

DIFFERENTIATION RULES

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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 $\frac{dR}{dM}$.