

C7L1 Notes

Zero and Negative Exponents

$$x^3 = x \cdot x \cdot x$$

$$\text{So } x^2 (x^3) = x \cdot x (x \cdot x \cdot x) = x^5$$

Zero Exponents:

$$3^5 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 243$$

$$3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$$

$$3^3 = 3 \cdot 3 \cdot 3 = 27$$

$$3^2 = 3 \cdot 3 = 9$$

$$3^1 = 3 = 3$$

$$3^0 = 1$$

Therefore: $x^0 = 1$

Negative Exponents:

The base with the negative exponent always MOVES!

$$x^{-1} = \frac{1}{x} \quad \frac{1}{x^{-1}} = x \quad x^{-2} = \frac{1}{x^2} \quad \frac{1}{x^{-2}} = x^2$$

$$x^3 x^{-5} = \frac{x^3}{x^5} = \frac{\cancel{x} \cdot \cancel{x} \cdot \cancel{x}}{\cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x}} = \frac{1}{\cancel{x} \cdot \cancel{x}} = \frac{1}{x^2}$$

Evaluate each expression.

1. 2^{-3}

$$\frac{1}{2^3}$$
$$\frac{1}{2 \cdot 2 \cdot 2}$$
$$\frac{1}{8}$$

2. $(-2)^{-3}$

$$\frac{1}{(-2)^3}$$
$$\frac{1}{(-2)(-2)(-2)}$$
$$\frac{1}{-8}$$

3. -2^{-3}

$$\frac{-1}{2^3}$$
$$\frac{-1}{2 \cdot 2 \cdot 2}$$
$$-\frac{1}{8}$$

4. 2^{-4}

$$\frac{1}{2^4}$$
$$\frac{1}{2 \cdot 2 \cdot 2 \cdot 2}$$
$$\frac{1}{16}$$

5. $(-2)^{-4}$

$$\frac{1}{(-2)^4}$$
$$\frac{1}{(-2)(-2)(-2)(-2)}$$
$$\frac{1}{16}$$

6. -2^{-4}

$$\frac{-1}{2^4}$$
$$\frac{-1}{2 \cdot 2 \cdot 2 \cdot 2}$$
$$-\frac{1}{16}$$

7. 8^0

$$1$$

8. -8^0

$$-1(1)$$
$$-1$$

9. 7^{-1}

$$\frac{1}{7}$$

10. -7^{-1}

$$-\frac{1}{7}$$

11. $(-1)^{-7}$

$$\frac{1}{(-1)^7}$$
$$\frac{1}{\underbrace{(-1)(-1)(-1)(-1)(-1)(-1)(-1)}}_7$$
$$\frac{1}{-1}$$
$$-1$$

12. $(-1)^{-8}$

$$\frac{1}{(-1)^8}$$
$$\frac{1}{\underbrace{(-1)(-1)(-1)(-1)(-1)(-1)(-1)(-1)}}_8$$
$$\frac{1}{1}$$
$$1$$

Simplify. Use only positive exponents.

13. $5xy^0$

$$5x(1)$$
$$5x$$

14. $\frac{1}{n^{-3}}$

$$n^3$$

15. $4n^{-3}$

$$\frac{4}{n^3}$$

16. $\frac{4^{-2}}{n}$

$$\frac{1}{4^2 n}$$

$$\frac{1}{16n}$$

17. $m^{-8}n^0$

$$\frac{n^0}{m^8}$$

$$\frac{1}{m^8}$$

18. $\frac{8xy^{-4}}{7z}$

$$\frac{8x}{7zy^4}$$

19. $r^{-4}s^{11}$

$$\frac{s^{11}}{r^4}$$

20. $\frac{9x}{7y^{-5}}$

$$\frac{9xy^5}{7}$$

21. $3^{-2}m^3n^{-8}$

$$\frac{m^3}{3^2 n^8}$$

$$\frac{m^3}{9n^8}$$

22. $11^0u^4v^{-3}$

$$\frac{1u^4}{v^3}$$

$$\frac{u^4}{v^3}$$

23. $\frac{5x^{-1}y^{-5}}{z^0}$

$$\frac{5}{1xy^5}$$

$$\frac{5}{xy^5}$$

24. $\frac{5a^0b^{-4}}{3^{-1}c^7}$

$$\frac{5(1)3}{b^4 c^7}$$

$$\frac{15}{b^4 c^7}$$

Evaluate for $a = -2$ and $b = 3$

25. a^{-3}

$$\frac{1}{a^3}$$

$$\frac{1}{(-2)^3}$$

$$\frac{1}{-8}$$

26. b^{-4}

$$\frac{1}{b^4}$$

$$\frac{1}{(3)^4}$$

$$\frac{1}{81}$$

27. $a^0 b^{-2}$

$$1(b^{-2})$$

$$\frac{1}{b^2}$$

$$\frac{1}{(3)^2}$$

$$\frac{1}{9}$$

28. $5b^{-1}$

$$\frac{5}{b}$$

$$\frac{5}{3}$$

29. $\frac{4a}{b^{-3}}$

$$4ab^3$$

$$4(-2)(3)^3$$

$$-8(27)$$

$$-216$$

30. $\frac{a^0}{b^{-2}}$

$$\frac{1}{b^{-2}}$$

$$1 \cdot b^2$$

$$1(3)^2$$

$$1(9)$$

$$9$$

31. $3a^{-3}b^{-2}$

$$\frac{3}{a^3 b^2}$$

$$\frac{3}{(-2)^3 (3)^2}$$

$$\frac{3}{(-8)(9)}$$

$$\frac{3}{-72}$$

$$\frac{1}{-24}$$

32. $\frac{1}{4^{-2} a^3 b^{-3}}$

$$\frac{4^2 b^3}{a^3}$$

$$\frac{16 b^3}{a^3}$$

$$\frac{16(3)^3}{(-2)^3}$$

$$\frac{16(27)}{-8}$$

$$\frac{432}{-8}$$

$$-54$$

33. $\frac{b^{-2}}{a^{-4}}$

$$\frac{a^4}{b^2}$$

$$\frac{(-2)^4}{(3)^2}$$

$$\frac{16}{9}$$