

1.	Show that the function $f(x) = x $ is continuous but not differentiable at $x = 0$.
2.	Show that the function $f(x) = x - 2 $; $x \in \mathbb{R}$ is continuous but not differentiable at $x = 2$
3.	Show that the function $f(x) = 2x - x $ is continuous but not differentiable at $x = 0$
4.	Discuss the differentiability of $f(x) = x x $ at $x = 0$.
5.	Write an example of a function which is continuous everywhere but not differentiable exactly at 5 points.
6.	Show that the function f defined as $f(x) = \begin{cases} 3x-2, & 0 < x \leq 1 \\ 2x^2 - x, & 1 < x \leq 2 \\ 5x-4, & x > 2 \end{cases}$ is continuous at $x = 2$ but not differentiable at $x = 2$
7.	Check the differentiability of the function $f(x) = \begin{cases} x[x], & 0 \leq x < 2 \\ (x-1), & 2 \leq x < 3 \end{cases}$ at $x = 2$
8.	Examine the differentiability of the function f defined by $f(x) = \begin{cases} 2x+3, & -3 \leq x < -2 \\ x+1, & -2 \leq x < 0 \\ x+2, & 0 \leq x \leq 1 \end{cases}$ at $x = -2$ and $x = 0$
9.	Find whether the following function is differentiable at $x = 1$ and $x = 2$ or not $f(x) = \begin{cases} x, & x \leq 1 \\ 2-x, & 1 < x \leq 2 \\ -2+3x-x^2, & x > 2 \end{cases}$
10.	Show that the function $f(x) = x + 1 + x - 1 $, $x \in \mathbb{R}$, is not differentiable at $x = -1$ and $x = 1$.
11.	Find the value of p and q so that $f(x) = \begin{cases} x^2+3x+p, & x \leq 1 \\ qx+2, & x > 1 \end{cases}$ is differentiable at $x = 1$
HOME WORK	
12.	Show that the function $f(x) = x - 3 $; $x \in \mathbb{R}$ is continuous but not differentiable at $x = 3$
13.	Show that the function $f(x) = x + 1 $; $x \in \mathbb{R}$ is continuous but not differentiable at $x = -1$
14.	Check the differentiability of the function $f(x) = \begin{cases} 1+x, & x \leq 2 \\ 5-x, & x > 2 \end{cases}$ at $x = 2$

15.	Show that $f(x) = \begin{cases} 12x-13, & x \leq 3 \\ 2x^2+5, & x > 3 \end{cases}$ is differentiable at $x = 3$. Also find $f'(3)$
16.	Show that the function f defined by $f(x) = \begin{cases} 3x-2, & 0 < x \leq 1 \\ 2x^2-x, & 1 < x \leq 2 \\ 5x-4, & x > 2 \end{cases}$ is continuous but not differentiable at $x = 2$
17.	Prove that the greatest integer function $f(x) = [x]$, $0 < x < 3$ is not differentiable at $x = 1$ and $x = 2$.
18.	Show that the function $f(x) = x-1 + x+1 $ for all $x \in \mathbb{R}$ is not differentiable at $x = 1$ and $x = -1$.
SELF STUDY	
19.	A function $f : \mathbb{R} \rightarrow \mathbb{R}$ satisfy the equation $f(x+y) = f(x).f(y)$ for all $x, y \in \mathbb{R}$, $f(x) \neq 0$. Suppose that the function is differentiable at $x = 0$ and $f'(0) = 2$. Prove that $f'(x) = 2f(x)$.
20.	For what choice of a and b is the function $f(x) = \begin{cases} x^2, & x \leq c \\ ax+b, & x > c \end{cases}$ differentiable at $x = c$.