

Operations on Powers Lesson Solutions (DO NOT WRITE ON PAPER)

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

$$2. \frac{(-5)^3}{-125}$$

$$3. \frac{-3^2}{-1 \times 3^2} \\ \frac{-1 \times 9}{-1 \times 9} \\ -9$$

$$4. \frac{(-1)^{100}}{1}$$

$$5. \frac{(-1)^{123}}{-1}$$

$$6. \frac{-1^{666}}{-1}$$

$$7. \frac{-2(-2)^2}{-2 \times 4} = -8$$

$$8. \frac{-2^2 - (-2)^2}{-4 - 4} = -8$$

$$9. \frac{0^1}{0}$$

$$10. \frac{1^0}{1}$$

$$11. \frac{\pi^0}{1}$$

$$12. \frac{0^0}{\text{Undefined}}$$

$$13. \left(\frac{2}{3}\right)^2 \\ \frac{4}{9}$$

$$14. 2^{-3} \\ = \frac{1}{2^3} \\ = \frac{1}{8}$$

$$15. \left(\frac{3}{2}\right)^{-2} \\ = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$$

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

$$17. 4(-2)^{-3} \div \frac{1}{2^{-2}} \\ = \frac{4}{(-2)^3} \div 2^2 \\ = \frac{4}{-8} \times \frac{1}{4} \\ = -\frac{1}{8}$$

$$18. \frac{a(2a^3 \times 3a^2)}{6a^6}$$

$$19. \frac{x(x^2)(x^5)}{x^4} \\ = \frac{x^8}{x^4} = x^4$$

$$20. \frac{(2x^3y^2)^3}{8x^9y^6}$$

$$21. \left(\frac{4x^5}{2x^3}\right)^3 \\ = (2x^2)^3 \\ = 8x^6$$

$$22. \left(\frac{3a}{9a^{-2}}\right)^2 \\ \left(\frac{a^3}{3}\right)^2 = \frac{a^6}{9}$$

$$23. \left(\frac{5x^2yz^3}{25x^{-1}y^3}\right)^{-3} \\ = \left(\frac{25x^{-1}y^3}{5x^2yz^3}\right)^3 \\ = \left(\frac{5y^2}{x^3z^3}\right)^3 \\ = \frac{125y^6}{x^9z^9}$$

$$\begin{aligned}
 24. \quad & 16^{1-2x} = 2^x \\
 & (2^4)^{(1-2x)} = 2^x \\
 & 2^{4-8x} = 2^x \\
 & 4 - 8x = x \\
 & 4 = 9x \\
 & \frac{4}{9} = x
 \end{aligned}$$

$$\begin{aligned}
 25. \quad & -3x \left(\frac{2x^5 y^{-2}}{x^{-3} y^5} \right)^{-3} \div \frac{1}{x^{-3} y} \\
 & -3x \left(\frac{2x^8}{y^7} \right)^{-3} \div \frac{x^3}{y} \\
 & -3x \cdot \left(\frac{y^7}{2x^8} \right)^3 \times \frac{y}{x^3} \\
 & -\frac{3y}{x^2} \cdot \frac{y^{21}}{8x^{24}} \\
 & = -\frac{3y^{22}}{8x^{26}}
 \end{aligned}$$

Challenge

$$\begin{aligned}
 26. \quad & \frac{125^{3x}}{25^{x-1}} = 625^{2x+1} \\
 & \frac{(5^3)^{3x}}{(5^2)^{(x-1)}} = (5^4)^{(2x+1)} \\
 & \frac{5^{9x}}{5^{(2x-2)}} = 5^{8x+4} \\
 & 5^{7x+2} = 5^{8x+4} \\
 & 7x + 2 = 8x + 4 \\
 & -2 = x
 \end{aligned}$$

$$27. \quad \left[\frac{(-2)^{500}}{-2^{497}} \right]^{-3} \div \left[-\frac{2^{200}}{(-2)^{199}} \right]^{-1} \times \frac{1^0}{\frac{0}{1-0! \times 1!}}$$

Hint: $k!$ means k factorial

$$\begin{aligned}
 & = [-2^3]^{-3} \div [2]^{-1} \times \frac{1}{0-1 \times 1} \\
 & = [-8]^{-3} \div \frac{1}{2} \times -1 \\
 & = \frac{1}{(-8)^3} \times 2 \times -1 \\
 & = \frac{1}{-512} \times -2 \\
 & = \frac{2}{512} = \frac{1}{256}
 \end{aligned}$$

$$\begin{aligned}
 28. \quad & \text{Solve } 25^{2x-1} = 6^{x+3} \text{ using Desmos or a} \\
 & \text{graphing calculator} \\
 & x \approx 1.85
 \end{aligned}$$