



Key

Simplify the following using the necessary exponent laws.

1  $(2x)^4 \times (3x)^2 =$  \_\_\_\_\_

My calculations

$$2^4 x^4 \cdot 3^2 x^2$$

$$2^4 3^2 x^6$$

$$144x^6$$

2  $(5x^2)^{-1} =$  \_\_\_\_\_

My calculations

$$5^{-1} x^{-2}$$

$$\frac{1}{5x^2}$$

3  $(4x^6)^{\frac{1}{2}} =$  \_\_\_\_\_

My calculations

$$4^{\frac{1}{2}} x^{6 \cdot \frac{1}{2}}$$

$$\sqrt{4} \cdot x^3$$

$$2x^3$$

4  $\left(\frac{x^4}{y^3}\right)^2 =$  \_\_\_\_\_

My calculations

$$\frac{x^8}{y^6}$$

5  $\left(\frac{3}{x^5}\right)^{-2} =$  \_\_\_\_\_

My calculations

$$\frac{3^{-2}}{x^{-10}}$$

$$\frac{x^{10}}{3^2}$$

6  $\left(\frac{x^6 y^4}{z^{10}}\right)^{\frac{1}{2}} =$  \_\_\_\_\_

My calculations

$$\frac{x^{6 \cdot \frac{1}{2}} \cdot y^{4 \cdot \frac{1}{2}}}{z^{10 \cdot \frac{1}{2}}}$$

$$\frac{x^3 y^2}{z^5}$$

77  $\left(\frac{x^{-1}}{y^3}\right)^{-2} =$  \_\_\_\_\_

My calculations

$$\frac{x^{-2}}{y^{-6}}$$

$$\frac{x^2 y^6}{1}$$

83  $\left(\frac{2x^2}{3y^4}\right) \times \left(\frac{6y}{7x^3}\right) =$  \_\_\_\_\_

My calculations

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

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

$$\frac{2^2 x^{-1} y^{-3}}{7}$$

$$\frac{2^2}{7xy^3}$$

9  $\left(\frac{10x}{15y^3}\right) \times \left(\frac{3x^4}{4y}\right)^0 =$  \_\_\_\_\_

My calculations

$$\frac{10x}{15y^3} \cdot 1$$

$$\frac{2x}{3 \cdot 5y^3}$$

10  $(2x^{-1}y)^0 \times (3xy^{-2}) =$  \_\_\_\_\_

My calculations

$$1 \times 3xy^{-2}$$

$$\frac{3x}{y^2}$$



Simplify the following using the necessary exponent laws.

1  $\frac{(xy^{-1})^{-2}}{xy^2} =$  \_\_\_\_\_

**My calculations**

$$= \frac{x^{-2}y^2}{x^1y^2}$$

$$= x^{-2-1}y^{2-2}$$

$$= x^{-3}y^0$$

$$= \frac{1}{x^3}$$

2  $\left(\frac{2x^{-3}y^{-2}}{x^2y^{-1}}\right)^{-1} =$  \_\_\_\_\_

\* you can flip entire fraction first or simplify inside bracket.

**My calculations**

$$\frac{x^2y^{-1}}{2x^{-3}y^{-2}}$$

$$\frac{x^{2-(-3)}y^{-1-(-2)}}{2} = \frac{x^5y^1}{2}$$

3  $(x^{-3})^y =$  \_\_\_\_\_

**My calculations**

$$x^{-3y}$$

$$\frac{1}{x^{3y}}$$

4  $\frac{x^{24}}{\sqrt{x^{16}}} =$  \_\_\_\_\_

**My calculations**

$$= \frac{x^{24}}{x^{16 \cdot 1/2}}$$

$$= \frac{x^{24}}{x^8}$$

$$x^{24-8}$$

$$x^{16}$$

5  $(\sqrt{x^{-36}})^2 =$  \_\_\_\_\_

**My calculations**

$$(x^{-36 \cdot 1/2})^{1/2}$$

$$(x^{-18})^{1/2}$$

$$x^{-18 \cdot 1/2} = x^{-9}$$

$$= \frac{1}{x^9}$$

6  $(x^3y)^{-2} =$  \_\_\_\_\_

**My calculations**

$$x^{-6}y^{-2}$$

$$\frac{1}{x^6y^2}$$

7  $(x^2)^{\frac{1}{2}} \times \left(\frac{4x^2y}{3}\right)^{-2} =$  \_\_\_\_\_

My calculations

$$\frac{x \cdot 4^{-2} x^{-4} y^{-2}}{3^{-2}} = \frac{4^{-2} x^{-3} y^{-2}}{3^{-2}}$$

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

$$\frac{4^2 x^{-3} y^{-2}}{3^{-2}} = 4^2 x^3 y^2$$

8  $\frac{(4x^6y^{-2})^{\frac{1}{2}}}{x^5} =$  \_\_\_\_\_

My calculations

$$\frac{\sqrt{4} x^{6 \cdot \frac{1}{2}} y^{-2 \cdot \frac{1}{2}}}{x^5} = \frac{2x^3 y^{-1}}{x^5}$$

$$2x^{3-5} y^{-1}$$

$$2x^{-2} y^{-1}$$

$$\frac{2}{x^2 y}$$

9  $(3x^{\frac{1}{2}}) \times (7x)^{\frac{1}{2}} =$  \_\_\_\_\_

My calculations

$$3x^{\frac{1}{2}} \cdot 7^{\frac{1}{2}} x^{\frac{1}{2}}$$

$$3\sqrt{7} \cdot x$$

10  $\frac{xy^{-2}}{x^3y^{-5}} =$  \_\_\_\_\_

My calculations

$$x^{1-3} y^{-2-(-5)}$$

$$x^{-2} y^3 = \frac{y^3}{x^2}$$

# 10 Exponent Laws Review Level 3

ENRICHMENT



Skill Builder

Simplify the following using the necessary exponent laws.

1  $\left(\frac{3xy}{2x^2y^{-1}}\right)^{-2} \left(\frac{4x^3y}{6xy^2}\right)^{-1} =$

See loose leaf

My Calculations

$$\frac{2}{3y^3}$$

2  $\sqrt{\sqrt{x^{-12}}} =$

My Calculations

$$\left(\left(x^{-12}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}}$$

$$x^{-12 \cdot \frac{1}{2} \cdot \frac{1}{2}}$$

$$x^{-3/2} \quad \frac{1}{x^{3/2}}$$

3  $(5^2x^{-3}yz^4)^{-1} (3^{-2}xy^8z^{-3})^{-2} =$

My Calculations

$$5^{-2} x^3 y^{-1} z^{-4} \cdot 3^4 x^{-2} y^{-16} z^{16}$$

$$\frac{3^4 x^3 y^{-1-16} z^{-4+16}}{5^2}$$

$$\frac{3^4 x y^{-17} z^2}{5^2} \quad \frac{3^4 x z^2}{5^2 y^{17}}$$

4  $(16x^{12}y^8)^{\frac{1}{2}} (36x^{-4}y^{10})^{-\frac{1}{2}} = ?$

$$\frac{-4 \cdot -1}{2}$$

$$\frac{-2 \cdot -1}{2}$$

My Calculations

$$16^{1/2} x^{12 \cdot 1/2} y^{8 \cdot 1/2} \cdot 36^{-1/2} x^{-4 \cdot -1/2} y^{10 \cdot -1/2}$$

$$\frac{4 x^6 y^4 x^2 y^{-5}}{6 x^2 y^{-1}}$$

$$\frac{2 x^8}{3 y}$$

5  $\left(\frac{x^8}{\sqrt{x^{16}}}\right)^{-3} \left(\frac{\sqrt{x^{36}}}{x^{12}}\right)^{-1} =$

My Calculations

$$\left(\frac{x^{8 \cdot -3}}{x^{16 \cdot 1/2}}\right)^{-1} \left(\frac{x^{36 \cdot 1/2}}{x^{12}}\right)^{-1}$$

$$\frac{x^{8 \cdot -3}}{x^{8 \cdot -3}} \cdot \left(\frac{x^{18}}{x^{12}}\right)^{-1}$$

$$1 (x^6)^{-1} \quad \frac{1}{x^6}$$

6  $(x^3)^y (x^2)^{-4y} =$

My Calculations

$$x^{3y} x^{-8y}$$

$$\frac{x^{3y}}{x^{8y}} \quad x^{3y-8y}$$

$$x^{-5y}$$

# Skill Builder

$$7 \quad \left(\sqrt{\sqrt{x^{-16y}}}\right)\left(\sqrt{\sqrt{\sqrt{x^{24y}}}}\right)^3 =$$

My Calculations

$$\begin{aligned} &(x^{-16y})^{1/2 \cdot 1/2} (x^{24y})^{1/2 \cdot 1/2 \cdot 1/2 \cdot 3} \\ &x^{-4y} \cdot x^{9y} \\ &x^{5y} \end{aligned}$$

$$8 \quad (x^{2a}y^{3b})^4(x^{-a}y^{5b})^{-2} =$$

My Calculations

$$\begin{aligned} &x^{8a}y^{12b} \cdot x^{2a}y^{-10b} \\ &x^{10a}y^{2b} \end{aligned}$$

$$9 \quad \left(5x^{\frac{1}{2}}\right)\left(9x\right)^{\frac{1}{2}}\left(4x\right)^{\frac{-1}{2}} =$$

My Calculations

$$\begin{aligned} &5x^{1/2} \cdot 9^{1/2}x^{1/2} \cdot 4^{-1/2}x^{-1/2} \\ &\frac{5\sqrt{9}}{\sqrt{4}}x^{1/2+1/2-1/2} \\ &\frac{5 \cdot 3x^{1/2}}{2} \end{aligned}$$

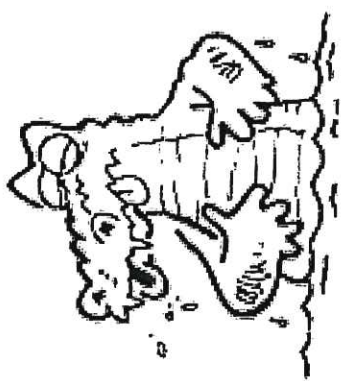
$$10 \quad \left(\sqrt{\frac{9x^{14}}{y^4}}\right)^3\left(\sqrt{\frac{x^{100}}{4y^6}}\right)^{-1} =$$

My Calculations

$$\begin{aligned} &\left(\frac{3x^7}{y^2}\right)^3\left(\frac{x^{50}}{2y^3}\right)^{-1} \\ &\frac{3^3x^{21}}{y^6} \cdot \frac{x^{-50}}{2^{-1}y^{-3}} \\ &\frac{3^3 \cdot 2x^{29}}{y^3} \end{aligned}$$

# LAST LINE

A careless zookeeper named Blake  
Fell into a tropical lake  
Said a fat alligator  
A few moments later ...



"V E R Y G O O D B U T I  
 $\frac{17}{40} - \frac{11}{18} = \frac{17}{6} - \frac{11}{28} = \frac{7}{18} - \frac{5}{28} = \frac{3}{16} - \frac{3}{8} = \frac{11}{36} - \frac{11}{36} = \frac{1}{15} - \frac{5}{12}$   
 S T I L L P R E F E R S T E A K"  
 $\frac{19}{36} - \frac{11}{12} = \frac{11}{24} - \frac{11}{24} = \frac{23}{40} - \frac{7}{12} = \frac{11}{24} - \frac{1}{6} = \frac{11}{18} - \frac{1}{4} = \frac{11}{18} - \frac{5}{36} = \frac{11}{18} - \frac{5}{36} = \frac{22}{36} - \frac{5}{36} = \frac{17}{36}$   
 $\frac{3}{4} - \frac{3}{4} = \frac{2}{3} - \frac{9}{15} = \frac{1}{6} - \frac{2}{12} = \frac{2}{12} - \frac{2}{12} = \frac{7}{12} - \frac{67}{100} = \frac{3}{10} - \frac{3}{10} = \frac{1}{4} - \frac{1}{9} = \frac{2}{9} - \frac{2}{9} = \frac{2}{3} - \frac{4}{8} = \frac{1}{3} - \frac{1}{6} = \frac{2}{6} - \frac{1}{6} = \frac{1}{6}$

To decode the last line of this limerick: Do each exercise below and find your answer in the code. Each time the answer appears, write the letter of the exercise above it.

- (D)  $\frac{7}{8} - \frac{7}{8} = \frac{7}{2 \times 4} - \frac{7}{8} = \frac{7}{8} - \frac{7}{8} = \frac{1}{2} - \frac{4}{8} = \frac{2}{8} - \frac{4}{8} = -\frac{2}{8} = -\frac{1}{4}$  (A)  $\frac{19}{20} - \frac{11}{20} = \frac{8}{20} = \frac{2}{5}$
- (I)  $\frac{2}{3} - \frac{10}{15} = \frac{2 \times 5}{3 \times 5} - \frac{10}{15} = \frac{10}{15} - \frac{10}{15} = \frac{3 \times 3}{5 \times 3} - \frac{9}{15} = \frac{9}{15} - \frac{9}{15} = \frac{7}{12} - \frac{67}{100} = \frac{175}{300} - \frac{201}{300} = -\frac{26}{300} = -\frac{13}{150}$  (B)  $\frac{9}{10} - \frac{2}{5} = \frac{9}{10} - \frac{4}{10} = \frac{5}{10} = \frac{1}{2}$
- (E)  $\frac{5}{6} - \frac{2}{9} = \frac{5 \times 3}{6 \times 3} - \frac{2 \times 2}{9 \times 2} = \frac{15}{18} - \frac{4}{18} = \frac{11}{18}$  (V)  $\frac{4}{5} - \frac{3}{8} = \frac{32}{40} - \frac{15}{40} = \frac{17}{40}$
- (Y)  $\frac{6}{7} - \frac{1}{4} = \frac{6 \times 4}{7 \times 4} - \frac{1 \times 7}{4 \times 7} = \frac{24}{28} - \frac{7}{28} = \frac{17}{28}$  (S)  $\frac{7}{9} - \frac{1}{4} = \frac{28}{36} - \frac{9}{36} = \frac{19}{36}$

(G)  $(\frac{2}{5} + \frac{1}{2}) - \frac{3}{10} = \frac{4}{10} + \frac{5}{10} - \frac{3}{10} = \frac{9}{10} - \frac{3}{10} = \frac{6}{10} = \frac{3}{5}$

(K)  $\frac{5}{8} + (\frac{2}{3} - \frac{1}{4}) = \frac{5}{8} + \frac{8}{12} - \frac{3}{12} = \frac{5}{8} + \frac{5}{12} = \frac{15}{24} + \frac{10}{24} = \frac{25}{24}$

(R) Razzle Shoes bought a  $\frac{1}{2}$ -page ad in the Times. Dazzle Shoes bought two ads that were  $\frac{1}{6}$  page each. How much more advertising did Razzle Shoes buy?

Ans.  $\frac{1}{2}$  vs  $2(\frac{1}{6}) = \frac{2}{3}$   
 $\frac{1}{2} - \frac{2}{3} = \frac{3}{6} - \frac{4}{6} = -\frac{1}{6}$

(T) Jill made a sauce in cooking class. She used  $\frac{1}{2}$  cup of milk,  $\frac{2}{3}$  cup of cream, and  $\frac{1}{4}$  cup of water. How much less water was used than milk and cream combined?

Ans. milk + cream =  $\frac{1}{2} + \frac{2}{3} = \frac{3}{6} + \frac{4}{6} = \frac{7}{6}$   
 water =  $\frac{1}{4} = \frac{3}{12}$   
 $\frac{7}{6} - \frac{3}{12} = \frac{14}{12} - \frac{3}{12} = \frac{11}{12}$

# DID YOU HEAR ABOUT...

A	The	B	clever	C	couple	D	who	E	gave	F	their
G	baby	H	daughter	I	the	J	name	K	margarine	L	because
M	they	N	didn't	O	have	P	any	Q	but	R	her

(butter)

Answers A-I:

42	PEOPLE
18	COUPLE
48	THE
54	DAUGHTER
36	WHO
81	THE
900	THEIR
500	CLEVER
650	THAT
64	BABY
78	SAID
150	GAVE

Evaluate each expression below for the given value of the variable. Find your answer in the appropriate answer column and notice the word next to it. Write the word in the box above that contains the letter of that exercise. Keep working and you will hear about the "dairy" best name.

- (A)  $a^2$  if  $a = 9$
- (B)  $5m^2$  if  $m = 10$
- (C)  $2x^2$  if  $x = 3$
- (D)  $(2x)^2$  if  $x = 3$
- (E)  $6u^2$  if  $u = 5$
- (F)  $(6u)^2$  if  $u = 5$
- (G)  $y^3$  if  $y = 4$
- (H)  $2t^3$  if  $t = 3$
- (I)  $3d^4$  if  $d = 2$
- (J)  $7v^3$  if  $v = 1$
- (K)  $(7v)^3$  if  $v = 1$
- (L)  $(x+1)^2$  if  $x = 11$
- (M)  $4(n-1)^2$  if  $n = 10$
- (N)  $8(x-3)^3$  if  $x = 8$
- (O)  $(t+1)^2(t-1)$  if  $t = 3$
- (P)  $(c+2)(c-2)^2$  if  $c = 8$
- (Q)  $(2m+1)^2$  if  $m = 7$
- (R)  $2(3x-1)^2$  if  $x = 4$

Answers J-R:

32	HAVE
24	BEST
144	BECAUSE
242	HER
825	WANT
360	ANY
1000	DIDN'T
7	NAME
324	THEY
356	CREAM
225	BUT
343	MARGARINE



## Review Level 3

$$\left(\frac{3xy}{2x^2y^{-1}}\right)^2 \left(\frac{4x^3y}{6xy^2}\right)^{-1}$$

1<sup>st</sup> step Option 1 Flip fractions to remove negative on exponent outside the bracket

$$\left(\frac{2x^2y^{-1}}{3xy}\right)^2 \left(\frac{6xy^2}{4x^3y}\right)^1$$

Simplify inside brackets, or distribute the 2 to each exponent in bracket

$$\left(\frac{2^2 x^{2 \cdot 2} y^{-1 \cdot 2}}{3^2 x^2 y^2}\right) \left(\frac{6xy^2}{4x^3y}\right)$$

$$\frac{2^2 x^4 y^{-2}}{3^2 x^2 y^2} \cdot \frac{6xy^2}{4x^3y}$$

$$\frac{2^2 x^{4-2} y^{-2-2}}{3^2 \cdot 3} \cdot \frac{2 \cdot 3 x^{1-3} y^{2-1}}{2 \cdot 2}$$

$$\frac{2x^2 y^{-4} x^{-2} y^1}{3}$$

$$\frac{2x^{2-2} y^{-4+1}}{3}$$

$$\frac{2x^0 y^{-3}}{3}$$

$$\frac{2}{3y^3}$$

Try simplifying inside brackets first

$$\left(\frac{3xy}{2x^2y^{-1}}\right)^{-2} \left(\frac{4x^3y}{6xy^2}\right)^{-1}$$

$$\left(\frac{3x^{1-2}y^{1-(-1)}}{2}\right)^{-2} \left(\frac{\cancel{2} \cdot 2}{\cancel{2} \cdot 3} x^{3-1} y^{1-2}\right)^{-1}$$

$$\left(\frac{3x^{-1}y^2}{2}\right)^{-2} \left(\frac{2x^2y^{-1}}{3}\right)^{-1}$$

$$\frac{3^{-2}x^2y^{-4}}{2^{-2}} \cdot \frac{2^{-1}x^{-2}y^1}{3^{-1}}$$

$$\frac{2^2x^2}{3^2y^4} \cdot \frac{3y}{2x^2}$$

$$\frac{2 \cdot 2 \cdot \cancel{3}}{\cancel{3} \cdot 2} y^{1-4}$$

$$\frac{2y^{-3}}{3}$$

$$\frac{2y^{-3}}{3}$$

$$\frac{2}{3y^3}$$