

Power Rule & Constant Rule for Derivatives

Calculus Worksheet · Grade 11–12

Name: _____

Date: _____

Learning Objectives

- Apply the power rule to find derivatives of polynomial and rational functions
- Apply the constant rule to identify derivatives of constant terms
- Convert radical and fractional expressions before differentiating

Problems

1. Use the constant rule to find the derivative.

$$f(x) = 47$$

2. Use the power rule to find the derivative.

$$f(x) = x^5$$

3. Use the power rule to find the derivative.

$$f(x) = 4x^3$$

4. Find the derivative of the linear function below.

$$f(x) = 9x$$

5. Find the derivative of the constant expression below.

$$f(x) = e^\pi$$

6. Find the derivative of the polynomial below using the power rule and constant rule.

$$f(x) = 5x^4 - 3x^2 + 8$$

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7. Expand the binomial first, then find the derivative.

$$f(x) = (2x + 3)^2$$

8. Convert the radical to an exponential expression, then find the derivative.

$$f(x) = \sqrt[4]{x^3}$$

9. Rewrite the fraction using a negative exponent, then find the derivative.

$$f(v) = \frac{7}{v^5} + \pi^3$$

10. Find the derivative of the function below, which combines polynomial, radical, and constant terms.

$$f(x) = 6x^4 - \frac{2}{x^3} + \sqrt[3]{x} + 15$$

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Power Rule & Constant Rule for Derivatives — Answer Key

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Answer Key

1. Answer: $f'(x) = 0$

- 47 is a constant value with no variable.
 - By the constant rule, the derivative of any constant is 0.
 - $f'(x) = 0$
-

2. Answer: $f'(x) = 5x^4$

- Apply the power rule: bring the exponent down as a multiplier.
 - $f'(x) = 5 \cdot x^{(5-1)}$
 - $f'(x) = 5x^4$
-

3. Answer: $f'(x) = 12x^2$

- Apply the power rule: bring down the exponent and multiply by the coefficient.
 - $f'(x) = 3 \cdot 4x^{(3-1)}$
 - $f'(x) = 12x^2$
-

4. Answer: $f'(x) = 9$

- Rewrite as $9x^1$ and apply the power rule.
 - $f'(x) = 1 \cdot 9x^{(1-1)} = 9x^0$
 - Since $x^0 = 1$, $f'(x) = 9$
-

5. Answer: $f'(x) = 0$

- e and π are both mathematical constants.
 - e^π evaluates to a fixed number, making it a constant.
 - By the constant rule, $f'(x) = 0$
-

6. Answer: $f'(x) = 20x^3 - 6x$

- Differentiate each term separately.
 - Derivative of $5x^4 = 20x^3$
 - Derivative of $-3x^2 = -6x$
 - Derivative of 8 (constant) = 0
 - $f'(x) = 20x^3 - 6x$
-

7. Answer: $f'(x) = 8x + 12$

- Expand: $(2x+3)^2 = 4x^2 + 12x + 9$
 - Differentiate each term: derivative of $4x^2 = 8x$
 - Derivative of $12x = 12$, derivative of $9 = 0$
 - $f'(x) = 8x + 12$
-

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8. Answer: $f'(x) = \frac{3}{4} x^{-1/4}$ or $\frac{3}{4}\sqrt[4]{x}$

- Rewrite the radical as $f(x) = x^{(3/4)}$.
 - Apply the power rule: bring down 3/4.
 - $f'(x) = (3/4) \cdot x^{(3/4 - 1)} = (3/4) \cdot x^{(-1/4)}$
 - Convert negative exponent: $f'(x) = 3 / (4 \cdot x^{(1/4)}) = 3 / (4 \cdot \text{fourth-root of } x)$
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9. Answer: $f'(v) = -35v^{-6}$

- Rewrite as $f(v) = 7v^{(-5)} + \pi^3$.
 - π^3 is a constant, so its derivative is 0.
 - Apply the power rule to $7v^{(-5)}$: bring down -5.
 - $f'(v) = -5 \cdot 7v^{(-5-1)} = -35v^{(-6)}$
-

10. Answer: $f'(x) = 24x^3 + 6x^{-4} + \frac{1}{3}x^{-2/3}$

- Rewrite each term: $6x^4$, $-2x^{(-3)}$, $x^{(1/3)}$, and 15.
 - Derivative of $6x^4 = 24x^3$.
 - Derivative of $-2x^{(-3)} = (-3)(-2)x^{(-4)} = 6x^{(-4)}$.
 - Derivative of $x^{(1/3)} = (1/3)x^{(1/3 - 1)} = (1/3)x^{(-2/3)}$.
 - Derivative of 15 (constant) = 0.
 - $f'(x) = 24x^3 + 6x^{(-4)} + (1/3)x^{(-2/3)}$
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