

Key 2023

Advanced Algebra

Exponent Rules and Shortcuts Practice **BLUE 2022**

Multiplying Like Bases Shortcut: $b^m b^n = b^{m+n}$

Dividing Like Bases Shortcut: $\frac{b^m}{b^n} = b^{m-n}$

Parenthesis Exponents Shortcut: $(ab)^n = a^n b^n$

Negative Exponents Shortcut: $b^{-m} = \frac{1}{b^m}$

and $\frac{a^{-n}}{b^{-m}} = \frac{b^m}{a^n}$

Zero Exponents Shortcut: $b^0 = 1$

Use two of the rules to simplify these expressions:

1) $(3x^3)^4 x^4$

$3^4 x^{12} x^4$
 $81x^{16}$

2) $a^6 b^{12} c^4 a^8 b^5 c^{-10}$

$a^{14} b^{17} c^{-6}$

$\frac{a^{14} b^{17}}{c^6}$

3) $(b^6 a^5)^8 ab^6$

$b^{48} a^{40} ab^6$
 $a^{41} b^{54}$

4) $(x^4 y^9)^{-4}$

$x^{-16} y^{-36}$

$\frac{1}{x^{16} y^{36}}$

5) $\frac{(a^5 b^4)^6}{b^6 a^1}$

$\frac{a^{30} b^{24}}{b^6 a^1}$

$a^{29} b^{18}$

6) $(\frac{a^8}{3b})^5$

$\frac{a^{40}}{3^5 b^5}$

$\frac{a^{40}}{243b^5}$

7) $(a^7 b^9)^{-10}$

$a^{-70} b^{-90}$

$\frac{1}{a^{70} b^{90}}$

8) $\frac{(4x^5)^3}{x^{10}}$

$\frac{4^3 x^{15}}{x^{10}}$

$\frac{64x^{15}}{x^{10}}$

$64x^5$

9) $x^{-4} x^4 z^{-6} x^{-8} y^5 z^{12}$

$x^{-12} y^9 z^{18}$

$\frac{y^9 z^{18}}{x^{12}}$

10) $\frac{5w^{-12} y^{-8}}{y^8 z^5 w^{-32}}$

$\frac{w^{20}}{5y^{16}}$

$\frac{w^{32}}{5w^{12} y^8 y^8}$

Remember that you can write any ROOT as a fraction exponent

$$1) \sqrt[3]{81x^9y^{12}} \quad (81x^9y^{12})^{\frac{1}{3}} \quad 81^{\frac{1}{3}} x^3 y^4$$

$$2) \frac{x^8 y^{-12} z^{-5}}{(a^5 b^5 c^{10})^{\frac{1}{3}}} \quad \frac{x^8}{a^{\frac{5}{3}} b^{\frac{5}{3}} c^{\frac{10}{3}}} \quad \frac{x^8}{y^{\frac{12}{3}} z^{\frac{5}{3}} a^{\frac{5}{3}} b^{\frac{5}{3}} c^{\frac{10}{3}}}$$

$$3) \left(\frac{b^{2x} b^{5x}}{b^4}\right)^3 \quad \left(\frac{b^{7x}}{b^4}\right)^3 \quad \frac{b^{21x}}{b^{12}}$$

$$4) \frac{27x^3 + 63x^5}{9x^2} \quad \frac{3 \cdot 27 \cdot x^3 + 3 \cdot 63 \cdot x^5}{9x^2} \quad 189x^6$$

$$5) 8^{3k+1} 64^{4k-1} \quad 8^{3k+1} \cdot 8^{2(4k-1)} \quad 8^{3k+1} \cdot 8^{8k-2} \quad 8^{11k-1}$$

$$6) \frac{27x^3 - 63x^5}{9x^2} \quad \frac{27x^3}{9x^2} - \frac{63x^5}{9x^2} \quad 3x - 7x^3$$

$$7) (x^2 y^5)^{40} \quad x^{80} y^{200}$$

$$8) \sqrt[3]{f^{4.7} - 6f^{2.7}} \quad f^{\frac{1}{3}} (f^{4.7} - 6f^{2.7}) \quad f^5 - 6f^3$$

$$9) (8^9 \sqrt[3]{8})^3 \sqrt[8]{8^2} \quad 8^9 \cdot 8^{\frac{1}{3}} \cdot 8^{\frac{2}{8}} \quad 8^{10}$$

$$10) \sqrt{f(f^{3.5} \cdot 2f^{1.5})} \quad f^{\frac{1}{2}} (f^{3.5} \cdot 2f^{1.5}) \quad f^{\frac{1}{2}} (2f^5) \quad 2f^{5.5}$$

$$11) \frac{a^2 b^{-\frac{1}{3}} c^{-1}}{a^{\frac{1}{2}} b^{\frac{4}{3}} c^2} \quad \frac{a^{\frac{3}{2}}}{b^{\frac{5}{3}} c^3}$$