DERIVATIVE RULES

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Name: Solutions

Use **only the following rules** to compute the derivative of the given function.

Theorem. *Let c and n be constants. If f and g are differentiable functions, then*

Derivative of a Constant Function: $\frac{\mathrm{d}}{\mathrm{d}x}(c) = 0$

Power Rule: $\frac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

Constant Multiple Rule: $\frac{\mathrm{d}}{\mathrm{d}x}\big(cf(x)\big) = cf'(x)$

Sum Rule: $\frac{\mathrm{d}}{\mathrm{d}x}\big(f(x)+g(x)\big) = f'(x)+g'(x)$

Difference Rule: $\frac{\mathrm{d}}{\mathrm{d}x}\big(f(x)-g(x)\big) = f'(x)-g'(x)$

1. $f(x) = \pi^{400}$

$f'(x) = 0.$

2. $f(x) = 10x^4 + 3x^2 - 7x + 500\pi$

$f'(x) = 10(4x^3) + 3(2x) - 7(1) + 0$

$= \boxed{40x^3 + 6x - 7.}$

3. $f(x) = 6\sqrt[3]{x^2} + 2\sqrt{x^3}$

$= 6(x^2)^{1/3} + 2(x^3)^{1/2}$

$= 6x^{2/3} + 2x^{3/2}$

$f'(x) = 6\left(\frac{2}{3}x^{-\frac{1}{3}}\right) + 2\left(\frac{3}{2}x^{1/2}\right)$

$= 4x^{-\frac{1}{3}} + 3x^{1/2}$

$= \boxed{\frac{4}{\sqrt[3]{x}} + 3\sqrt{x}}$

4. $f(x) = (x+2)^2$

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

$= x^2 + 4x + 4$

$\boxed{f'(x) = 2x + 4}$

5. $f(x) = (3x-1)(x+2)$

$$= 3x^2 + 6x - x - 2$$

$$= 3x^2 + 5x - 2$$

$$f'(x) = \boxed{6x+5}$$

6. $f(x) = \dfrac{1}{x^{12}} + 7x - 21$

$$= x^{-12} + 7x - 21$$

$$f'(x) = \boxed{-12x^{-13} + 7}$$

Find the equation of the line tangent to the given curve at the given point.

7. $f(x) = 2x^3 - x^2 + 2$, $(1, 3)$.

$f'(x) = 6x^2 - 2x$

$f'(1) = 6 - 2 = 4$

$\boxed{y - 3 = 4(x-1)}$

or

$\boxed{y = 4x - 1}$

8. $f(x) = \sqrt{x}$, $(1, 1)$.

$f(x) = x^{1/2}$

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

$f'(1) = \frac{1}{2\sqrt{1}} = \frac{1}{2(1)} = \frac{1}{2}$

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

or

$\boxed{y = \frac{1}{2}x + \frac{1}{2}}$

9. $f(x) = x^2$, $(1, 1)$

$f'(x) = 2x$

$f'(1) = 2(1) = 2$

$\boxed{y - 1 = 2(x-1)}$

or

$\boxed{y = 2x - 1}$