Don't write your name in pieces: Key

AP Calculus AB: 4.2 Differentiable with Piecewise

Find whether the functions below are differentiable at their changing point or not. If it is not differentiable give the reason why.

1. $f(x) = \begin{cases} 3x^2 - 7x, & x < 2 \\ x^3 - 10, & x \geq 2 \end{cases}$ (Left / Right)

Cont

① $\lim_{x \to 2} f(x)$ Left $3(2)^2 - 7(2) = 12 - 14 = -2$ > -2

Right $(2)^3 - 10 = 8 - 10 = -2$

② $f(2) = (2)^3 - 10 = -2$

③ $\lim_{x \to 2} f(x) = f(2) = -2$ $f(x)$ is continuous @ $x = 2$

diff

Left deriv $6x - 7 = 6(2) - 7 = 5$

Right deriv $3x^2 = 3(2)^2 = 12$

Not diff @ $x = 2$

$\lim_{x \to 2^-} f'(x) \neq \lim_{x \to 2^+} f'(x)$

2. $f(x) = \begin{cases} x^2 - 1, & x < 1 \\ \ln(x^2), & x \geq 1 \end{cases}$

The function is diff @ $x = 1$

3. $f(x) = \begin{cases} \frac{x^2 - 4x - 5}{x - 5}, & x < 5 \\ x^2, & x \geq 5 \end{cases}$

Not diff or cont @ $x = 5$

b/c $\lim_{x \to 5} f(x)$ DNE

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4. $f(x) = \begin{cases} 5 - x^2, & x = 3 \\ -\frac{4}{3}x, & x \neq 3 \end{cases}$

finds the point only

only function for limits

cont

① $\lim_{x \to 3} f(x) = \frac{-4}{3}(3) = -4$

② $f(3) = 5 - (3)^2 = -4$

③ $\lim_{x \to 3} f(x) = f(3) = -4$

$f(x)$ is cont @ $x = 3$

diff

only need the derivative of the bottom function since the top is only a point.

$f' = \frac{-4}{3}$ ← slope is always the same

Diff @ $x = 3$

5. $f(x) = \begin{cases} x^2 + 3, & x < -1 \\ -2x + 2, & x \geq -1 \end{cases}$

$f(x)$ is continuous and diff @ $x = -1$

6. $f(x) = \begin{cases} e^{4x^2}, & x \leq 0 \\ \frac{3x^2+5x}{x}, & x > 0 \end{cases}$

Not cont or diff @ $x = 0$

b/c $\lim_{x \to 0} f(x)$ DNE