

key 2023

Advanced Algebra

Name \_\_\_\_\_ hr \_\_\_\_\_

Exponent Rules and Shortcuts Practice GREEN 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:  $(ab)^n = a^n b^n$  and  $(b^m)^n = b^{m \cdot n}$

NEGATIVE EXPONENTS

Shortcuts:  $b^{-m} = \frac{1}{b^m}$  and  $\frac{a^{-n}}{b^{-m}} = \frac{b^m}{a^n}$

ZERO EXPONENTS

Shortcut:  $b^0 = 1$

Use the shortcuts to simplify these expressions. They should be quick one-step problems.

1)  $b^3 b^9$   
 $b^{12}$

2)  $\frac{x^{12}}{x^4}$   
 $x^8$

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

4)  $\frac{x^2}{x^5}$   
 $\frac{1}{x^3}$

5)  $x^0$   
1

6)  $(a^3 b c^5)^{14}$   
 $a^{42} b^{14} c^{70}$

7)  $(2xy8)^0$   
1

8)  $a^8 a^{-5}$   
 $a^3$

9)  $a^{10} b^{-6} c^{-2}$   
 $\frac{a^{10}}{b^6 c^2}$

10)  $(x^3)^{10}$   
 $x^{30}$

11)  $(a^4)^6$   
 $a^{24}$

Use two of the rules together to simplify these expressions.

1)  $(3x^2)^2 x^7$   
 $9x^4 x^7$   
 $9x^{11}$

3)  $\frac{(a^4 b^3)^8}{ab^4}$   
 $\frac{a^{32} b^{24}}{a b^4}$   
 $a^{31} b^{20}$

2)  $(a^3 b^2)^6 a^2 b^3$   
 $a^{18} b^{12} a^2 b^3$   
 $a^{20} b^{15}$

4)  $\frac{(3x^3)^2}{x^8}$   
 $\frac{9x^6}{x^8}$   
 $\frac{9}{x^2}$

$$5) x^{-3}y^4z^3x^{-6}y^3z^{10}$$

$$x^{-9}y^7z^{13}$$

$$\frac{z^3 \cdot 7}{x^9}$$

$$8) (a^4b^9)^{-10}$$

$$a^{-40}b^{-90}$$

$$\frac{1}{a^{40}b^{90}}$$

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

$$\frac{a^6b^4}{c^4}$$

$$9) \left(\frac{a^6}{2b}\right)^3$$

$$\frac{a^{18}}{8b^3}$$

$$7) (x^2y^4)^{-2}$$

$$x^{-4}y^{-8}$$

$$\frac{1}{x^4y^8}$$

$$10) \frac{5w^{-18}y^{-4}}{25y^8w^{-22}}$$

$$\frac{w^{22}}{5w^{18}y^8y^4}$$

$$\frac{w^4}{5y^{12}}$$

All Together Now - remember what third (& fourth) roots means!

$$1. \sqrt[3]{54x^6y^9}$$

$$(54x^6y^9)^{\frac{1}{3}} = 54^{\frac{1}{3}}x^2y^3$$

$$5. (6^5\sqrt{6})(\sqrt{6^3})$$

$$6^5 \cdot 6^{\frac{1}{2}} \cdot 6^{\frac{3}{2}} = 6^7$$

Key point Radical to Rational Notation

$$2. \left(\frac{b^x b^{3x}}{b^3}\right)^2$$

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

$$6. \frac{a^2 b^{\frac{1}{3}} c^{-1}}{a^{\frac{1}{2}} b^{\frac{4}{3}} c^2}$$

$$\frac{a^{1.5}}{b^{\frac{5}{3}}c^3}$$

$$3. 2^{3k+1}4^{k-1}$$

key point Change of base!!

$$2^{3k+1} \cdot 2^{2(k-1)} = 2^{5k-1}$$

$$4. \left(x^{\frac{1}{2}}y^{\frac{1}{5}}\right)^{20}$$

$$x^{10}y^4$$

$$7. \frac{x^2y^{-3}z^{-1}}{\left(\frac{2}{a^5}b^{\frac{1}{5}}c^{\frac{3}{5}}\right)^{10}}$$

$$\frac{x^2y^{-3}z^{-1}}{a^4b^2c^6} = \frac{x^2}{a^4b^2c^6y^3z}$$