

Manipulating Powers

1) $(a^x)^y = a^{xy}$

4) $(ab)^x = a^x b^x$

7) $\frac{1}{a^{-x}} = a^x$

2) $a^x \cdot a^y = a^{x+y}$

5) $\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$

3) $\frac{a^x}{a^y} = a^{x-y}$

6) $a^{-x} = \frac{1}{a^x}$

Simplify each expression.

Example: $(x^2)^4 = x^{2 \cdot 4} = x^8$

1. $x^4 \cdot x^2$

x^6

2. $\frac{x^8}{x^6} x^2$

3. $(x^2y)^3$

$x^6 y^3$

4. $\left(\frac{x}{y^3}\right)^5$

$\frac{x^5}{y^{15}}$

5. y^{-15}

$\frac{1}{y^{15}}$

6. $\frac{1}{x^{-15}}$

x^{15}

7. $\frac{a^6}{a^9}$

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

8. $(2c^2)^3$

$8c^6$

9. $\frac{n^4 \cdot n^6}{n^8 \cdot n^2}$

$\frac{n^{10}}{n^{10}} = 1$

10. $4a^5 \cdot 3a^3$

$12a^8$

11. $\left(\frac{v}{3}\right)^4 \cdot \left(\frac{5}{v}\right)^2$

$\frac{\cancel{v^4} v^2}{3^4} \cdot \frac{5^2 \cancel{v^2}}{\cancel{v^2}} = \frac{25v^2}{81}$

12. $(x^{-2})^2 x^{-4}$

$= \frac{1}{x^4}$

13. $\left(\frac{2}{x}\right)^{-1}$

$\frac{x}{2}$

$$a^2 \cdot a^3 = a^5$$

$$a^{n+3}$$

Name _____

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14. $(x^{-2} \cdot y)^{-3} x^6 y^{-3} = \boxed{\frac{x^6}{y^3}}$

15. $\frac{12x^6}{3x^7} = \boxed{\frac{4}{x}}$

16. $\frac{8d}{(10d^{-4})(9d^2)} = \frac{8d}{90d^{-2}} = \frac{8d^3}{90} = \boxed{\frac{4d^3}{45}}$

17. $-2x^{-2} = \boxed{-\frac{2}{x^2}}$

18. $x^{\frac{1}{3}} \cdot x^{\frac{2}{3}} = \boxed{x^1}$

19. $\left(\frac{8x}{125}\right)^{-2} \left(\frac{125}{8x}\right)^2 = \boxed{\frac{15625}{64x^2}}$

20. $\frac{a^4 \cdot b^6 \cdot a^9}{b^{-2}} = \boxed{a^{13} b^8}$

21. $\frac{x^{-4} y^{-6}}{x^2 y^5 z} = \boxed{\frac{1}{x^6 y^{11} z}}$

22. $\left(\frac{x^2}{(xz)^2}\right)^{-2} \left(\frac{x^2 z^2}{x^2}\right)^2 \frac{x^4 y^4}{x^4} = \boxed{z^4}$

23. $\left(\frac{x^2 y^1 z}{a^4 b^{-7}}\right)^{-3} \left(\frac{a^4 b^{-7}}{x^2 y^1 z}\right)^3 \left(\frac{a^4}{x^2 y^1 z b^7}\right)^3 = \boxed{\frac{a^{12}}{b^2 x^6 y^3 z^3}}$

24. $(x^2 y^2)^{-2} \cdot x^4 y^{19} \frac{x^4 y^{19}}{x^4 y^4} = \boxed{y^{15}}$

25. $\left(\frac{x^{-4}}{y^6}\right)^3 \cdot \left(\frac{x}{y^4}\right)^{-4} \frac{x^{-12}}{y^{18}} \cdot \frac{x^{-4}}{y^{16}} = \frac{x^{-16}}{y^{34}} = \boxed{\frac{1}{x^{16} y^{34}}}$

26. $(a^2 b^1 c^8)^6 \cdot a^{-9} \cdot b^4 \cdot x = \frac{a^{12} b^6 c^{48} \cdot b^4 x}{a^9} = \boxed{a^3 b^{10} c^{48} x}$

27. $\left(\frac{x^4 b^{-1}}{4}\right)^{-3} \cdot 2x^5 (x^1 b^3 \cdot 4^3)(2x^5) = \boxed{128 b^3 x^{17}}$

28. $(a^2 b^{-2} c^1)^{-4} \cdot \left(\frac{ab}{x}\right)^3 = \frac{a^{11} b^8 c^{-4}}{x^3} = \boxed{\frac{b^8}{a^{33} c^4 x^3}}$

29. $\left(\frac{x^{-4} y^{-6} z^{10}}{a^1 b^2 c^{-4}}\right)^{-2} \cdot \left(\frac{a^1 b c^{-4}}{x^6 y z^9}\right) = \frac{x^8 y^{12} z^{-20}}{a^{-2} b^{-4} c^8} = \frac{a^2 b^4 x^8 y^{12}}{c^8 z^{20}} \cdot \frac{a b}{c^4 x^6 y z^9} = \boxed{\frac{a^3 b^5 x^2 y^{11}}{c^{12} z^{29}}}$