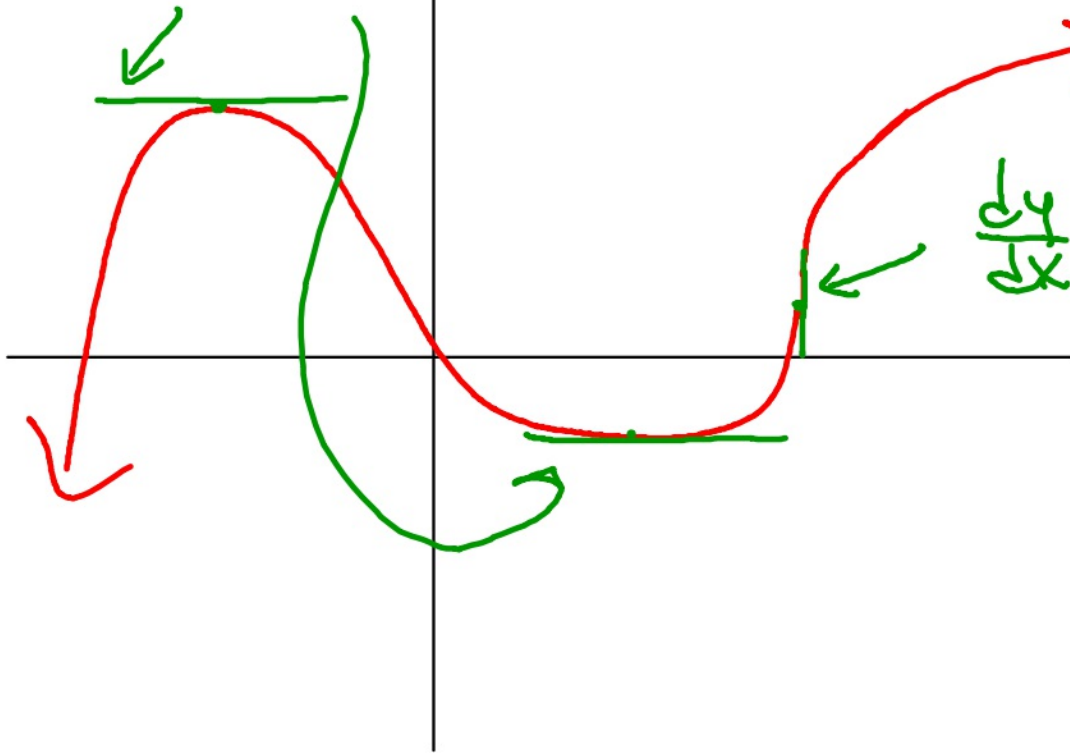


## Calculus Mini Lesson: Horizontal and Vertical Tangents

Find the x-values where  $g(x)$  has horizontal or vertical tangents.

$$f(x) = \sqrt[3]{16 - x^2}$$

$$\text{slope} / \frac{dy}{dx} = 0$$



$$\frac{dy}{dx} = \text{undefined} = \frac{\sqrt{\#}}{0}$$

Find the x-values where g(x) has horizontal or vertical tangents.

$$f(x) = \sqrt[3]{16-x^2} = (16-x^2)^{1/3}$$

$$f'(x) = \frac{1}{3}(16-x^2)^{-2/3} \cdot (-2x)$$

$$\frac{-2x}{3(16-x^2)^{2/3}} = \frac{-2x}{3\sqrt[3]{(16-x^2)^2}}$$

H.T.  
Set num = 0

$$2x = 0$$
$$x = 0$$

V.T.  
Set denom = 0.

$$3\sqrt[3]{(16-x^2)^2} = 0$$
$$x = \pm 4$$

Find the x-value(s) where the function has horizontal and/or vertical tangents.

$$g(x) = 3x \cdot \sqrt{2x-4}$$

$$\frac{(3x)(2x-4)^{1/2}}{f \quad g}$$

$f'g + fg'$

$$f': 3 \quad g': \frac{1}{2}(2x-4)^{-1/2} \cdot 2$$

$$: (2x-4)^{-1/2}$$

$$\frac{3(2x-4)^{1/2}}{1} + \frac{3x \cdot (2x-4)^{-1/2}}{1}$$

$$3(2x-4)^{-1/2} \left( (2x-4)' + x \right)$$

⊙?

$$3(3x-4)$$

$$\text{H.T.} = 0$$

$$\frac{3(3x-4)}{\sqrt{2x-4}}$$

$$= 0 \text{ V.T.}$$

$3x^{1/2} + 3x^3$   
 $3x^3(3x^{1/2} + 1)$   
 Factor · lesser exp.

$x = 4/3$

$x = 2$

Find the h/v tangents of  $y = \frac{4x^2}{\sqrt[3]{4x+1}}$

$$f: 8x$$

$$g: \frac{1}{3}(4x+1)^{-2/3} \cdot 4$$

$$\frac{4}{3}(4x+1)^{-2/3}$$

$$\underline{f'g + fg'} \quad 8x \cdot (4x+1)^{1/3} + \underline{4x^2} \cdot \underline{\frac{4}{3}}(4x+1)^{-2/3}$$

$$8x(4x+1)^{1/3} + \frac{16}{3}x^2(4x+1)^{-2/3}$$

$$\frac{1}{3}x(4x+1)^{-2/3} \left[ 24(4x+1)^{1/3} + 16x \right]$$

$$\frac{x \cdot [96x + 24 + 16x]}{3(4x+1)^{-2/3}}$$

$$\frac{dy}{dx} = \frac{x \cdot [112x + 24]}{3\sqrt[3]{(4x+1)^2}} \stackrel{\text{HT}}{=} 0$$

$x(112x+24) = 0$   
 $\downarrow \quad \downarrow$   
 $x=0$        $112x = -24$   
 $\quad \quad \quad \downarrow$   
 $\quad \quad \quad x = -\frac{24}{112}$   
 $\quad \quad \quad x = -\frac{12}{56}$   
 $\quad \quad \quad x = -\frac{6}{28}$   
 $\quad \quad \quad x = -\frac{3}{14}$

$\text{U.T.} \quad \sqrt{\quad} = 0$   
 $3\sqrt[3]{(4x+1)^2} = 0$   
 $(4x+1)^2 = 0^3 = 0$   
 $4x+1 = 0 \rightarrow x = -\frac{1}{4}$

## Helpful hints for the AP packet due Monday

- 4th derivative?? **take the derivative of the derivative to get the 2nd derivative and so on**

-  $\frac{d^2 y}{dx^2} =$  **means 2nd derivative**

- p18 88BC #3

**2 primes**

**means 2nd derivative**

88  
88

3. If  $f(x) = \ln(\sqrt{x})$ , then  $f''(x) =$

(A)  $-\frac{2}{x^2}$       (B)  $-\frac{1}{2x^2}$       (C)  $-\frac{1}{2x}$       (D)  $-\frac{1}{2x^{\frac{3}{2}}}$       (E)  $\frac{2}{x^2}$

