MULTIPLY AND DIVIDE ALGEBRAIC FRACTIONS

BUILDING BLOCKS

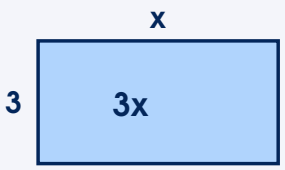
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KEY IDEA

In algebra we leave out the × sign.

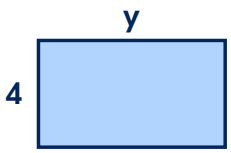
$3 \times x = 3x$ $a \times b = ab$ $x \times x = x^2$

The area of a rectangle is length × width.



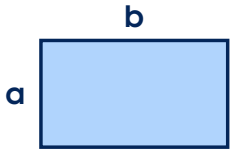
1 Write the area of each rectangle without a × sign.

a)



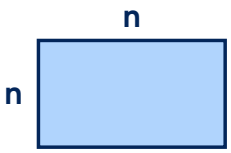
Area = ☐

b)



Area = ☐

c)



Area = ☐

2 Multiply the numerators. Multiply the denominators.

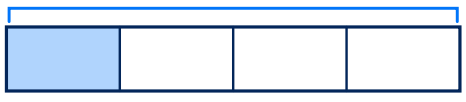
a) $\frac{2}{5} \times \frac{1}{3} = \frac{2 \times 1}{5 \times 3} = \frac{\square}{\square}$

b) $\frac{3}{4} \times 3 = \frac{3 \times 3}{4} = \frac{\square}{\square}$

3 Each bar is split into equal parts. What fraction of the letter is shaded?

Example: $\frac{1}{3}$ of x $= \frac{x}{3}$

a)



$\frac{1}{4}$ of y $= \frac{\square}{\square}$

b)



$\frac{2}{5}$ of m $= \frac{\square}{\square}$

4 Simplify. Divide the numerator and the denominator by the same number.

a) $\frac{4}{6} = \frac{\square}{\square}$ b) $\frac{9}{12} = \frac{\square}{\square}$ c) $\frac{3x}{6} = \frac{\square}{\square}$ d) $\frac{10y}{15} = \frac{\square}{\square}$

MULTIPLY AND DIVIDE ALGEBRAIC FRACTIONS

SUPPORT

NAME _____ CLASS _____ DATE _____

KEY IDEA

Letters work just like numbers.

$\frac{2}{3} \times 4 = \frac{8}{3}$ $\qquad$ $\frac{x}{3} \times 4 = \frac{4x}{3}$

$\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$ $\qquad$ $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$

1 Work out the number calculation, then the algebra calculation next to it.

a) $\frac{2}{7} \times 3 = \frac{\square}{\square}$ $\qquad$ $\frac{x}{7} \times 3 = \frac{\square}{\square}$

b) $\frac{1}{5} \times \frac{2}{3} = \frac{\square}{\square}$ $\qquad$ $\frac{a}{5} \times \frac{2}{b} = \frac{\square}{\square}$

2 Work out.

a) $\frac{y}{4} \times 5 = \frac{\square}{\square}$ $\qquad$ b) $\frac{2}{m} \times 3 = \frac{\square}{\square}$

c) $\frac{a}{3} \times \frac{b}{2} = \frac{\square}{\square}$ $\qquad$ d) $\frac{x}{5} \times \frac{3}{y} = \frac{\square}{\square}$

3 Divide by multiplying by the reciprocal.

a) $\frac{x}{4} \div \frac{1}{3} = \frac{x}{4} \times 3 = \frac{\square}{\square}$ $\qquad$ b) $6 \div \frac{1}{x} = 6 \times \square = \square$

c) $\frac{a}{2} \div \frac{b}{5} = \frac{a}{2} \times \frac{\square}{\square} = \frac{\square}{\square}$

4 Lily has made a mistake.

Lily writes: $\frac{x}{2} \times \frac{x}{3} = \frac{2x}{6}$

a) What has Lily done wrong?

b) Work out the correct answer. $\frac{x}{2} \times \frac{x}{3} = \frac{\square}{\square}$

MULTIPLY AND DIVIDE ALGEBRAIC FRACTIONS

CORE

NAME _____ CLASS _____ DATE _____

KEY IDEA

Multiply numerators and denominators; to divide, multiply by the reciprocal of the divisor. Cancel common factors, including letters.

$\frac{2x}{3} \times \frac{9}{4x} = \frac{18x}{12x} = \frac{3}{2}$ $\qquad$ $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

FLUENCY

1 Work out. Give each answer in its simplest form.

a) $\frac{3a}{5} \times \frac{2}{7} = \frac{\square}{\square}$ $\qquad$ b) $\frac{4x}{9} \times \frac{3}{2x} = \frac{\square}{\square}$

c) $\frac{5m}{6} \div \frac{m}{3} = \frac{\square}{\square}$ $\qquad$ d) $\frac{x^2}{4} \times \frac{2}{x} = \frac{\square}{\square}$

e) $\frac{3p}{8} \div \frac{9}{4q} = \frac{\square}{\square}$ $\qquad$ f) $\frac{2y}{5} \div 4 = \frac{\square}{\square}$

2 Find the missing values.

a) $\frac{x}{3} \times \frac{\square}{\square} = \frac{5x}{12}$ $\qquad$ b) $\frac{4a}{5} \div \square = \frac{2a}{5}$

REASONING

3 Kim has made a mistake.

Kim writes: $\frac{x}{2} \times \frac{x}{3} = \frac{x}{6}$

a) Substitute x = 6 into both sides to show that Kim is wrong.

.....

b) Write the correct answer. $\frac{x}{2} \times \frac{x}{3} = \frac{\square}{\square}$

4 Explain why this rule for dividing fractions works.

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

.....

MULTIPLY AND DIVIDE ALGEBRAIC FRACTIONS

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

REASONING

1 Is each statement always, sometimes or never true? Circle your answer.

If it is sometimes true, give an example of when it is true and when it is not.

a) $\frac{x}{2} \times 2 = x$ ALWAYS SOMETIMES NEVER

b) $\frac{x}{3} \times \frac{x}{3} = \frac{2x}{3}$ ALWAYS SOMETIMES NEVER

c) $\frac{1}{x} \div \frac{1}{x} = 1$ (x is not 0) ALWAYS SOMETIMES NEVER

d) $\frac{a}{b} \times \frac{b}{a} = 2$ (a and b are not 0) ALWAYS SOMETIMES NEVER

PROBLEM SOLVING

2 A rectangle has these side lengths.

$\text{Length} = \frac{3x}{4}$ cm $\quad$ $\text{Width} = \frac{2}{x}$ cm

a) Show that the area of the rectangle does not depend on x.

b) Find the perimeter of the rectangle when x = 4. ☐

3 Find the missing algebraic fractions.

a) $\frac{2a}{3} \times \frac{\square}{\square} = \frac{4ab}{9}$ $\quad$ **b)** $\frac{6x}{5} \div \frac{\square}{\square} = \frac{3}{y}$

★ CHALLENGE FOR ALL

4 Look at this product of algebraic fractions.

$\frac{x}{3} \times \frac{6}{x+2}$

a) Write it as a single fraction in its simplest form. ☐

b) Find its value when x = 4. ☐ $\quad$ **c)** Find x when it equals 1. ☐

STEP 9 ANSWERS

ANSWERS

Multiply and divide algebraic fractions

BUILDING BLOCKS

1a) $4y$ b) ab c) n^2

2a) $\frac{2}{15}$ b) $\frac{9}{4}$

3a) $\frac{y}{4}$ b) $\frac{2m}{5}$

4a) $\frac{2}{3}$ b) $\frac{3}{4}$ c) $\frac{x}{2}$ d) $\frac{2y}{3}$

SUPPORT

1a) $\frac{6}{7}, \frac{3x}{7}$ b) $\frac{2}{15}, \frac{2a}{5b}$

2a) $\frac{5y}{4}$ b) $\frac{6}{m}$ c) $\frac{ab}{6}$ d) $\frac{3x}{5y}$

3a) $\frac{3x}{4}$ b) $x, 6x$ c) $\frac{5}{b}, \frac{5a}{2b}$

4a) She wrote $x \times x = 2x$; it is x^2 b) $\frac{x^2}{6}$

CORE

1a) $\frac{6a}{35}$ b) $\frac{2}{3}$ c) $\frac{5}{2}$ d) $\frac{x}{2}$ e) $\frac{pq}{6}$ f) $\frac{y}{10}$

2a) $\frac{5}{4}$ b) 2

3a) LHS: $3 \times 2 = 6$; RHS: $\frac{6}{6} = 1$ b) $\frac{x^2}{6}$

4) Dividing by $\frac{c}{d}$ is multiplying by its reciprocal $\frac{d}{c}$: $\frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

GREATER DEPTH

1a) Always b) Sometimes (true for $x = 0$ or 6) c) Always d) Never (it is 1)

2a) $\frac{3x}{4} \times \frac{2}{x} = \frac{6x}{4x} = \frac{3}{2}$ cm^2 b) $2(3 + \frac{1}{2}) = 7$ cm

3a) $\frac{2b}{3}$ b) $\frac{2xy}{5}$

4a) $\frac{2x}{x+2}$ b) $\frac{8}{6} = \frac{4}{3}$ c) $x = 2$