A#24,25

Name: KEY Date:________ Period:___

Constant, Power, Product, and Quotient Rule Worksheet

◆Find the derivative of the function.

1. $y = 3$

$y' = 0$

2. $f(x) = x + 1$

$f'(x) = 1$

3. $f(t) = -2t^2 + 3t - 6$

$f'(t) = -4t + 3$

4. $f(x) = x^3 - 3x - 2x^{-4}$

$f'(x) = 3x^2 - 3 + 8x^{-5}$

5. $g(t) = t^2 - \frac{4}{t} \rightarrow -4t^{-1}$

$g'(t) = 2t + 4t^{-2}$

6. $h(s) = s^{4/5}$

$h'(s) = \frac{4}{5} s^{-1/5}$

OR

$\frac{4}{5\sqrt[5]{s}}$

$\frac{Lo D_{Hi} - Hi D_{Lo}}{[Lo]^2}$

7. $f(x) = \frac{3x - 2}{2x - 3}$

$\frac{(2x-3)\cdot 3 - (3x-2)2}{(2x-3)^2}$

$f'(x) = \frac{-5}{(2x-3)^2}$

8. $f(x) = \frac{x+1}{\sqrt{x}} = \frac{x+1}{x^{1/2}}$

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

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

9. $h(t) = \frac{t+1}{t^2 + 2t + 2}$ Hi $D_{Hi} = 1$ Lo $D_{Lo} = 2t+2$

$h'(t) = \frac{(t^2+2t+2)1 - (t+1)(2t+2)}{(t^2+2t+2)^2}$

$h'(t) = \frac{-1}{t^2+2t+2}$

10. Find an equation of the tangent line to the graph of $y = x^4 - 3x^2 + 2$ at (1,0).

SLOPE @ X=1

$y' = 4x^3 - 6x$

$y'(1) = 4(1)^3 - 6(1)$

$y'(1) = -2$

POINT

(1, 0)

$y(1) = 0$

SINCE $y'(1) = -2$

$y(1) = 0$

THEN

$y + 0 = -2(x-1)$

OR

$y = -2x + 2$

11. Find an equation of the tangent line to the graph of $f(x) = \frac{x}{x-1}$ at (2,2).

SLOPE @ X = 2

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

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

$f'(2) = -1$

POINT

(2, 2)

$f(2) = 2$

$\boxed{y - 2 = -(x-2)}$

12. Determine the point(s) (if any) at which $y = x^4 - 3x^2 + 2$ has a horizontal tangent line.

WHEN DOES $y' = 0$? $\quad y' = 4x^3 - 6x$

$0 = 4x^3 - 6x \rightarrow 0 = 2x \cdot (2x^2 - 3)$

$2x = 0 \quad$ OR $\quad 2x^2 - 3 = 0$

$\boxed{x = 0} \quad x^2 = \frac{3}{2}$

$x = \pm\sqrt{3/2} = \pm\frac{\sqrt{3}}{\sqrt{2}} = \boxed{\pm\frac{\sqrt{6}}{2}}$

POINTS SO
$(0,2)$
$\left(-\frac{\sqrt{6}}{2}, -\frac{1}{4}\right)$
$\left(\frac{\sqrt{6}}{2}, -\frac{1}{4}\right)$

13. Determine the point(s) (if any) at which $f(x) = \dfrac{x^2}{x-1}$ has a horizontal tangent line.

$$y' = \frac{(x-1)2x - x^2(1)}{(x-1)^2} = \frac{x^2 - 2x}{(x-1)^2}$$

$$0 = \frac{x^2 - 2x}{(x-1)^2} \rightarrow 0 = x^2 - 2x \rightarrow 0 = x(x-2) \quad \boxed{x = 0, 2}$$

POINTS
$(0,0)$
$(2,4)$

14. Find $f'(2)$ given that $f(x) = 2g(x) + h(x)$, $g(2) = 3$, $g'(2) = -2$, $h(2) = -1$, and $h'(2) = 4$.

$$f'(x) = 2 \cdot g'(x) + h'(x)$$

THERE FOR $\quad f'(2) = 2 \cdot g'(2) + h'(2)$

$$f'(2) = 2(-2) + (4)$$

$$\boxed{f'(2) = 0}$$

15. Find $f'(2)$ given that $f(x) = \dfrac{g(x)}{h(x)}$, $g(2) = 3$, $g'(2) = -2$, $h(2) = -1$, and $h'(2) = 4$.

$$f'(x) = \frac{h(x)g'(x) - g(x)h'(x)}{[h(x)]^2}$$

$$\text{So } f'(2) = \frac{h(2) \cdot g'(2) - g(2) \cdot h'(2)}{[h(2)]^2}$$

$$f'(2) = \frac{(-1) \cdot (-2) - (3)(4)}{(-1)^2}$$

$$\boxed{f'(2) = -10}$$