Expressions with Rational Numbers Notes

Like terms are terms that have the same variables in the same degree.

You can always multiply and divide unlike terms. You can never add or subtract unlike terms.

Expressions are simplified when all like terms have been combined and all multiplication and division have been simplified.

Example 1: Simplify

$4(-3y) - 15y$

$-12y - 15y$	Multiply $4(-3y) = 4 \cdot -3 \cdot y = -12y$
$-27y$	Combine like terms $(-12 - 15)y = -27y$

Example 2: Simplify

$5s(-6t)$

$5 \cdot -6 \cdot s \cdot t$	Re-order multiplication $5 \cdot s \cdot -6 \cdot t$. When we re-order multiplication, the variables typically get put in alphabetical order.
$-30st$	Multiply $5 \cdot -6$

Example 3: Simplify

$6x(-7y) + (-15xy)$

$6 \cdot -7 \cdot x \cdot y + (-15xy)$	Re-order multiplication $6 \cdot x \cdot -7 \cdot y$. When we re-order multiplication, the variables typically get put in alphabetical order.
$-42xy + (-15xy)$	Multiply $6 \cdot -7$
$-57xy$	Combine like terms $(-42 + -15)xy = -57xy$

Example 4: Simplify

$$-7(3d + d)$$

If a variable is by itself, we can assume that there is a one as a coefficient. If we have an x, we have $1x$.

$-7(4d)$	Combine like terms $3d + 1d = 4d$. We are combining like terms first because our order of operations says we have to take care of what is in parenthesis first.
$-28d$	Multiply $-7(4d) = -7 \cdot 4 \cdot d = -28d$

Example 5: Simplify

$$-7v - 5 - 3 + 5v$$

$-7v + 5v - 5 - 3$	Reorder addition. Remember as you order that the sign of the term is the sign in front of it and that sign must travel with the term.
$-2v - 8$	Combine like terms $-7v + 5v = (-7 + 5)v = 2v$
	and $-5 - 3 = -8$

Since $-2v$ and -8 are not like terms, $-2v - 8$ is the final answer.

Example 6: Simplify

$$-2x + 5 + 2x$$

$-2x + 2x + 5$	Reorder addition. Remember as you order that the sign of the term is the sign in front of it and that sign must travel with the term.
$0 + 5$	Combine like terms $-2x + 2x = (-2 + 2)x = 0x = 0$
5	Combine like terms $0 + 5 = 5$

Example 7: Simplify

$2 - 5y - 7$

$-5y + 2 - 7$	Reorder addition. Remember as you order that the sign of the term is the sign in front of it and that sign must travel with the term.
$-5y - 5$	Combine like terms ($-5y$ does not have a like term, so leave it alone) and $-5 - 3 = -8$

Since $-5y$ and -5 are not like terms, $-5y - 5$ is the final answer.

Example 8: Simplify

$1 + 6p - 4 - 2p$

$6p - 2p + 1 - 4$	Reorder addition. Remember as you order that the sign of the term is the sign in front of it and that sign must travel with the term.
$4p - 3$	Combine like terms $6p - 2p = (6 - 2)p = 4p$
	and $1 - 4 = -3$

Since $4p$ and -3 are not like terms, $4p - 3$ is the final answer.

Example 9: Simplify

$x - 4 + 5 + x$

$x + x - 4 + 5$	Reorder addition. Remember as you order that the sign of the term is the sign in front of it and that sign must travel with the term.
$2x + 1$	Combine like terms $x + x = 1x + 1x = (1 + 1)x = 2x$
	and $-4 + 5 = 1$

Since $2x$ and 1 are not like terms, $2x + 1$ is the final answer.

Example 10: Simplify

$9 - 7c + 17c - 9$

$-7c + 17c + 9 - 9$ Reorder addition. Remember as you order that the sign of the term is the sign in front of it and that sign must travel with the term.

$10c + 0$ Combine like terms $-7c + 17c = (-7 + 17)c = 10c$

and $9 - 9 = 0$

We do not need to write the $+0$ since adding zero doesn't change anything.

$10c$

Example 11: Evaluate

$x - 4(y + x)$; use $x = 1$ and $y = -3$

The first step should always be to replace the variables with the values given to us.

$1 - 4(-3 + 1)$

Now, use the order of operations to simplify.

$1 - 4(-2)$ Calculate inside of parentheses $-3 + 1 = -2$

$1 + 8$ Multiply $-4(-2) = +8$

Remember that the negative belongs to the four.

9 Combine like terms $1 + 8 = 9$

Example 12: Evaluate

$\frac{y^2 - (x-y)}{3}$; use $x = 3$ and $y = -4$

The first step should always be to replace the variables with the values given to us.

$$\frac{(-4)^2 - (3 - -4)}{3}$$

Now, use the order of operations to simplify.

$\frac{16-(3--4)}{3}$ Calculate exponent $(-4)^2 = -4 \cdot -4 = +16$

$\frac{16-7}{3}$ Calculate inside of parentheses $3 - -4 = 3 + 4 = 7$

$\frac{9}{3}$ Calculate the numerator $16 - 7 = 9$

3 Divide $9 \div 3 = 3$

Example 13: Evaluate

$(x + y)(-5x - x)$; use $x = -1$ and $y = 3$

The first step should always be to replace the variables with the values given to us.

$(-1 + 3)(-5 \cdot -1 - -1)$ **Remember that a number next to a variable indicates multiplication $-5x = -5 \cdot x$

Now, use the order of operations to simplify.

$(2)(-5 \cdot -1 - -1)$ Calculate inside of first set of parentheses $-1 + 3 = 2$

$(2)(5 - -1)$ Calculate multiplication in second set of parentheses $-5 \cdot -1 = 5$

$(2)(6)$ Calculate inside of second set of parentheses $5 - -1 = 5 + 1 = 6$

12 Multiply $2 \cdot 6 = 12$

Example 14: Evaluate

Evaluate if $m = -\frac{2}{3}$, $n = \frac{1}{2}$, and $p = -3\frac{3}{4}$

$6m$

Replace variables with values

$6 \cdot -\frac{2}{3}$ Remember that $6m = 6 \cdot m$

$\frac{6}{1} \cdot -\frac{2}{3}$ Turn integer into an improper fraction

$-\frac{6 \cdot 2}{1 \cdot 3}$ Multiply fractions

$-\frac{12}{3}$

-4 Simplify and divide

Example 15: Evaluate

Evaluate if $m = -\frac{2}{3}$, $n = \frac{1}{2}$, and $p = -3\frac{3}{4}$

np

Replace variables with values

$\frac{1}{2} \cdot -3\frac{3}{4}$	Remember that $np = n \cdot p$
$\frac{1}{2} \cdot -\frac{15}{4}$	Turn mixed number into an improper fraction
$-\frac{1 \cdot 15}{2 \cdot 4}$	Multiply fractions
$-\frac{15}{8}$	
$-1\frac{7}{8}$	Divide

Example 16: Evaluate

Evaluate if $m = -\frac{2}{3}$, $n = \frac{1}{2}$, and $p = -3\frac{3}{4}$

$n^2(m + 2)$

Replace variables with values

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

$\left(\frac{1}{4}\right)\left(-\frac{2}{3} + 2\right)$	Calculate exponent $\left(\frac{1}{2}\right)^2 = \frac{1}{2} \cdot \frac{1}{2} = \frac{1 \cdot 1}{2 \cdot 2} = \frac{1}{4}$
$\left(\frac{1}{4}\right)\left(-\frac{2}{3} + \frac{2}{1}\right)$	Turn integer into an improper fraction
$\left(\frac{1}{4}\right)\left(-\frac{2}{3} + \frac{6}{3}\right)$	Common denominator $\frac{2 \cdot 3}{1 \cdot 3} = \frac{6}{3}$
$\left(\frac{1}{4}\right)\left(\frac{4}{3}\right)$	Combine terms in second parentheses $-\frac{2}{3} + \frac{6}{3} = \frac{4}{3}$
$\frac{1}{3}$	Multiply fractions $\frac{1 \cdot 4}{4 \cdot 3}$ and cancel 4s out $\frac{1}{3}$