

MULTIPLYING AND DIVIDING FRACTIONS

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Name: Key Date: _____ Period: _____

SECTION 9.2 DIVISION OF FRACTIONS

VOCABULARY

DEFINITION	EXAMPLE
<p><i>or multiplicative inverse</i></p> <p>Reciprocal: The reciprocal of $\frac{x}{y}$ is $\frac{y}{x}$ where x and y are not 0, because $\frac{x}{y} \cdot \frac{y}{x} = \frac{xy}{yx} = \frac{xy}{xy} = 1$</p>	<p>$\frac{4}{5} \cdot \frac{5}{4} = \frac{20}{20} = 1$</p> <p>$3 \cdot \frac{1}{3} = \frac{3}{3} = 1$</p>

Big Idea: How do we divide fractions?

EXPLORATION 1

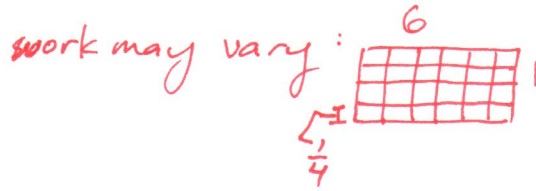
Rene has 6 pounds of jellybeans. She plans to make little party bags containing $\frac{1}{4}$ pound in each bag.

- a. If we let the variable x represent the number of bags Rene can make, write this problem as an equation.

$6 \div \frac{1}{4} = x$

- b. How many party bags can she make?

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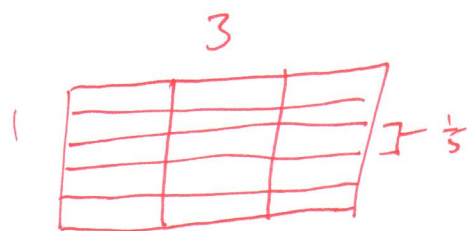
PROBLEM 1

Draw area models to represent the following expressions and compute their values.

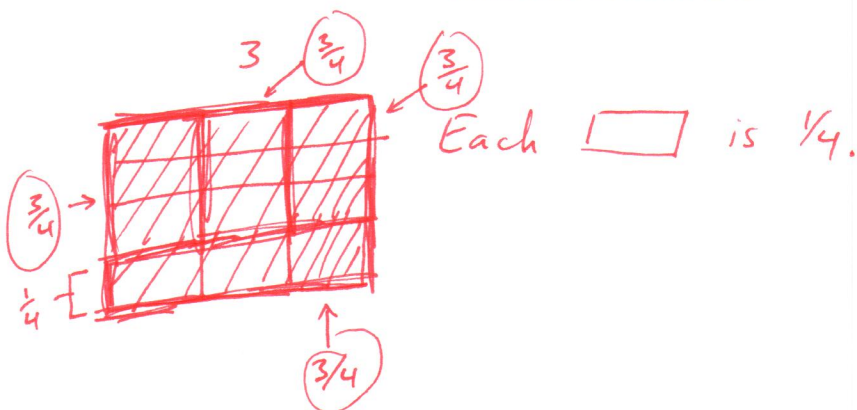
a. $2 \div \frac{1}{3} = 6$



b. $3 \div \frac{1}{5} = 15$



c. $3 \div \frac{3}{4} = \boxed{4}$



PROBLEM 2

Maria has $\frac{3}{4}$ pizza in the refrigerator. She wants to share this equally with 3 friends. Use an area model to determine how much of a pizza each person will get.

- a. Solve for how much each friend gets.



each friend:
 $\frac{3}{12} = \boxed{\frac{1}{4} \text{ pizza}}$

- b. Write a multiplication problem to represent this problem.

$$\frac{3}{4} \cdot \frac{1}{3} = p$$

- c. How can this be rewritten as a division problem?

$$\frac{3}{4} \div 3 = p$$

- d. Write a statement to explain how division of fractions is similar to multiplication of fractions.

Dividing by a fraction is the same as multiplying by its reciprocal.

- e. Write a rule for dividing fractions

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{a \cdot d}{b \cdot c} = \frac{ad}{bc}$$

$\boxed{\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}}$

EXPLORATION 2

Madison has two-thirds of a pan of brownies and shares it evenly among five friends. How much does each friend receive?

- a. Write a multiplication problem to represent this problem.

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

- b. Solve for how much each friend gets.

$$\frac{2 \cdot 1}{3 \cdot 5} = \boxed{\frac{2}{15} \text{ of the pan of brownies}}$$

- c. How could the problem be written as a division problem?

$$\frac{2}{3} \div 5 = x$$

PROBLEM 3

Compute the following division of fractions using the stacking method as set up for you in part a.

a. $\frac{1}{2} \div \frac{1}{3} = \frac{\frac{1}{2} \cdot \frac{3}{1}}{\frac{1}{3} \cdot \frac{3}{1}} = \frac{\frac{1}{2} \cdot \frac{3}{1}}{\frac{3}{3}}$

$$= \frac{\frac{3}{2}}{1} = \boxed{\frac{3}{2}}$$

b. $\frac{1}{3} \div \frac{1}{2} =$

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

$$= \frac{\frac{2}{3}}{\frac{2}{2}} = \frac{\frac{2}{3}}{1}$$

$$= \boxed{\frac{2}{3}}$$

PROBLEM 4

Compute the following quotients.

$$\begin{aligned} \text{a. } \frac{7}{10} \div \frac{2}{5} &= \frac{\frac{7}{10} \cdot \frac{5}{2}}{\frac{2}{5} \cdot \frac{5}{2}} = \frac{\frac{35}{20}}{\frac{10}{10}} \\ &= \frac{7}{4} = \boxed{\frac{7}{4}} = 1 \frac{3}{4} \end{aligned}$$

$$\begin{aligned} \text{b. } \frac{2}{5} \div \frac{7}{10} &= \frac{2}{5} = \frac{\frac{2}{5} \cdot \frac{10}{7}}{\frac{7}{10} \cdot \frac{10}{7}} = \frac{2 \cdot 10}{5 \cdot 7} \\ &= \frac{20}{35} = \boxed{\frac{4}{7}} \end{aligned}$$

$$\begin{aligned} \text{c. } \frac{7}{8} \div \frac{1}{6} &= \frac{\frac{7}{8} \cdot \frac{6}{1}}{\frac{1}{6} \cdot \frac{6}{1}} = \frac{7 \cdot 6}{8 \cdot 1} \\ &= \frac{42}{8} = \boxed{\frac{21}{4}} = 5 \frac{1}{4} \end{aligned}$$

$$\begin{aligned} \text{d. } \frac{3}{11} \div \frac{6}{33} &= \frac{3}{11} = \frac{\frac{3}{11} \cdot \frac{33}{6}}{\frac{6}{33} \cdot \frac{33}{6}} = \frac{3 \cdot 33}{11 \cdot 6} = \frac{99}{66} \\ &= \boxed{\frac{3}{2}} = 1 \frac{1}{2} \end{aligned}$$

EXAMPLE 1

A $3 \frac{1}{4}$ ft. long party sub is being cut into $\frac{1}{2}$ ft. pieces. How many servings can be cut?

$$\begin{aligned} \left(3 \frac{1}{4}\right) \div \left(\frac{1}{2}\right) &= \frac{13}{4} \div \frac{1}{2} = \frac{13}{4} \left(\frac{2}{1}\right) = \frac{26}{4} = \frac{13}{2} = \boxed{6 \frac{1}{2}} \\ &\text{servings} \end{aligned}$$

EXAMPLE 2

Solve the equation $3(x+2) = 7$ algebraically, indicating the properties you use at each step.

$$\begin{aligned} 3(x+2) &= 7 \\ 3x+6 &= 7 && \text{by distributive property} \\ (3x+6)-6 &= 7-6 && \text{by subtraction prop.} \\ 3x+(6-6) &= 7-6 && \text{by associative prop.} \\ 3x+0 &= 7-6 && \text{by additive inverse prop.} \end{aligned}$$

continued...

Example 2 (continued)

$$3x = 7 - 6$$

by additive identity prop.

$$3x = 1$$

subtraction fact

$$\frac{1}{3} \cdot (3x) = \frac{1}{3} \cdot 1$$

by multiplication prop. of equality

$$\left(\frac{1}{3} \cdot 3\right)x = \frac{1}{3} \cdot 1$$

by associative prop of multiplication

$$(1)x = \frac{1}{3} \cdot 1$$

by multiplicative inverse prop.

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

by multiplicative identity prop.

PRACTICE EXERCISES

1. Compute the following division problems.

a. $\frac{3}{10} \div \frac{5}{6}$

$$= \frac{3}{10} \cdot \frac{6}{5} = \frac{18}{50}$$

$$= \boxed{\frac{9}{25}}$$

b. $\frac{4}{9} \div \frac{8}{27}$

$$= \frac{4}{9} \cdot \frac{27}{8} = \frac{108}{72}$$

$$= \boxed{\frac{3}{2}}$$

$$= 1\frac{1}{2}$$

c. $\frac{3}{8} \div \frac{1}{6}$

$$= \frac{3}{8} \cdot \frac{6}{1} = \frac{18}{8}$$

$$= \boxed{\frac{9}{4}}$$

$$= 2\frac{1}{4}$$

d. $\frac{8}{15} \div \frac{2}{3}$

$$\frac{8}{15} \cdot \frac{3}{2} = \frac{24}{30} = \frac{12}{15}$$

$$= \boxed{\frac{4}{5}}$$

e. $\frac{21}{44} \div \frac{7}{11}$

$$= \frac{21}{44} \cdot \frac{11}{7} = \frac{21 \cdot 11}{44 \cdot 7}$$

$$= \frac{21}{7} \cdot \frac{11}{44} = \frac{3}{1} \cdot \frac{1}{4}$$

$$= \boxed{\frac{3}{4}}$$

f. $2\frac{3}{4} \div \frac{2}{3}$

$$= \frac{11}{4} \div \frac{2}{3}$$

$$= \frac{11}{4} \cdot \frac{3}{2}$$

$$= \boxed{\frac{33}{8}}$$

g. $4\frac{1}{8} \div 2\frac{1}{4}$

$$= \frac{33}{8} \div \frac{9}{4}$$

$$\frac{33}{8} \cdot \frac{4}{9} = \frac{33 \cdot 4}{8 \cdot 9} = \frac{33 \cdot 4}{9 \cdot 8}$$

$$= \frac{11}{3} \cdot \frac{1}{2} = \boxed{\frac{11}{6}} = 1\frac{5}{6}$$

h. $16 \div 5\frac{2}{5}$

$$= \frac{16}{1} \div \frac{27}{5}$$

$$= \frac{16}{1} \cdot \frac{5}{27} = \boxed{\frac{80}{27}}$$

$$= 2\frac{26}{27}$$

i. $\frac{15a^2}{b} \div \frac{3a^3}{2b^2}$

$$= \frac{15a^2}{b} \cdot \frac{2b^2}{3a^3}$$

$$= \frac{30a^2b^2}{3a^3b}$$

$$= \frac{30}{3} \cdot \frac{a^2}{a^3} \cdot \frac{b^2}{b}$$

$$= 10 \cdot \frac{1}{a} \cdot b$$

$$= \boxed{\frac{10b}{a}}$$

$$j. \frac{6x}{z^2} \div \frac{9x^2}{16z} = \frac{6x}{z^2} \cdot \frac{16z}{9x^2} = \frac{96xz}{9x^2z^2} = \boxed{\frac{32}{3xz}}$$

2. Solve the equations.

a. $3x + 4 = 8$

$$\begin{aligned} 3x + 4 &= 8 \\ 3x + (4 - 4) &= 8 - 4 \\ 3x + 0 &= 4 \\ 3x &= 4 \\ \frac{1}{3} \cdot 3x &= \frac{1}{3} \cdot 4 \\ \boxed{x = \frac{4}{3}} \end{aligned}$$

b. $4(x - 3) = 6$

$$\begin{aligned} 4x - 12 &= 6 \\ 4x - 12 + 12 &= 6 + 12 \\ 4x &= 18 \\ \frac{1}{4} \cdot 4x &= \frac{1}{4} \cdot 18 \\ x = \frac{18}{4} &= \frac{9}{2} \\ \boxed{x = \frac{9}{2}} \\ x &= 4\frac{1}{2} \end{aligned}$$

SUMMARY (What I learned today)
