5 - 2 = 3 \]

9. **Bonus:** If you were running for President of the United States, what would be your slogan?

* A fluffy bunny in every pot
  and a chicken in every garage!