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## 10 - Basic Derivative Rules

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## Theorem: Constant Rule \& Power Rule

Let $c$ be any constant and $n$ any real number.

$$
\frac{d}{d x}(c)=0 \quad \text { and } \quad \frac{d}{d x}\left(x^{n}\right)=n x^{n-1}
$$

1. Find $f^{\prime}(x)$, 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. $\frac{d}{d x}[c f(x)]=c \frac{d}{d x}[f(x)] \quad$ or alternatively $\quad[c f(x)]^{\prime}=c f^{\prime}(x)$
2. $\frac{d}{d x}[f(x) \pm g(x)]=\frac{d}{d x}[f(x)] \pm \frac{d}{d x}[g(x)] \quad$ or alternatively $\quad[f(x) \pm g(x)]^{\prime}=f^{\prime}(x) \pm g^{\prime}(x)$
3. Compute the derivative.
(a) $f(x)=7+0.5 x^{2}-\frac{3}{\sqrt{x}}+\pi^{3}$
(b) $g(x)=\left(x+x^{-1}\right)\left(7+\pi x-x^{2}\right)$
(c) $h(t)=\frac{t^{5}-\sqrt{t}}{3 t^{2}}$
4. Find all points where the graph of $y=\frac{1}{x^{2}}+16 x^{2}$ has a horizontal tangent line.
5. The graph of $f(x)=e^{x}$ is below.

(a) What is the geometric meaning of $f^{\prime}(0)$ ?
(b) Use the graph of $f(x)$ to find $f^{\prime}(0)$.

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

