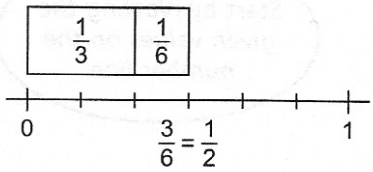
3.2 Skill Builder

Adding Fractions

Here are 2 ways to add $\frac{1}{3}$ and $\frac{1}{6}$.

- Using fraction strips on a number line:
  Place the fraction strips end to end, starting at 0.



  From the number line: $\frac{1}{3} + \frac{1}{6} = \frac{3}{6}$, or $\frac{1}{2}$

- Using common denominators:
  $\frac{1}{3}$ is the same as $\frac{2}{6}$.

  So, $\frac{1}{3} + \frac{1}{6} = \frac{2}{6} + \frac{1}{6}$

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

Some additions give answers that are greater than 1.

$\frac{2}{3} + \frac{1}{2} = \frac{4}{6} + \frac{3}{6}$

$= \frac{7}{6}$ ← improper fraction

$= 1\frac{1}{6}$ ← mixed number

Rewrite the improper fraction as a mixed number: divide 6 into 7 to see that there is 1 whole, and 1 sixth left over.

Check

1. Find each sum. Use diagrams to show your thinking.

a) $\frac{1}{6} + \frac{4}{6} =$ _____

b) $\frac{1}{3} + \frac{1}{2} =$ _____

2. Find each sum. Use the method you like best.

a) $\frac{2}{5} + \frac{4}{5} =$ _____, or _____

b) $\frac{2}{4} + \frac{5}{8} =$ _____

$=$ _____, or _____

Adding Mixed Numbers

Mixed numbers combine whole numbers and fractions.

We can add numbers in any order without changing the answer.

Add: $1\frac{1}{8} + 3\frac{3}{4}$

Add the whole numbers and add the fractions.

$1\frac{1}{8} + 3\frac{3}{4} = 1 + 3 + \frac{1}{8} + \frac{3}{4}$ A common denominator is 8.

$= 1 + 3 + \frac{1}{8} + \frac{6}{8}$

$= 4 + \frac{7}{8}$

$= 4\frac{7}{8}$

Check

1. Find each sum. Use diagrams to show your thinking.

a) $1\frac{1}{3} + 1\frac{2}{3} =$ _____

b) $2\frac{1}{6} + \frac{1}{2} =$ _____

2. Find each sum.
Use the method you like best.

a) $3\frac{2}{7} + 2\frac{3}{7} =$ _____
$=$ _____
$=$ _____

b) $4\frac{1}{9} + 1\frac{2}{3} =$ _____
$=$ _____
$=$ _____
$=$ _____

3.2 Adding Rational Numbers

FOCUS **Solve problems by adding rational numbers.**

Integers and fractions are rational numbers.
So, you can use strategies for adding integers, and strategies for adding fractions, to add rational numbers.

Example 1 Adding Rational Numbers on a Number Line

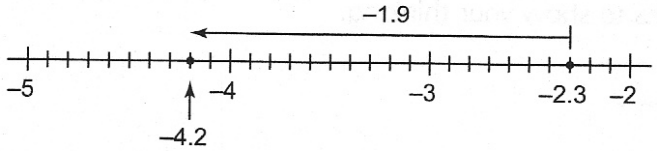
a) $-2.3 + (-1.9)$

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

Solution

a) $-2.3 + (-1.9)$

Use a number line divided in tenths.
Start at -2.3. To add -1.9, move 1.9 to the left.

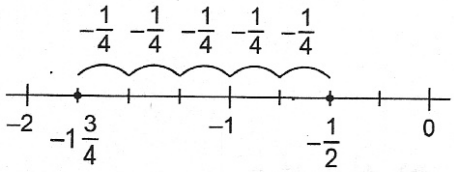


When we add a negative number, we move to the left. When we add a positive number, we move to the right.

So, $-2.3 + (-1.9) = -4.2$.

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

Use a number line divided into fourths.
Start at $-\frac{1}{2}$. To add $-\frac{5}{4}$, move $\frac{5}{4}$ to the left.

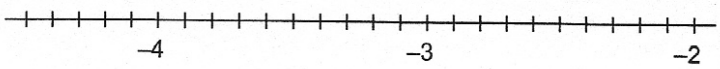


So, $-\frac{1}{2} + \left(-\frac{5}{4}\right) = -1\frac{3}{4}$.

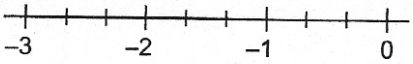
Check

1. Use a number line to add.

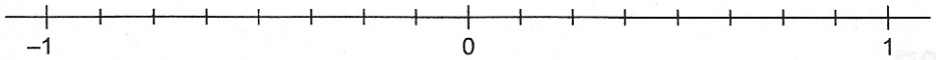
a) $-4.5 + 2.3 =$ _____



b) $-\frac{1}{3} + \left(-\frac{7}{3}\right) =$ _____



c) $\frac{3}{8} + \left(-\frac{3}{4}\right) =$ _____



Example 2 Adding Fractions without a Number Line

Add: $-\frac{2}{5} + \left(-\frac{1}{2}\right)$

Solution

To find $-\frac{2}{5} + \left(-\frac{1}{2}\right)$, look for a common denominator.

Use a common denominator of 10.

Multiples of 5: 5, 10, 15, ...
Multiples of 2: 2, 4, 6, 8, 10, ...

$$-\frac{2}{5} \overset{\times 2}{\underset{\times 2}{=}} -\frac{4}{10} \quad \text{and} \quad -\frac{1}{2} \overset{\times 5}{\underset{\times 5}{=}} -\frac{5}{10}$$

So, $-\frac{2}{5} + \left(-\frac{1}{2}\right) = -\frac{4}{10} + \left(-\frac{5}{10}\right)$

$= -\frac{9}{10}$

Think of integer addition: $(-4) + (-5) = -9$

Check

1. Add.

a) $-\frac{7}{12} + \frac{1}{6}$ Use a common denominator of ____.

$\frac{1}{6} \overset{\_\_}{\underset{\_\_}{=}} \frac{\_\_}{\_\_}$

$= -\frac{7}{12} + \_\_\_\_$

$= \_\_\_\_$

b) $\frac{3}{5} + \left(-\frac{2}{3}\right)$ Use a common denominator of ____.

$\frac{3}{5} \overset{\_\_}{\underset{\_\_}{=}} \frac{\_\_}{\_\_}$ and $-\frac{2}{3} \overset{\_\_}{\underset{\_\_}{=}} \frac{\_\_}{\_\_}$

$= \_\_\_\_ + \_\_\_\_$

$= \_\_\_\_$

Example 3 Adding Mixed Numbers

Calculate: $-2\frac{1}{8} + 3\frac{1}{3}$

Solution

Estimate first to predict the answer:

$-2\frac{1}{8} + 3\frac{1}{3}$ is about $-2 + 3$, or 1.

We expect an answer close to 1.

To calculate, add the whole numbers and add the fractions.
Keep the signs with each part of the mixed number.

$-2\frac{1}{8} + 3\frac{1}{3} = (-2) + 3 + \left(-\frac{1}{8}\right) + \frac{1}{3}$ Use a common denominator of 24.

$-\frac{1}{8} \overset{\times 3}{\underset{\times 3}{=}} -\frac{3}{24}$ and $\frac{1}{3} \overset{\times 8}{\underset{\times 8}{=}} \frac{8}{24}$

So, $-2\frac{1}{8} + 3\frac{1}{3} = (-2) + 3 + \left(-\frac{3}{24}\right) + \frac{8}{24}$

$= 1 + \frac{5}{24}$

$= 1\frac{5}{24}$

Check: the answer is reasonably close to the original estimate of 1.

Check

1. Find each sum.

a) $-1\frac{5}{16} + 3\frac{3}{8} =$ ___ + ___ + ___ + ___ Use a common denominator of ___.

$= $ ___ + ___ + ___ + ___

$= $ ___ + ___

$= $ ___

$\frac{3}{8} \overset{\times \_\_}{\underset{\times \_\_}{=}} \frac{\_\_}{\_\_}$

Estimate to check if your answer is reasonable.

b) $2\frac{3}{5} + 1\frac{1}{4} =$ ___ + ___ + ___ + ___

= ___ + ___ + ___ + ___

= ___ + ___

= ___

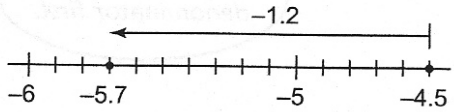
Use a common denominator of ___.

$\frac{3}{5} = \frac{\_\_\_}{\_\_\_}$ and $\frac{1}{4} = \frac{\_\_\_}{\_\_\_}$

Practice

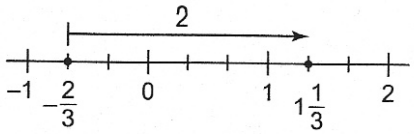
1. Write the addition statement shown by each number line.

a)



_____ + (_____) = _____

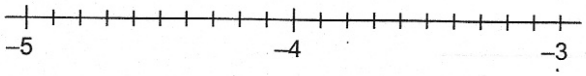
b)



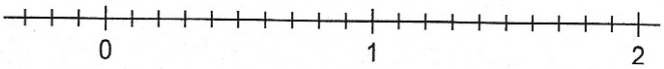
_____

2. Use the number line to add.

a) $-4.5 + (1.2) =$ _____



b) $1.7 + (-1.9) =$ _____



3. Add.

a) i) $4 + 6 =$ _____ **ii)** $4.1 + 6.4 =$ _____ **iii)** $\frac{4}{11} + \frac{6}{11} =$ _____

b) i) $4 + (-6) =$ _____ **ii)** $4.1 + (-6.4) =$ _____ **iii)** $\frac{4}{11} + \left(-\frac{6}{11}\right) =$ _____

c) i) $-4 + 6 =$ _____ **ii)** $-4.1 + 6.4 =$ _____ **iii)** $-\frac{4}{11} + \frac{6}{11} =$ _____

d) i) $-4 + (-6) =$ _____ **ii)** $-4.1 + (-6.4) =$ _____ **iii)** $-\frac{4}{11} + \left(-\frac{6}{11}\right) =$ _____

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4. Find each sum.

a) $-4.6 + 5.8 =$ _____

b) $2.3 + (-4.6) =$ _____

c) $-0.3 + (-6.2) =$ _____

d) $(-26.5) + (-18.1) =$ _____

5. Find each sum.

a) $-\frac{1}{3} + \frac{5}{9}$

$= \_\_\_ + \frac{5}{9}$

$= \_\_\_$

b) $\frac{1}{3} + \left(-\frac{2}{5}\right)$

$=$ _____

$= \_\_\_$

c) $-\frac{3}{8} + \left(-\frac{1}{3}\right)$

$=$ _____

$= \_\_\_$

6. Find each sum.

Look for a common denominator first.

a) $-2\frac{2}{5} + 6\frac{1}{2}$

_____

_____

_____

_____

b) $-1\frac{1}{6} + \left(-3\frac{1}{4}\right)$

_____

_____

_____

_____

c) $\left(-3\frac{1}{3}\right) + \left(-5\frac{1}{7}\right)$

_____

_____

_____

_____