

# DIFFERENTIATION RULES

NUTM Nexus Writing Team

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## 1 Examples

1. (*Example 1*) Differentiate the following powers of  $x$ :

(a)  $x^3$

(b)  $x^{2/3}$

(c)  $x^{\sqrt{2}}$

(d)  $\frac{1}{x^4}$

(e)  $x^{-4/3}$

(f)  $\sqrt{x^{2+\pi}}$

2. (*Example 2*) Compute  $\frac{d}{dx}(3x^2)$ .

3. (*Example 3*) Find the derivative of the polynomial  $y = x^3 + \frac{4}{3}x^2 - 5x + 1$ .

## 2 ClassWork Problems

Find the derivative of the following functions with respect to their independent variable (assume  $y, s, w, r$  depend on  $x, t, z, s$  respectively, unless otherwise implied by notation like  $d/dx$ ).

4.  $y = -x^2 + 3$

5.  $y = x^2 + x + 8$

6.  $s = 5t^3 - 3t^5$

7.  $w = 3z^7 - 7z^3 + 21z^2$

8.  $y = \frac{4x^3}{3} - x + 2e^x$

9.  $y = \frac{x^3}{3} + \frac{x^2}{2} + \frac{x}{4}$

10.  $w = 3z^{-2} - \frac{1}{z}$

11.  $s = -2t^{-1} + \frac{4}{t^2}$

12.  $y = 6x^2 - 10x - 5x^{-2}$

13.  $y = 4 - 2x - x^{-3}$

14.  $r = \frac{1}{3s^2} - \frac{5}{2s}$

15.  $r = \frac{12}{\theta} - \frac{4}{\theta^3} + \frac{1}{\theta^4}$

16.  $y = \frac{x^4}{2} - \frac{3}{2}x^2 - x$

17.  $y = \frac{x^5}{120}$

### 3 Application

18. The reaction  $R$  of the body to a dose  $M$  of medicine is given by

$$R = M^2 \left( \frac{C}{2} - \frac{M}{3} \right)$$

where  $C$  is a positive constant. Find the sensitivity of the body to the medicine, which is defined as  $\frac{dR}{dM}$ .