

# ALG 1 - Unit 7 - Rational Exponents Day 3

Name \_\_\_\_\_

## BACKGROUND INFO

### How to add fractions

You try!  
Add the following:

$$\frac{1}{2} + \frac{3}{5} = \frac{5}{10} + \frac{6}{10}$$

$$= \frac{11}{10}$$

$$\begin{aligned} \frac{3}{4} + \frac{1}{3} &= \frac{3 \times 3}{4 \times 3} + \frac{1 \times 4}{3 \times 4} \\ &= \frac{9}{12} + \frac{4}{12} \\ &= \frac{13}{12} \end{aligned}$$

Make each fraction have the same denominator (the Least Common Multiple). Multiply each fraction by n/n so that the denominators are the LCM.

Now that the fractions have the same denominator, add the numerators.

Reduce the answer when necessary.

### How to multiply fractions

You try!  
Multiply the following:

$$\frac{1}{2} \cdot \frac{3}{5} = \frac{3}{10}$$

Multiply the numerators

$$\frac{2}{5} \times \frac{3}{4} = \frac{6}{20}$$

Multiply the denominators

$$\frac{2}{5} \times \frac{3}{4} = \frac{6}{20}$$

Reduce the fraction if necessary

$$\frac{6}{20} = \frac{3}{10}$$

The properties of exponents you learned previously in this unit apply to rational exponents as well.

Property	Example
1. $a^m \cdot a^n = a^{m+n}$	$5^{1/2} \cdot 5^{3/2} = 5^{(1/2 + 3/2)} = 5^2 = 25$
2. $(a^m)^n = a^{mn}$	$(3^{5/2})^2 = 3^{(5/2 \cdot 2)} = 3^5 = 243$
3. $(ab)^m = a^m b^m$	$(16 \cdot 9)^{1/2} = 16^{1/2} \cdot 9^{1/2} = 4 \cdot 3 = 12$
4. $a^{-m} = \frac{1}{a^m}, a \neq 0$	$36^{-1/2} = \frac{1}{36^{1/2}} = \frac{1}{6}$
5. $\frac{a^m}{a^n} = a^{m-n}, a \neq 0$	$\frac{4^{5/2}}{4^{1/2}} = 4^{(5/2 - 1/2)} = 4^2 = 16$
6. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$	$\left(\frac{27}{64}\right)^{1/3} = \frac{27^{1/3}}{64^{1/3}} = \frac{3}{4}$

Simplify.

$$\begin{aligned} 1. (n^4)^{3/2} &= n^{4 \cdot \frac{3}{2}} \\ &= n^{12/2} = \boxed{n^6} \end{aligned}$$

$$\begin{aligned} 2. (27p^6)^{5/3} &= 27^{5/3} p^{30/3} \\ &= (\sqrt[3]{27})^5 p^{10} \\ &= 3^5 p^{10} = \boxed{243p^{10}} \end{aligned}$$

$$\begin{aligned} 3. (25b^6)^{3/2} &= 25^{-3/2} b^{-18/2} \\ &= (\sqrt{25})^{-3} b^{-9} = 5^{-3} b^{-9} \\ &= \boxed{\frac{1}{125b^9}} \end{aligned}$$

$$4. 2m^2 \cdot 4m^{2/3} \cdot 4m^{-2}$$

$$\begin{aligned} &= 32m^{2 + \frac{2}{3} - 2} \\ &= \boxed{32m^{2/3}} \\ \text{or } &\boxed{32\sqrt[3]{m^2}} \end{aligned}$$

$$5. \frac{4x^2}{2x^{1/2}}$$

$$\begin{aligned} &= 2x^{2 - 1/2} \\ &= \boxed{2x^{3/2}} \\ \text{or } &\boxed{2\sqrt{x^3}} \end{aligned}$$

$$6. 3b^{1/2} \cdot b^{2/3}$$

$$\begin{aligned} &= 3b^{\frac{1}{2} + \frac{2}{3}} = \boxed{3b^{7/6}} \\ \text{or } &\boxed{3\sqrt[6]{b^7}} \end{aligned}$$

Rational Exponents Review Problems

Simplify. Your answers should only have positive exponents.

$$1. (64m^4)^{\frac{3}{2}}$$

$$= 64^{3/2} m^6 = \boxed{512 m^6}$$

$$2. (a^8)^{\frac{3}{2}}$$

$$= \boxed{a^{12}}$$

$$3. (9r^4)^{\frac{1}{2}}$$

$$= \boxed{3r^2}$$

$$4. \frac{\cancel{3}x^{\cancel{2}} \cdot \cancel{3}\cancel{x}^{\cancel{2}} y^{\frac{1}{3}}}{\cancel{3}y^{\frac{7}{4}}}$$

$$= 3y^{-1/3 - 7/4}$$

$$= \boxed{3y^{17/12}}$$

$$5. (81x^{12})^{\frac{5}{4}}$$

$$= \boxed{243x^{15}}$$

$$6. (216r^9)^{\frac{1}{3}}$$

$$= \boxed{6r^3}$$

$$7. \left(a^{\frac{1}{2}}\right)^{\frac{3}{2}} = \boxed{a^{3/4}}$$

$$8. \left(p^{\frac{3}{2}}\right)^{-2}$$

$$= p^{-3} = \boxed{\frac{1}{p^3}}$$

$$9. \left(m^1 \cdot m^{-2} n^{\frac{5}{3}}\right)^2$$

$$= \left(m^{-1} n^{5/3}\right)^2$$

$$= m^{-2} n^{10/3}$$

$$= \boxed{\frac{1}{m^2 n^{10/3}}}$$

$$10. \left(\frac{x^{\frac{1}{2}} y^{-2}}{yx^{\frac{7}{4}}}\right)^4$$

$$\frac{x^2 y^{-8}}{y^4 x^{-7}}$$

$$= x^9 y^{-12}$$

$$= \boxed{\frac{x^9}{y^{12}}}$$

$$11. \frac{(x^3 y^2)^{\frac{3}{2}}}{(x^{-1} y^{\frac{2}{3}})^{\frac{1}{4}}}$$

$$= \frac{x^{9/2} y^3}{x^{-1/4} y^{2/12}}$$

$$= x^{9/2 - (-1/4)} y^{3 - 2/12}$$

$$= \boxed{x^{19/4} y^{19/6}}$$

$$12. \frac{\left(x^{\frac{1}{2}} y^4\right)^{\frac{1}{4}}}{x^{\frac{2}{3}} y^{\frac{3}{2}} \cdot x^{\frac{3}{2}} y^{\frac{1}{2}}}$$

$$= \frac{x^{-1/8} y^1}{x^{-5/6} y^2}$$

$$= x^{-1/8 - (-5/6)} y^{1-2}$$

$$= \boxed{\frac{x^{17/24}}{y}}$$