

Understanding Multiplication (of Fractions)

Recall: Multiplication is a concise way of adding the same number a certain number of times.

ex $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 3 \times \frac{1}{4} = \frac{3}{4} = 0.75$

ex $\frac{4}{2} + \frac{4}{2} + \frac{4}{2} = 3 \cdot \frac{4}{2} = \frac{12}{2} = 6$

ex $\frac{16}{4} + \frac{16}{4} + \dots + \frac{16}{4} = 10 \times \frac{16}{4} = 40$
 10 times

hard one:

$$\frac{x}{2} + \frac{x}{2} + \frac{x}{2} = 3 \cdot \frac{x}{2}$$

$$\frac{1}{y} + \frac{1}{y} = 2 \times \frac{1}{y}$$

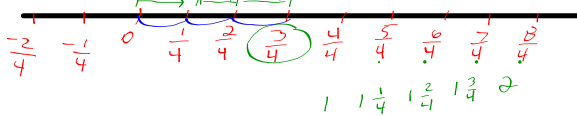
Multiplication of Integers and Unit Fractions

whole #'s $\frac{1}{x}$

Evaluate

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

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}$$



$$\begin{array}{r} \times \\ 3 \\ \hline 1 \end{array} \cdot \frac{1}{4}$$

$$\begin{array}{r} 3 \times 1 \\ \hline 1 \times 4 \end{array}$$

$$\frac{3}{4}$$

Visualize

step i. construct # line and go up by unit fraction.

step ii. Illustrate the multiplication as addition using # line.

Algebraic Procedure

step i. Rewrite integer as fraction

step ii. Times the tops and put over the multiplication of bottoms.

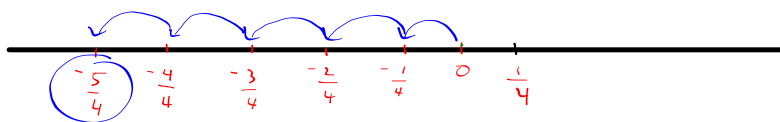
ex. Ajay makes a quarter bet 5 times.
He loses each time

$$5 \times \left(-\frac{1}{4}\right) = -\frac{5}{4}$$

law of signs
multip fractions

| | | | | |
|---|---|---|---|---|
| + | x | + | = | + |
| - | x | + | = | - |
| + | x | - | = | - |
| - | x | - | = | + |

$$-\frac{1}{4} + \left(-\frac{1}{4}\right) + \left(-\frac{1}{4}\right) + \left(-\frac{1}{4}\right) + \left(-\frac{1}{4}\right) = -\frac{5}{4}$$



$$5 \times \left(-\frac{1}{4}\right)$$

$$\frac{5}{1} \times \frac{-1}{4}$$

$$\frac{5 \times (-1)}{1 \times 4}$$

$$\frac{-5}{4}$$

Question 3:



$$0 \times \frac{1}{7}$$

$$\frac{0 \times 1}{1 \times 7}$$

$$\frac{0}{7}$$

$$0$$

Understanding the Multiplication of
2 Fractions.

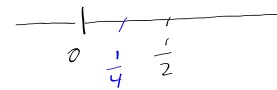
Nazir has half a pizza

Atash takes half of his half.
x

a.



$$\frac{1}{2} \times \frac{1}{2}$$



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

← what you have
← how broken up.

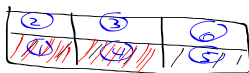
$$\frac{1 \times 1}{2 \times 2} = \frac{1}{4}$$

e.x. $\frac{2}{3} \times \frac{1}{2} = \frac{2 \times 1}{3 \times 2} = \frac{2}{6}$

← parts you have
← how whole is broken up.

Vanessa has half a chocolate bar.

Ajay takes $\frac{2}{3}$ of her half
x



(same)



$$\frac{2}{3} \times \frac{1}{2} = \frac{2}{6} \quad \checkmark$$

final answer in reduced form

$$\frac{2}{6} = \frac{1}{3}$$

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

2 : 1, 2
6 : 1, 2, 3, 6

$$\frac{1}{3} \quad \checkmark$$

Multiplying 3 Fractions (and Simplifying)

(same procedure)

example:
multiply:

$$\frac{5}{2} \times \frac{-4}{3} \times \frac{2}{8}$$

$$\frac{5 \times (-4) \times 2}{2 \times 3 \times 8}$$

$$\frac{-20}{24} \div 4$$

$$\frac{-5}{6}$$

$$= \frac{-40}{48}$$

$$= \frac{-40}{48}$$

step i. Rewrite integers as fractions by writing a denominator of 1.

$$\frac{7}{0} = \text{error}$$

$$\frac{7}{1} = 7$$

$$\frac{7}{2} = 3.5$$

...

step ii. Times tops times bottoms:

Simplify, if possible.
step iii. Cancel out the same number found in top and bottom.
step iv. List the divisors of top. $-20; 1, 2, 4, 5, 10, 20$
List the divisors of bottom. $24; 1, 2, 3, 4, 6, 8$
step v. Identify GCD and divide top and bottom by GCD.

multiply:

$$\frac{2}{3} \times \frac{2}{5} \times \frac{7}{1}$$

$$\frac{2 \times 2 \times 7}{3 \times 5 \times 1}$$

$$\frac{28}{15}$$

nothing same in top and bottom.

$$28: 1, 2, 4, 7, 14, 28$$

$$15: 1, 3, 5, 15$$

no GCD
so most reduced form.

Question 9:

$$\frac{4}{3} \times \frac{(-4)}{1} \times \left(-\frac{9}{16}\right)$$

$$\frac{4 \times (-4) \times (-9)}{3 \times 1 \times 16}$$

$$\frac{144}{48} \quad \frac{6 \cancel{0} 0}{6 \cancel{0} 0} \quad 48$$

3

$$144 : 2 \quad 10 > 2 \quad (48)$$

↑
divisors

↑
divisor

48:

48