STATION ONE – LIMITS & CONTINUITY

1. The function $G(x) = \begin{cases} x^2 & x > 2 \\ 4-2x & x < 2 \end{cases}$ is not continuous at x=2 because

A) G(2) does not exist

B) $\lim_{x \to 2} G(x)$ does not exist

C) $\lim_{x \to 2} G(x) = G(2)$

D) All three statements A, B, and C

E) None of the above

2. Find the value of *a* and *b* that would make f(x) continuous for all real numbers.

$$f(x) = \begin{cases} 2, & for\ x \leq -1 \\ ax+b, & for -1 < x < 3 \\ -2, & for\ x \geq 3 \end{cases}$$

3. Find the limit: $\lim_{x \to 0} \frac{\sqrt{x+4}-2}{x}$

4. Find the limit: $\lim_{x \to -\infty} \frac{\sqrt{4x^2+4}}{x^2}$

STATION TWO: DERIVIATIVES OF TABLES

Suppose that the functions *f* and *g* and their first derivatives have the following values at x = -1 and x = 0.

X	f(x)	g(x)	f'(x)	g'(x)
-1	0	-1	2	1
0	-1	-3	-2	4

Evaluate the first derivatives of the following combinations of *f* and *g* at the given value of x.

1. $3f(x) - g(x);\ x = -1$

2. $f(g(x));\ x = -1$

3. $[f(x)]^2[g(x)]^3;\ x = 0$

4. $\frac{f(x)}{g(x)+2};\ \ x = 0$

5. $g(x + f(x));\ x = 0$

STATION THREE: TANGENT LINES

1. Find the equation of the normal line to the curve $y = \frac{5}{(5-2x)^2}$ at $x = 0$.

2. Find all the x values on the graph of $f(x) = x^4 - 6x^2 + 4$, where the tangent line is horizontal.

3. Find the equation of the tangent line to the curve $y = \sqrt{3x-1}$ that is perpendicular to the line $3y + 2x = 3$.

4. Find the slope of graph $y = \frac{8}{(x^2+4)}$ at the point $(2,1)$.

STATION FOUR: DERIVATIVES

1. Find the derivative of $y = t^2 \sin(t^2)$

2. Find the derivative of $y = -4\csc^3(1-x)$

3. Find the second derivative of $y = \frac{3}{x^2-12}$

4. Find $\frac{dy}{dx}$ of $y = (\frac{3x-1}{x^2+3})^2$

5. $\frac{d}{dx}\left[\frac{t^2}{\sqrt{t^3+1}}\right] =$

STATION FIVE: ALL MIXED UP

1. Prove that the polynomial $f(x) = x^3 + 2x - 1$ has a zero in the interval $[0,1]$.

2. A particle's position is given by $x(t) = \tan t - \sin t$. At time $t = \frac{5\pi}{6}$, determine if the particle is speeding up or slowing down. Justify your answer.

3. If the position of a particle along a horizontal line is given by $x(t) = \frac{1}{3}t^3 - t^2 - 3t + 4$.

(a) Find the average rate of change on the interval [0,6].

(b) Find the instantaneous rate of change of the particle at $t = 3$.

4. Using the definition of a derivative, find the derivative of $f(x) = \sqrt{2x} - 4$

STATION SIX – MULTIPLE CHOICE PRACTICE

1. The function $G(x) = \begin{cases} x-3 & x>2 \\ -5 & x=2 \\ 3x-7 & x<2 \end{cases}$ is not continuous at $x = 2$ because

   A) $G(2)$ is not defined

   B) $\lim_{x \to 2} G(x)$ does not exist

   C) $\lim_{x \to 2} G(x) \neq G(2)$

   D) $G(2) \neq -5$

   E) All of the above

2. Let $F(x) = \begin{cases} \dfrac{x^2+x}{x} & x \neq 0 \\ 1 & x = 0. \end{cases}$ Which of the following statements are true of F?

   I. F is defined at $x = 0$.
   II. $\lim_{x \to 0} F(x)$ exists.
   III. F is continuous at $x = 0$.

   A) I only B) II only C) I, II only D) II, III only E) I, II, and III

3. The function

$$f(x) = \begin{cases} 4-x^2 & x \leq 1 \\ mx+b & x>1 \end{cases}$$

is continuous and differentiable for all real numbers. What must be the values of m and b ?

   A) $m = 2,\ b = 1$

   B) $m = 2,\ b = 5$

   C) $m = -2,\ b = 1$

   D) $m = -2,\ b = 5$

   E) None of these

4. In the xy-plane, the line $x + y = k$, where k is a constant, is tangent to the graph of $y = x^2 + 3x + 1$. What is the value of k ?

   (A) −3 (B) −2 (C) −1 (D) 0 (E) 1

5. $\lim_{h \to 0} \dfrac{6\cos\left(\dfrac{\pi}{6}+h\right) - 6\cos\dfrac{\pi}{6}}{h} =$ (A) 0 (B) −6 (C) 6 (D) −3 (E) 3