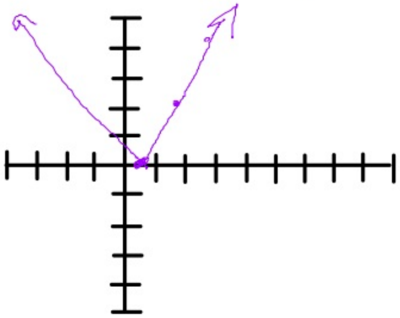
Compare the right hand and left hand derivatives to show the function is not differentiable at the point given.

1) $f(x) = |2x - 1|$ point $\left(\frac{1}{2}, 0\right)$



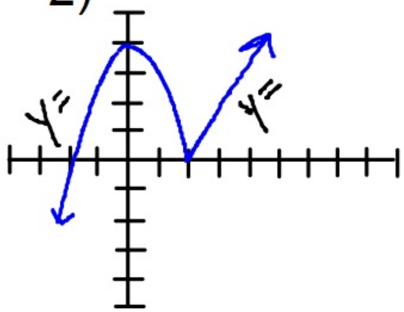
$\lim\limits_{x \to \frac{1}{2}^+} f'(x) = 2$

$\lim\limits_{x \to \frac{1}{2}^-} f'(x) = -2$

Since $\lim\limits_{x \to \frac{1}{2}^+} f'(x) \neq \lim\limits_{x \to \frac{1}{2}^-} f'$

f(x) is not differentiable at $x = \frac{1}{2}$

2)



left-hand function $y = -x^2 + 4$

right-hand function $y = x - 2$

left-hand derivative $f'(x) = -2x$

right-hand derivative $f'(x) = 1$

Write the function.

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

Point of concern is at x= 2 .

$$f'(x) = \begin{cases} -2x & x < 2 \\ 1 & x > 2 \end{cases}$$

Show that f(x) is not differentiable at x= 2.

L.H. $\lim\limits_{x \to 2^-} f'(x) = -4$

R.H. $\lim\limits_{x \to 2^+} f'(x) = 1$

f(x) is not diff. @ x = 2 b/c $\lim\limits_{x \to 2^-} f'(x) \neq \lim\limits_{x \to 2^+} f'(x)$

Review

Find the derivative.

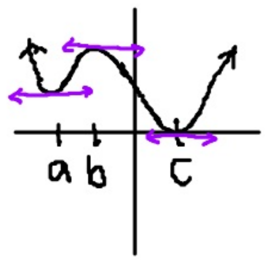
1) $y = 3x^5 + 2x^3 - 3x - 5$

$y' = 15x^4 + 6x^2 - 3$

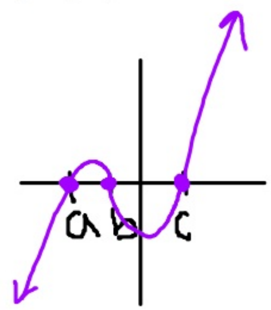
2) $y = \frac{1}{3}x^6 - 4x^3 + \pi x - 2$

$y' = 2x^5 - 12x^2 + \pi$

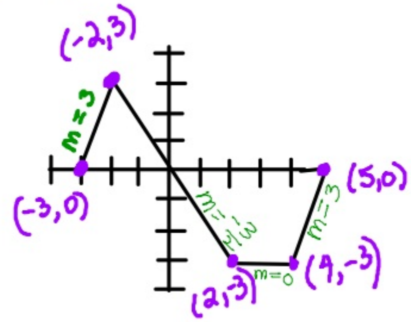
3) $f(x) =$



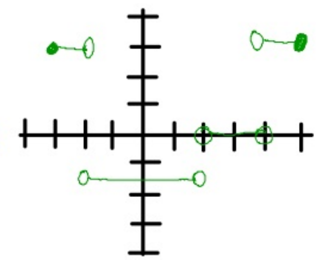
$f'(x) =$



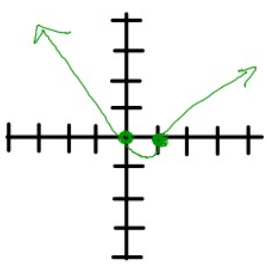
4) $g(x) =$



$g'(x) =$



5) $h(x) = \begin{cases} \overset{x(x-1)}{x^2 - x} & x \le 1 \\ x - 1 & x > 1 \end{cases}$ $\qquad h'(x) = \begin{cases} 2x - 1 & x < 1 \\ 1 & x \geq 1 \end{cases}$



What points are in the domain? $(-\infty, \infty)$

Is the function continuous? yes

Does the derivative exist everywhere?

$\lim_{x \to 1^-} h'(x) = 1$ $\qquad$ yes, $h(x)$ is diff. on $(-\infty, \infty)$

$\lim_{x \to 1^+} h'(x) = 1$ $\qquad$ b/c $\lim_{x \to 1^-} h'(x) \cancel{=} \lim_{x \to 1^+} h'(x)$