Rules of Differentiation

Derivative of a Constant

$f(x) = c$;where c is a constant

$$f'(x) = 0$$

Ex: $f(x) = 5$

Note that $f'(x) = 0$ because the slope of the tangent line is always zero.

The Power Rule

$f(x) = x^n$

$\mathbf{f'(x) = nx^{n-1}}$;where *n* can be a positive integer, a negative integer, or fractional

Ex: $f(x) = x^2$
Note that $f'(x) = 2x$

(Show by using the difference quotient for the instantaneous rate of change).

Contant Multiple Rule

If f(x) = cg(x), then **f' = cg'** ;where *c* is a constant

Ex: $f(x) = 3(x^2 - 12x)$

Note $f'(x) = 3(2x-12) = 6x-36$

Sum and Difference Rule

if $f(x) = g(x) \pm h(x)$ then $\mathbf{f' = g' \pm h'}$

No example needed:
Common sense here
folks

Product Rule

If $f(x) = u(x)\ v(x)$, then

$$f'(x) = u \cdot v' + v \cdot u'$$

Ex: $f(x) = (x^2+1)(3x^3-7)$

Note $f\,'(x) = (x^2+1)(9x^2)+(3x^3-7)(2x)$

Quotient Rule

(as a direct result of the product rule)

$$\text{If } f(x) = \frac{u}{v}$$

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

Ex: $f(x) = (2x+1)/(x-3)$

Note $f'(x) = [(x-3)(2)-(2x+1)(1)]/(x-3)^2$

Practice 1: Find the derivative of

$f(x) = -7x^{1/2} + 22$

$f(x) = 3x + 2x^{-5} + 11$

Practice 2: Find the derivative of

$$y = \sqrt{t^3} - t$$

$$g(\alpha) = \frac{4}{\alpha^2}$$

Practice 3: Find the derivative of

$$f(x) = \sqrt[3]{x}(x^2 + 5)$$

Practice 4: Find the derivative of

$$f(x) = \frac{\sqrt{x}}{x + 3x^4}$$

Practice 5: Determine all of the x values of the function $f(x) = (1/3)x^3 + x^2 - 35x$ at which the tangent lines are horizontal.

Practice 6: Determine all of the x values of the function $f(x) = 3x^5 - 20x^3$ at which the tangent lines are horizontal.

Homework
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