

**Problems of Derivability of functions**


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1) Find out the continuity and derivability of the following function at the point  $x = 1$ :

$$f(x) = \begin{cases} 15x + 6 & \text{if } x < 1 \\ 3x^2 + 9x + 10 & \text{if } x \geq 1 \end{cases}$$

2) Find out the continuity and derivability of the following function on  $\mathfrak{R}$ :

$$f(x) = 3\sqrt[3]{x+1}$$

3) Find out the continuity and derivability of the following function at the point  $x = -3$ :

$$f(x) = \begin{cases} 2x^3 - 82 & \text{if } x \leq -3 \\ 4x^2 + 73x + 47 & \text{if } x > -3 \end{cases}$$

4) Find out the continuity and derivability of the following function on  $\mathfrak{R}$ :

$$f(x) = |x - 7| + |x + 3|$$

5) Find out the continuity and derivability of the following function at the point  $x = 3$ :

$$f(x) = \begin{cases} 2x^2 - 15x + 30 & \text{if } x < 3 \\ \frac{3}{x-2} & \text{if } x \geq 3 \end{cases}$$

6) Find out the continuity and derivability of the following function on  $\mathfrak{R}$ :

$$f(x) = |x - 4| - 4x$$

7) Find out the value of the parameter  $p$  for which the following function is continuous and has derivative on  $\mathfrak{R}$ .

$$f(x) = \begin{cases} 18 - px^2 & \text{if } x \leq 1 \\ \frac{72}{px} & \text{if } x > 1 \end{cases}$$

8) Find out the value of the parameters  $m$  and  $p$  for which the following function is continuous and has derivative on  $\mathfrak{R}$ .

$$f(x) = \begin{cases} x^2 - 5x + m & \text{if } x \leq -1 \\ -x^2 + px & \text{if } x > -1 \end{cases}$$

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9) Find out the value of the parameters  $p$  and  $r$  for which the following function is continuous and has derivative on  $\mathfrak{R}$ .

$$f(x) = \begin{cases} 5x^3 + 3x & \text{if } x < 2 \\ px + r & \text{if } x \geq 2 \end{cases}$$

10) Find out the value of the parameters  $h$  and  $k$  for which the following function is continuous and has derivative on  $\mathfrak{R}$ .

$$f(x) = \begin{cases} 8x + h e^{x-4} & \text{if } x < 4 \\ 3x^2 + kx & \text{if } x \geq 4 \end{cases}$$

11) Find out the value of the parameters  $h$  and  $k$  for which the following function is continuous and has derivative on  $\mathfrak{R}$ .

$$f(x) = \begin{cases} -3x^2 + hx + k & \text{if } x < 1 \\ x + 9 & \text{if } x \geq 1 \end{cases}$$

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### Answers:

- 1) Has a jump discontinuity and hasn't derivative.
- 2) Continuous on  $\mathfrak{R}$ . Has derivative on  $\mathfrak{R} - \{-1\}$  (vertical tangent).
- 3) Continuous and hasn't derivative.
- 4) Continuous on  $\mathfrak{R}$ . Has derivative on  $\mathfrak{R} - \{-3, 7\}$  (peak points).
- 5) Continuous and has derivative.
- 6) Continuous on  $\mathfrak{R}$ . Has derivative on  $\mathfrak{R} - \{4\}$  (peak point).
- 7)  $p = 6$
- 8)  $m = 2, p = -9$
- 9)  $p = 63, r = -80$
- 10)  $h = 16, k = 0$
- 11)  $h = 7, k = 6$