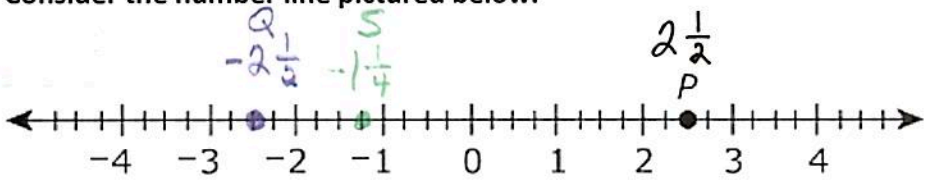
Pre-Algebra

Essential Question: How do we add rational numbers?

Do Now: Consider the number line pictured below.



A. Point ***Q*** is the opposite of point ***P***. Determine the location of point ***Q*** on the number line. $-2\frac{1}{2}$

B. Point ***S*** is the additive inverse of $\frac{5}{4}$. Determine the location of point ***S*** on the number line. $-\frac{5}{4} = -1\frac{1}{4}$

Placement of Negative Signs in Quotients

Consider the expressions below. Simplify each.

A) $-\frac{10}{5}$ the opposite of $\frac{10}{5}$ $-(2)$ -2

B) $\frac{-10}{5}$ -2

C) $\frac{10}{-5}$ -2

D) $\frac{-10}{-5}$ 2

There are 3 ways to represent the ***opposite*** of $\frac{a}{b}$

The (-) sign is in front of the fraction.	*The (-) sign is in the numerator.*	*The (-) sign is in the denominator.*
$-\frac{a}{b}$	$\frac{-a}{b}$	$\frac{a}{-b}$

Rewriting Mixed Numbers as Improper Fractions

Think about this.... $3\frac{1}{2} = \frac{7}{2}$ ***because*** $3+\frac{1}{2}=\frac{7}{2}$ $\frac{6}{2}+\frac{1}{2}=\frac{7}{2}$

Shortcut: $3\overset{+}{\underset{\cdot 2}{1}}\frac{1}{2} = \frac{7}{2}$

Why does $-3\frac{1}{2} = -\frac{7}{2}$***?***

Since $3\frac{1}{2} = \frac{7}{2}$, the opposite of $3\frac{1}{2}$ $(-3\frac{1}{2})$ is equal to the opposite of $\frac{7}{2}$ $(-\frac{7}{2})$.

What does $-5\frac{2}{3}$ ***look like as an improper fraction?***

$-\left(5\frac{2}{3}\right) = -\left(\frac{17}{3}\right)$

$\boxed{\frac{-17}{3}}$

same sign sum (+)
different sign difference (−)

Adding Rational Numbers

Let's warm up with integers! a) -10 + 14 b) 9 + (-45) c) -22 + (-41)

4 −36 −63

All integer rules apply to Rational Numbers!

1) $-\frac{3}{10}+\left(-\frac{9}{10}\right)$

$\frac{-12 \div 2}{10 \div 2}$

$\frac{-6}{5}$ or $-1\frac{1}{5}$

2) $-\frac{7}{8}+\frac{1}{4}$ · 2 · 2

$\frac{-7}{8}+\frac{2}{8}$

$\frac{-5}{8}$

3) 1.5 + (-5.3) = −3.8

$\begin{array}{r} 5.3 \\ -\ 1.5 \\ \hline 3.8 \end{array}$

How do we add rational numbers in the form of mixed numbers?

4) $-9\frac{1}{3}+3\frac{2}{3}$

$\frac{-28}{3}+\frac{11}{3}$

$\frac{-17}{3}$ or $-5\frac{2}{3}$

5) $-5\frac{3}{4}+10\frac{7}{8}$

2 · 2 ·

$\frac{-23}{4}+\frac{87}{8}$

$\frac{-46}{8}+\frac{87}{8}$

$\frac{41}{8}$ or $5\frac{1}{8}$

6) $-2\frac{1}{2}+-3\frac{3}{4}$

2 · 2 ·

$\frac{-5}{2}+\frac{-15}{4}$

$\frac{-10}{4}+\frac{-15}{4}$

$\frac{-25}{4}$ or $-6\frac{1}{4}$

-2.5 + (-3.75)

$\begin{array}{r} 2.50 \\ +3.75 \\ \hline 6.25 \end{array}$ −6.25

Adding Rational Numbers

1) Turn mixed numbers into improper fractions and place (-) symbol in the numerator.
2) Create equivalent fractions with a common denominator.
3) Add the numerators using integer rules for addition.
4) Simplify if possible.
5) To add decimals, apply integer rules for addition.

IT'S YOUR TURN NOW

7) $-\frac{5}{6}+\left(-\frac{2}{3}\right)$ ·2 ·2

$\frac{-5}{6}+\frac{-4}{6}$

$\frac{-9}{6}\div\frac{3}{3}=\frac{-3}{2}$ or $-1\frac{1}{2}$

8) $2\frac{1}{4}+\left(-1\frac{2}{5}\right)$

5·4 5·4

$\frac{45}{20}+\frac{-28}{20}$

$\frac{17}{20}$

9) $-1\frac{5}{6}+\frac{1}{9}$

3. 3.

$-\frac{11}{6}+\frac{1}{9}$ ·2 ·2

$\frac{-33}{18}+\frac{2}{18}$

$\frac{-31}{18}$ or $-1\frac{13}{18}$

10) -2.3 + (-3.6) = -5.9

3.6
+2.3
5.9

11) 0.4 + (-9.1) = -8.7

$^{8}\cancel{9}.^{1}1$
−0.4
8.7

12) 3.1 + (-0.7) = 2.4

$^{2}\cancel{3}.^{1}1$
−0.7
2.4

The TAKEAWAY

When adding rational numbers, it's helpful to turn mixed numbers into improper fractions.

The rules for adding rational numbers are the same as the rules for adding integers.

Reminder: Sometimes it's easier to add the decimal equivalents of mixed numbers.

Just one more thing...

When adding a string of positive and negative numbers, how can we use the commutative and associative properties to regroup numbers?

$-1.5+3.5+(-2)+\frac{1}{4}$

$-1.5+(-2)$

$-3.5+3.5+\frac{1}{4}$

opposites

$0+\frac{1}{4}$

$\frac{1}{4}$