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10 – Basic Derivative Rules

Theorem: Constant Rule & Power Rule

Let c be any constant and n any real number.

- $\frac{d}{dx}(c) = 0$ and $\frac{d}{dx}(x^n) = nx^{n-1}$
- **1.** Find f'(x), if possible.
 - (a) $f(x) = x^{\pi}$ (c) $f(x) = \pi^{x}$

(b)
$$f(x) = \frac{1}{\sqrt[3]{x}}$$
 (d) $f(x) = \pi^2$

Theorem: Sum, Difference, and Constant Multiple Rules Let f and g be differentiable, and let c be any constant.

- **1.** $\frac{d}{dx} [cf(x)] = c \frac{d}{dx} [f(x)]$ or alternatively [cf(x)]' = cf'(x)
- 2. $\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}[f(x)] \pm \frac{d}{dx}[g(x)]$ or alternatively $[f(x) \pm g(x)]' = f'(x) \pm g'(x)$
- 2. Compute the derivative.

(a)
$$f(x) = 7 + 0.5x^2 - \frac{3}{\sqrt{x}} + \pi^3$$

(b)
$$g(x) = (x + x^{-1}) (7 + \pi x - x^2)$$

(c)
$$h(t) = \frac{t^5 - \sqrt{t}}{3t^2}$$

3. Find all points where the graph of $y = \frac{1}{x^2} + 16x^2$ has a horizontal tangent line.

4. The graph of $f(x) = e^x$ is below.



- (a) What is the *geometric* meaning of f'(0)?
- (b) Use the graph of f(x) to find f'(0).



5. Find an equation for the tangent line to the graph of $f(x) = 7e^x - \sqrt{x} + 1$ where x = 1.