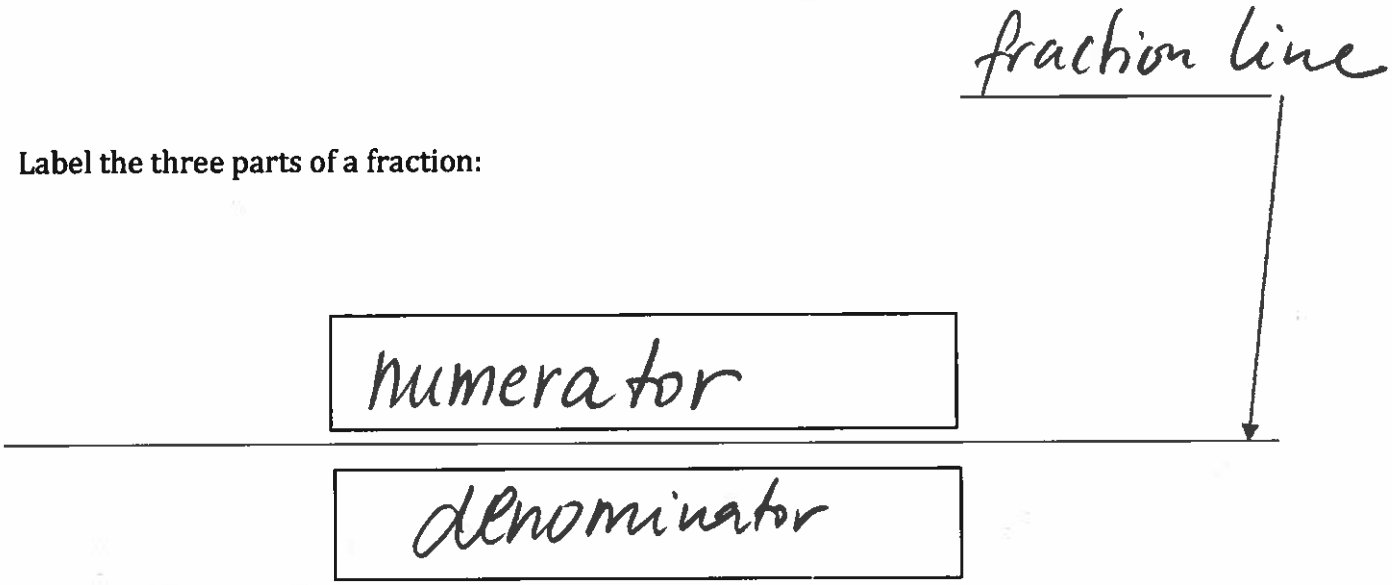
Notes:

M9

1.6 and 1.7 Multiplying and Dividing Fractions

Label the three parts of a fraction:



Q: What number is never allowed to be at the bottom of any fraction?

A: zero **is not allowed at the bottom of any fraction.**

Q: How do you express a fraction as a decimal number?

A: **To express a fraction as a decimal number one has to** divide **the** numerator **of the fraction by its** denominator.

Express the following fractions as decimal numbers:

$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{2}{3}$	$\frac{3}{4}$
0.5	$0.\overline{3}$	0.25	0.2	$0.\overline{6}$	0.75

Q: What do we call a fraction that has 100 as its denominator?

For example:

$\frac{13}{100} = 0.13 = 13\%$

A: **A fraction with a 100 in its denominator is called** a percentage

Q: What do we call a fraction that has 1 as its denominator?

For example:

$\frac{15}{1} = 15$

A: **A number that can be expressed as a fraction with 1 in its denominator is called** an integer

Q: Can a fraction have a negative number as its denominator?

Yes, but it is preferred to move the negative sign in the numerator. $\frac{2}{-5}$ OK $= -\frac{2}{5}$ ✓ $\frac{-2}{5}$ ✓

Q: What do you do when comparing fractions?

For example:

Is $\frac{14}{25}$ greater or smaller than $\frac{12}{23}$?

Recall that we use symbols: > for "greater than" and < for "less than"

A:

$\frac{23 \times 14}{23 \times 25} \; ? \; \frac{12 \times 25}{23 \times 25}$

Write each fraction with the same denominator.

$\frac{322}{575} > \frac{300}{575}$ $\therefore \frac{14}{25} > \frac{12}{23}$

Recall the appropriate mathematical terms for basic operations and their symbols:

Name of the operation	Symbol	Name of the result of the operation
Addition	+	Sum
Subtraction	−	Difference
Multiplication	$\cdot$ | × | ( )( )	Product
Division	÷ | $\frac{\square}{\square}$	Quotient

Reducing Fractions

To reduce a fraction is to express it in its lowest terms. That is, divide the numerator and the denominator by their largest common factor.

Example: Express given fractions in lowest terms:

$\frac{4\div2}{6\div2}$	$\frac{7\div7}{28\div7}$	$\frac{2}{13}$	$\frac{18\div2}{32\div2}$	$\frac{-9\div3}{15\div3}$
$\frac{2}{3}$	$\frac{1}{4}$	$\frac{2}{13}$	$\frac{9}{16}$	$\frac{-3}{5}$

Multiplying Fractions

To multiply fractions, follow these steps:

$$\frac{14}{18} \times \frac{5}{21}$$

1. Reduce each fraction if possible.

$$\frac{\cancel{14}^{7}}{\cancel{18}_{9}} \times \frac{5}{21}$$

2. Reduce fractions **diagonally** if possible.

$$\frac{\cancel{7}^{1}}{9} \times \frac{5}{\cancel{21}_{3}}$$

3. Multiply all numerators.

$$1 \times 5 = 5$$

4. Multiply all denominators.

$$9 \times 3 = 27$$

5. Double check that the numerator and denominator do not have a common factor other than 1.

$$\frac{5}{27}$$

Example: Multiply. Remember to show your work and clearly identify the final answer.

1	$\frac{3}{7} \times \frac{2}{11}$	$\frac{6}{77}$
2	$2\frac{6}{7} \times \frac{5}{21}$	$\frac{10}{49}$
3	$4\frac{2}{8} \times \frac{3}{6}$	$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$
4	$1\frac{24}{16} \times \frac{5}{16}$	$\frac{1}{1} \times \frac{5}{4} = \frac{5}{4} = 1\frac{1}{4}$
5	$\frac{3}{7} \times \frac{2}{9} \times \frac{14}{5}$	$\frac{1}{1} \times \frac{2}{3} \times \frac{2}{5} = \frac{4}{15}$
6	$\frac{10}{12} \times \frac{3}{5} \times \frac{11}{23}$	$\frac{1}{2} \times \frac{3}{1} \times \frac{11}{23} = \frac{11}{46}$
7	$\frac{15}{6} \times \frac{10}{5} \times \frac{32}{8}$	$\frac{3}{3} \times \frac{5}{1} \times \frac{4}{1} = \frac{20}{1} = 20$
8	$\frac{14}{16} \times \frac{12}{11} \times \frac{21}{7}$	$\frac{1}{2} \times \frac{3}{11} \times \frac{21}{1} = \frac{63}{22} = 2\frac{19}{22}$

Dividing Fractions

- Dividing fractions is very similar to multiplying fractions. However, there is an important additional step.
- Division is the same as multiplication by a reciprocal. For example: Dividing by two is the same as multiplying by $\frac{1}{2}$ *and* dividing by $\frac{1}{3}$ is the same as multiplying by 3.

Recall: A reciprocal is a flipped fraction.

Write reciprocals for each number:

$\frac{-5}{6}$	$\frac{1}{7}$	$\frac{2}{3}$	$-\frac{9}{17}$	$\frac{8}{1}$
$-\frac{6}{5}$	$\frac{7}{1} = 7$	$\frac{3}{2}$	$-\frac{17}{9}$	$\frac{1}{8}$

To divide fractions, follow these steps:

$$\frac{8}{12} \div \frac{16}{5}$$

1. Reduce each fraction if possible.

$$\frac{8^{2}}{12_{3}} \div \frac{16}{5}$$

2. KeepKissFlip = Copy the first fraction, change division to multiplication, reciprocate the second fraction.

$$\frac{2}{3} \times \frac{5}{16}$$

3. Reduce fractions diagonally if possible.

$\frac{\cancel{8}^{1}}{3} \times \frac{5}{\cancel{16}\,8}$

4. Multiply all numerators.

$1 \times 5 = 5$

5. Multiply all denominators.

$3 \times 8 = 24$

6. Double check that the numerator and denominator do not have a common factor other than 1. Box/circle/underline the final answer.

$\boxed{\frac{5}{24}}$

Example: Divide. Remember to show your work and clearly identify the final answer.

1	$\frac{3}{7} \div \frac{\cancel{8}^{1}}{\cancel{14}\,7}$	$\frac{3}{7} \div \frac{1}{7} = \frac{3}{\cancel{7}_{1}} \times \frac{\cancel{7}^{1}}{1} = \frac{3}{1} = \boxed{3}$
2	$\frac{6}{7} \div \frac{\cancel{15}^{5}}{\cancel{21}\,7}$	$\frac{6}{7} \div \frac{5}{7} = \frac{6}{\cancel{7}_{1}} \times \frac{\cancel{7}^{1}}{5} = \boxed{\frac{6}{5}} = \boxed{1\frac{1}{5}}$
3	$\frac{\cancel{12}^{1}}{\cancel{8}\,4} \div \frac{\cancel{12}^{4}}{\cancel{9}_{3}}$	$\frac{1}{4} \div \frac{4}{3} = \frac{1}{4} \times \frac{3}{4} = \boxed{\frac{3}{16}}$
4	$\frac{26}{33} \div \frac{5}{11}$	$\frac{\cancel{26}^{2}}{\cancel{33}_{3}} \times \frac{11}{5} = \boxed{\frac{26}{15}} = \boxed{1\frac{11}{15}}$

5	$\frac{7}{10} \div \frac{7}{15} \div \frac{1}{6}$	$\frac{7}{10} \div \frac{7}{15} \div \frac{1}{6} = \frac{7^{1}}{10_{2}} \times \frac{15^{3}}{7_{1}} \times \frac{6^{3}}{1} = \frac{9}{1} = 9$
6	$\frac{10}{12} \div \frac{3}{5} \div \frac{10}{23}$	$\frac{5}{6} \times \frac{5^{1}}{3} \times \frac{23}{10_{2}} = \frac{115}{36} = 3\frac{7}{36}$
7	$\frac{15}{6} \times \frac{10}{5} \div \frac{32}{8}$	$\frac{5}{2_{1}} \times \frac{2^{1}}{1} \times \frac{1}{4} = \frac{5}{4} = 1\frac{1}{4}$
8	$\frac{14}{16} \div \frac{12}{21} \times \frac{8}{7}$	$\frac{7}{8_{4}} \times \frac{7^{1}}{4_{1}} \times \frac{8^{1}}{7_{1}} = \frac{7}{4} = 1\frac{3}{4}$