

PRECALCULUS REVIEW

PART 4: BASIC LIMIT & DERIVATIVE RULES

SECTION A: DERIVATIVE OF A CONSTANT

1. 8

2. $-\frac{3}{4}$

3. π

4. 8

5. $-\frac{3}{4}$

6. π

7. 8

8. $-\frac{3}{4}$

9. π

10. 8

11. $-\frac{3}{4}$

12. π

13. 0

14. 0

15. 0

DERIVATIVE OF A CONSTANT

If $f(x) = c$, where c is a constant, then $f'(x) = \underline{0}$.

SECTION B: DERIVATIVE OF POWER

1. $f'(x) = 1$

2. $g'(x) = 2x$

3. $j'(x) = 3x^2$

4. $k'(x) = 4x^3$

5. $f'(x) = 5x^4$

6. $f'(x) = 6x^5$

7. $f'(x) = 7x^6$

8. $f'(x) = 8x^7$

9. $f'(x) = 9x^8$

10. $f'(x) = 10x^9$

THE POWER RULE

Given $f(x) = x^n$, where n is a real-number exponent, then $f'(x) = n \cdot x^{n-1}$.

11. (A) & (B) $f'(x) = -\frac{1}{x^2}$

12. (A) & (B) $f'(x) = \frac{1}{2\sqrt{x}}$

PRACTICE

Find the derivatives of the following using the power rule.

1. $f'(x) = -\frac{3}{x^4}$

2. $f'(x) = \frac{1}{3\sqrt[3]{x^2}}$

3. $f'(x) = \frac{3}{\sqrt[4]{x}}$

4. $f'(x) = -\frac{1}{4\sqrt[4]{x^5}}$

SECTION C: NEW DERIVATIVE RULES FROM OLD

PRACTICE

1. (A) $f'(x) = 8x + 6$

(B) $g'(x) = 15x^2 - 20x$

2. (A) $f'(x) = 8x + 6$

(B) $g'(x) = 15x^2 - 20x$

SECTION D: DERIVATIVE OF THE NATURAL EXPONENTIAL FUNCTION

h	$\frac{e^h - 1}{h}$
-1	0.6321206
-0.5	0.7869387
-0.1	0.9516258
-0.01	0.9950166
-0.001	0.9995002
-0.00001	0.999995
0	UNDEFINED
0.00001	1.000005
0.001	1.0005
0.01	1.005017
0.1	1.051709
0.5	1.297443
1	1.718282

$$\lim_{h \rightarrow 0} \left[\frac{e^h - 1}{h} \right] = 1$$

DERIVATIVE OF THE NATURAL EXPONENTIAL FUNCTION

Given $f(x) = e^x$, then $f'(x) = e^x$

SECTION E: SUMMARY & ALTERNATE NOTATION

CONSTANT RULE: $\frac{d}{dx}(c) = 0$, if c is a real-number constant.

POWER RULE: $\frac{d}{dx}(x^n) = nx^{n-1}$, if n is a real-number exponent.

CONSTANT MULTIPLE RULE:

$$\frac{d}{dx}[c \cdot f(x)] = \boxed{c} \cdot \frac{d}{dx} f(x) \text{ , if } c \text{ is a real-number constant.}$$

SUM RULE: $\frac{d}{dx}[f(x) + g(x)] = \frac{d}{dx} f(x) + \boxed{\frac{d}{dx} g(x)}$

DIFFERENCE RULE: $\frac{d}{dx}[f(x) - g(x)] = \frac{d}{dx} f(x) - \frac{d}{dx} g(x)$

NATURAL EXPONENTIAL RULE:

$$\frac{d}{dx}(e^x) = e^x$$

EXERCISES

Find the derivatives of the following functions, using the derivative rules learned in this lesson.

1. $f'(x) = 70x^6$

2. $f'(x) = 7e^x$

3. $f'(x) = -\frac{36}{x^4}$

4. $f'(x) = 0$

5. $f'(x) = \frac{3}{5\sqrt[5]{x^2}}$

6. $f'(x) = -\frac{4}{\sqrt{x^3}}$

7. $f'(x) = 12x^2 - 14x + 8$

8. $f'(x) = 12x + 4e^x + \frac{8}{x^2}$

9. $f'(x) = \frac{2}{3\sqrt[3]{x}} - \frac{2}{3\sqrt[3]{x^5}}$

10. $f'(x) = 9\sqrt{x} + \frac{2}{\sqrt{x}} - \frac{3}{2\sqrt{x^3}}$

11. $f'(t) = t^5 - 12t^3 + 1$

12. $f'(t) = -\frac{3}{\sqrt[5]{t^8}}$

13. $f''(x) = e^x - 14$

14. $f''(x) = 30$

15. $f''(x) = 48x$

16. $f''(x) = \frac{15}{16\sqrt[4]{x^5}}$

17. $f''(t) = 18 - \frac{8}{t^3} + \frac{18}{t^4}$

18. $f''(t) = -\frac{2}{9\sqrt[3]{t^4}} + \frac{3}{2\sqrt{t}}$

19.

(a) $v(t) = 12t^2 - 24t$ $a(t) = 24t - 24$

(b) $a(2) = 24 \text{ m/s}^2$

(c) 24 m/s^2

20.

(a) $v(t) = 3t^2 - 12t + 4$ $a(t) = 6t - 12$

(b) $a(1) = -6 \text{ ft/min}^2$

(c) $v(2) = -8 \text{ ft/min}^2$