FIND   THE   DERIVATIVES

① $y = \frac{8}{3}x^3 - 5x^2 + \frac{1}{3}x + 5$

② $y = 2(6x^2 - 3x)^3$

③ $y = \frac{2x - 5}{3x + 8}$

④ $y = \frac{\sqrt[3]{x}}{5} - \frac{8x}{\sqrt{x}}$

⑤ $y = (2x^2 - 1)(3x + 2)$

⑥ FIND THE DISTANCE AND MIDPOINT
$(-2, 3)$ $(3, -2)$

⑦ FIND WHERE THE TANGENT IS PARALLEL
TO   THE   X-AXIS

$y = \frac{1}{3}x^3 - 3x^2 + 5x$

Ch. 11 - Chain Rule

Chain Rule

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$ where   y is a funtion of ___
                                     and   u is a function of ___.

Ex. 1 $y = 6u + 2$ and $u = 2x$

          $y' = $ and $u' = $ __

          $y' \cdot u' = \frac{dy}{du} \cdot \frac{du}{dx} = $ __

Or   substitute   u   into   y.

Ex. 2 $y = 3u^2 + 5$, $u = 4x$

Ex. 3 $y = \sqrt{u}$ $u = 3x - 2$

$\boxed{\text{Ex. 4}}$ $y = 4u^2$ $u = 3 - 2t$ $t = 2x$

HIGHER ORDER DERIVATIVES

$\boxed{\text{Ex. 5}}$ $f(x) = 3x^3 - 7x^2 + 3$, find f', f'', f'''

$\boxed{\text{Ex. 6}}$ $f(x) = 8\sqrt{x}$, what is $f''(4)$?

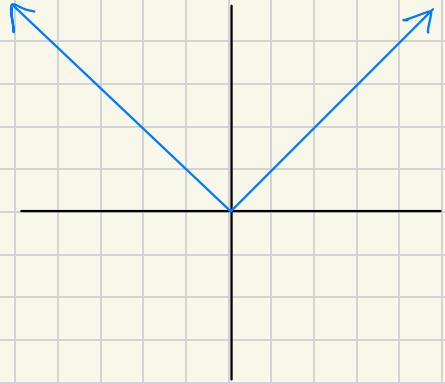$\boxed{\text{Ex. 7}}$ find $f'''(x)$, when $f(x) = 2x^5 - 3x^3 + x^2 - 7$

$\boxed{\text{Ex. 8}}$ what is $f''(-1)$ in example 7?
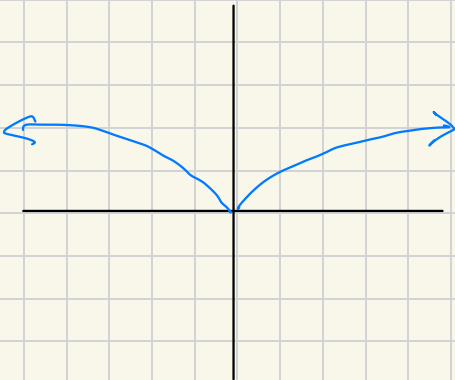
WHERE FUNCTIONS ARE NOT DIFFERENTIABLE

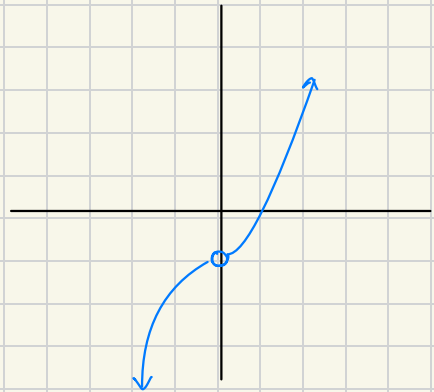1. VERTICAL TANGENTS
2. CORNERS
3. CUSPS
4. DISCONTINUITIES
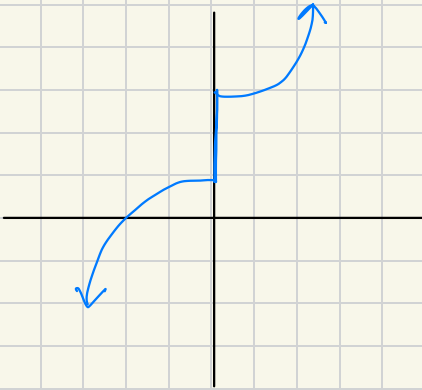
VERTICAL TANGENT

CORNER

CUSP

DISCONTINUITY

EX. 10 ARE THE FOLLOWING FUNCTIONS
DIFFERENTIABLE FOR ALL
VALUES OF x ? IF NOT, WHERE ?

a) $f(x) = \dfrac{2}{x-3}$

b) $f(x) = x^2 - 7x - 3$

c) $f(x) = \dfrac{3}{x^2 + 5x + 6}$

Find $\dfrac{dy}{dx}$. Check by substituting and taking the derivative of y with respect to x. You may leave square roots in the denominator.

1. $y = -2u^3$ and $u = \dfrac{x}{3}$

2. $y = 3u + 2$ and $u = -3x^2$

3. $y = 5u^2$ and $u = \sqrt{x}$

Find $\dfrac{dy}{dx}$ for the next three problems.

4. $y = 2u^5 + 1$ and $u = 3x$

5. $y = 1 - 4u^2$ and $u = -x^3$

6. $y = \sqrt{2u}$ and $u = 8x$

Find the first and second derivatives for each problem. Find the value of each derivative when x = 0.

7. $f(x) = 2x^5 - 3x^4 + 4x^3 - x^2 + 1$

8. $y = \dfrac{8}{\sqrt{1-8x}}$

Find $\dfrac{dy}{dx}$.

9. $y = 2u - 3$, $u = \sqrt{r}$, and $r = 4x$

10. $y = 2 - 5u$, $u = r^3$, and $r = \sqrt{1-5x}$