BOARD PROBLEMS CH. 10

FIND DERIVATIVES.

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

2) $f(x) = 2\sqrt{x+1}$

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

4) SOLVE FOR THE zeroes (start by factoring by grouping)

$3n^3 - 4n^2 + 9n - 12$

DERIVATIVE RULES

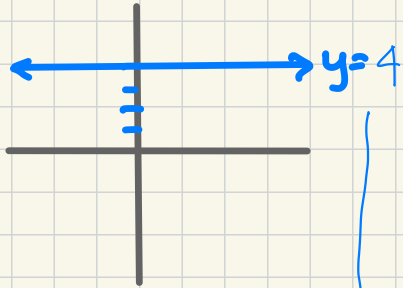
RULE 1 DERIVATIVE OF Constant

$f(x) = 4$

$\frac{d}{dx}(4) = 0$

or

$f'(x) = 0$



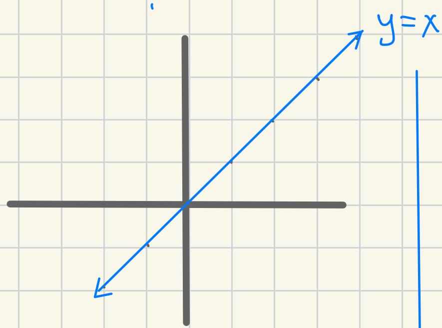
WHAT IS THE SLOPE ?

RULE 2

$f(x) = x$

$\frac{d}{dx}(x) = 1$

$f'(x) = 1$



WHAT IS THE SLOPE ?

RULE 3

$f(x) = 4x$

$\frac{d}{dx}(4x) = 4\frac{d}{dx}x =$ or

$y' = 4f'(x) =$

RULE 4 POWER RULE

$f(x) = x^n$ → WHERE N = REAL NUMBER

$f'(x) = nx^{n-1}$

$f(x) = x^4$, $g(x) = 3x^5$

$f'(x) =$, $g'(x) =$

$h(x) = 3x^{-4}$ $f(x) = -6x^{-3}$

$h'(x) =$ $f'(x) =$

RULE 5 SUM AND DIFFERENCE RULE

$h(x) = f(x) \pm g(x)$

then $h'(x) = f'(x) \pm g'(x)$

$h(x) = 4x^2 - 6x^4$

$h'(x) =$

RULE 6 PRODUCT RULE

$\frac{d}{dx}(u \cdot v) = u'v + v'u$

or $\frac{d}{dx} u \cdot v + \frac{d}{dx} v \cdot u$

$f(x) = (5x)(3x^2+8)$

$u =$ $v =$

$u' =$ $v' =$

$f'(x) =$

RULE 7 QUOTIENT RULE

$$h(x) = \frac{u}{v} = \frac{u'v - v'u}{v^2}$$

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

$$h(x) = \frac{(2x+1)}{(4-3x)}$$

$u =$ $\qquad$ $v =$

$u' =$ $\qquad$ $v' =$

RULE 8 Chain RULE (Substitution)

$$h(x) = f(g(x))$$

$$h' = f'(g(x)) \cdot g'(x) \text{ or } U' du$$

$$h(x) = (2x+3)^3 \qquad u = 2x+3$$

$$du =$$

$$h(x) = u^3 \cdot du$$

$$=$$

MORE EXAMPLES

differentiate the following.

1) $y = 5 - 2x$

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

3) $y = \frac{x^2}{3}$

4) $m = \sqrt{t}$

5) $y = \sqrt{1-t}$

6) $f(x) = (2-x)\sqrt{x}$

7) $y = (3x^2 + 5x)^{\frac{5}{2}}$

7) $f(x) = (4-3x)x^{\frac{3}{2}}$

8) $y = \dfrac{4-2x}{3-x}$

9) $f(x) = \sqrt{2x}\,(4+2x)$

10) $g(x) = (2x+4)^3 \cdot {}^-4x^{-5}$

List of Derivative Rules

Below is a list of all the derivative rules we went over in class.

- **Constant Rule:** $f(x) = c$ then $f'(x) = 0$

- **Constant Multiple Rule:** $g(x) = c \cdot f(x)$ then $g'(x) = c \cdot f'(x)$

- **Power Rule:** $f(x) = x^n$ then $f'(x) = nx^{n-1}$

- **Sum and Difference Rule:** $h(x) = f(x) \pm g(x)$ then $h'(x) = f'(x) \pm g'(x)$

- **Product Rule:** $h(x) = f(x)g(x)$ then $h'(x) = f'(x)g(x) + f(x)g'(x)$

- **Quotient Rule:** $h(x) = \dfrac{f(x)}{g(x)}$ then $h'(x) = \dfrac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$

- **Chain Rule:** $h(x) = f(g(x))$ then $h'(x) = f'(g(x))g'(x)$

- **Trig Derivatives:**
  - $f(x) = \sin(x)$ then $f'(x) = \cos(x)$
  - $f(x) = \cos(x)$ then $f'(x) = -\sin(x)$
  - $f(x) = \tan(x)$ then $f'(x) = \sec^2(x)$
  - $f(x) = \sec(x)$ then $f'(x) = \sec(x)\tan(x)$
  - $f(x) = \cot(x)$ then $f'(x) = -\csc^2(x)$
  - $f(x) = \csc(x)$ then $f'(x) = -\csc(x)\cot(x)$

- **Exponential Derivatives**
  - $f(x) = a^x$ then $f'(x) = \ln(a)a^x$
  - $f(x) = e^x$ then $f'(x) = e^x$
  - $f(x) = a^{g(x)}$ then $f'(x) = \ln(a)a^{g(x)}g'(x)$
  - $f(x) = e^{g(x)}$ then $f'(x) = e^{g(x)}g'(x)$

- **Logarithm Derivatives**
  - $f(x) = \log_a(x)$ then $f'(x) = \dfrac{1}{\ln(a)x}$
  - $f(x) = \ln(x)$ then $f'(x) = \dfrac{1}{x}$
  - $f(x) = \log_a(g(x))$ then $f'(x) = \dfrac{g'(x)}{\ln(a)g(x)}$
  - $f(x) = \ln(g(x))$ then $f'(x) = \dfrac{g'(x)}{g(x)}$

LESSON PRACTICE

Differentiate. You may leave the square roots in the denominator.

1. $y = 6x - 3$

2. $y = 5x^2 - 4x + 1$

3. $y = (4 - 3t)^2$

4. $y = (5 + 2t)^3$

5. $y = 2z^6$