$\lim_{x \to c} \frac{f(x) - f(c)}{x - c}$

Name G 20

Honors Precalc

13.4 Worksheet #2

Continuity, Alternative Form Defn of Deriv

Use the alternative form of the definition of the derivative to find the derivative at x = c.

1. $f(x) = x^2 - 2, c = 5$ $\quad f(5) = 25 - 2$

$f'(x) = \lim_{x \to 5} \frac{x^2 - 2 - f(5)}{x - 5}$

$= \lim_{x \to 5} \frac{x^2 - 2 - 23}{x - 5} = \frac{x^2 - 25}{x - 5}$

$f'(5) = \lim_{x \to 5} \frac{(x+5)\cancel{(x-5)}}{\cancel{x-5}} = \boxed{10}$

2. $f(x) = x^2 - 3x, c = 1$ $\quad f(1) = 1 - 3$

$f'(x) = \lim_{x \to 1} \frac{x^2 - 3x + 2}{x - 1} = \frac{(x-2)\cancel{(x-1)}}{\cancel{x-1}}$

$\boxed{f'(1) = -1}$

3. $f(x) = x^3 - 8, c = -1$

$f'(-1) = \lim_{x \to -1} \frac{x^3 - 8 + 9}{x + 1} = \frac{x^3 + 1}{x + 1}$

$\lim_{x \to -1} \frac{\cancel{(x+1)}(x^2 - 1x + 1)}{\cancel{x+1}}$

$\boxed{f'(-1) = 1 + 1 + 1 = 3}$

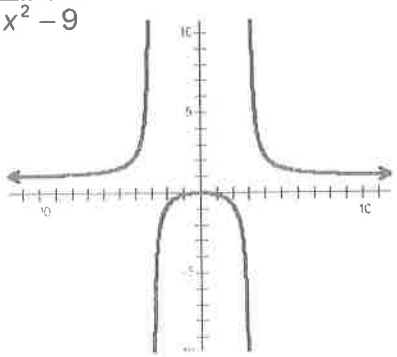
4. $f(x) = \frac{1}{x}, c = 2$

$f'(2) = \lim_{x \to 2} \left(\frac{\frac{1}{x} - \frac{1}{2}}{x - 2} \right) 2x = \frac{2\cancel{x}}{2x\cancel{(x-2)}} = \frac{-1}{2x}$

$f'(2) = \frac{-1}{2(2)} = \boxed{\frac{-1}{4}}$

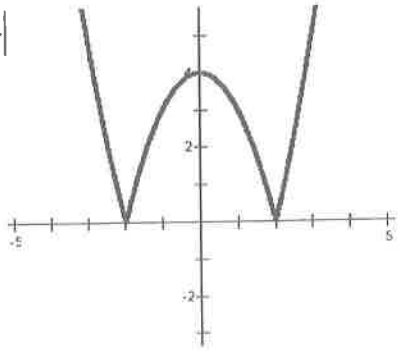
Find any x-values at which the function is not differentiable and explain why.

5. $f(x) = \frac{x^2}{x^2 - 9}$



$x = \pm 3 \rightarrow$ Asym.

6. $f(x) = |x^2 - 4|$

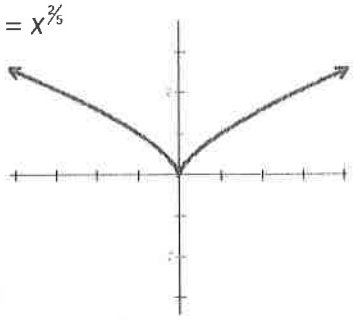


$x = \pm 2$

Sharp Turns

56

7. $f(x) = x^{2/5}$



$x = 0$

(Sharp Turn)

8. $f(x) = |x - 2|$

$x = 2$

Sharp Turn

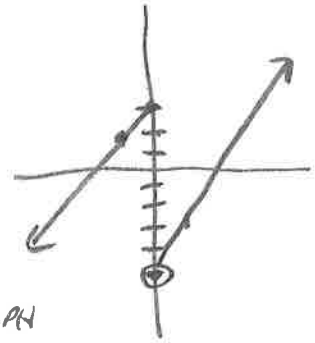
9. $f(x) = \dfrac{4x}{x+1}$

$x = -1$

VA

10. $f(x) = \begin{cases} 2x - 5 & \text{if } x > 0 \\ x + 3 & \text{if } x \le 0 \end{cases}$

$\lim_{x \to 0^-} = 3$ / $\lim_{x \to 0^+} = -5$



Disc. / Jump in Graph

$x = 0$

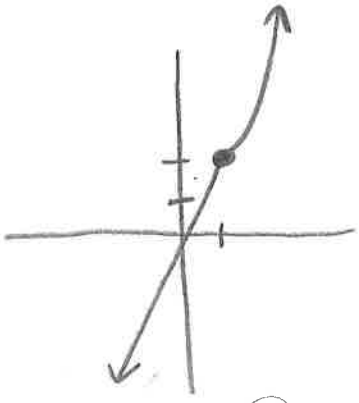
11. $f(x) = (x - 2)^{2/3}$

$x = 2$

Turn

12. $f(x) = \begin{cases} x^2 + 1 & \text{if } x > 1 \\ 2x & \text{if } x \le 1 \end{cases}$

$\lim_{x \to 1^-} = 2$ / $\lim_{x \to 1^+} = 2$



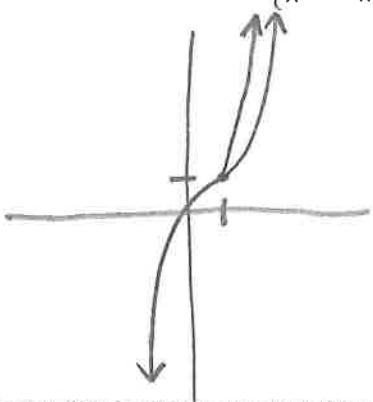
Smooth

None

$2t = 2(1)$ (2)

(2)

13. $f(x) = \begin{cases} x^2 & \text{if } x > 1 \\ x^3 & \text{if } x \le 1 \end{cases}$



$\lim_{x \to 1^-} = 1$ / $\lim_{x \to 1^+} = 1$

$x = 1$