SUBTRACTING FRACTIONS AND MIXED NUMBERS

To find the difference of fractions, we subtract. We will first explore subtracting fractions using fraction bars for fractions with like and unlike denominators. Using fraction bars helps us to understand the meaning of subtraction of fractions. We will then practice subtracting fractions with paper and pencil.
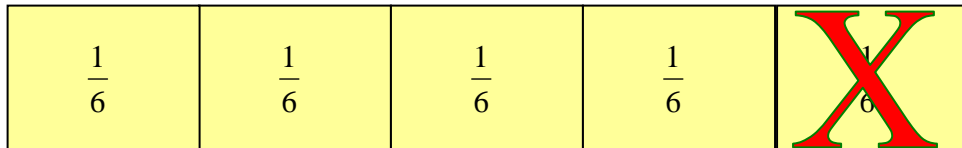
Next we'll look at subtracting mixed fractions using fraction bars and then practice subtracting mixed fractions with paper and pencil.

Sometimes we must borrow to subtract mixed fractions. To borrow we will first look at subtracting mixed fractions from whole numbers using fraction bars and then practice subtracting mixed fractions from whole numbers with paper and pencil.

On some occasions the mixed fraction from which that we are subtracting includes a fraction that is smaller than the mixed fraction we are subtracting. To understand this borrowing process, we will first look at subtracting mixed fractions with borrowing using fraction bars and then practice subtracting mixed fractions with borrowing with paper and pencil.
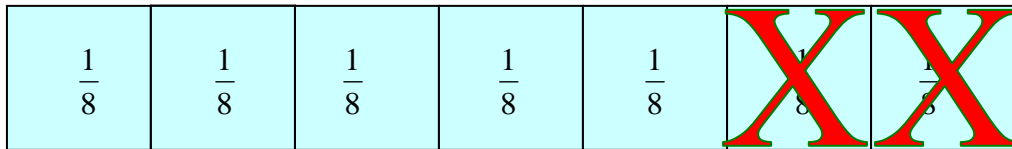
Subtracting Fractions Using Fraction Bars

Study the subtraction problems below. When subtracting fractions with unlike denominators, express the fractions into equivalent fractions with the same denominator, then subtract.
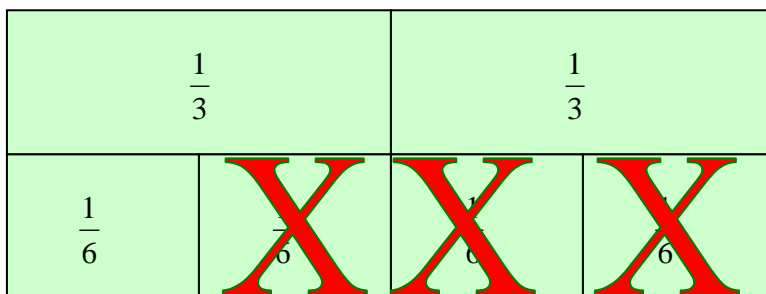
$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	X

$$\frac{5}{6}$$
$$-\frac{1}{6}$$
$$\overline{}$$
$$\frac{4}{6} \quad = \quad \frac{2}{3}$$

$(\frac{4}{6} \div \frac{2}{2} = \frac{2}{3})$

$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	XX

$$\frac{7}{8} \quad = \quad \frac{7}{8}$$
$$-\frac{1}{4} \quad = \quad \frac{2}{8}$$
$$\overline{}$$
$$\frac{5}{8}$$

$\frac{1}{3}$		$\frac{1}{3}$	
$\frac{1}{6}$	XXX		

$$\frac{2}{3} \quad = \quad \frac{4}{6}$$
$$-\frac{1}{2} \quad = \quad \frac{3}{6}$$
$$\overline{}$$
$$\frac{1}{6}$$

Fraction Bars

Look over these fraction strips. Each strip represents 1 whole.
1 = 2 halves, 3 thirds, 4 fourths, 5 fifths, 6 sixths, and so on.

Thus, $1 = \dfrac{2}{2} = \dfrac{3}{3} = \dfrac{4}{4} = \dfrac{5}{5} = \dfrac{6}{6}$ and so on...

1											
$\frac{1}{2}$						$\frac{1}{2}$					
$\frac{1}{3}$				$\frac{1}{3}$				$\frac{1}{3}$			
$\frac{1}{4}$			$\frac{1}{4}$			$\frac{1}{4}$			$\frac{1}{4}$		
$\frac{1}{5}$		$\frac{1}{5}$		$\frac{1}{5}$		$\frac{1}{5}$		$\frac{1}{5}$			
$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$	
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$				
$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$	$\frac{1}{9}$			
$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$		
$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{12}$
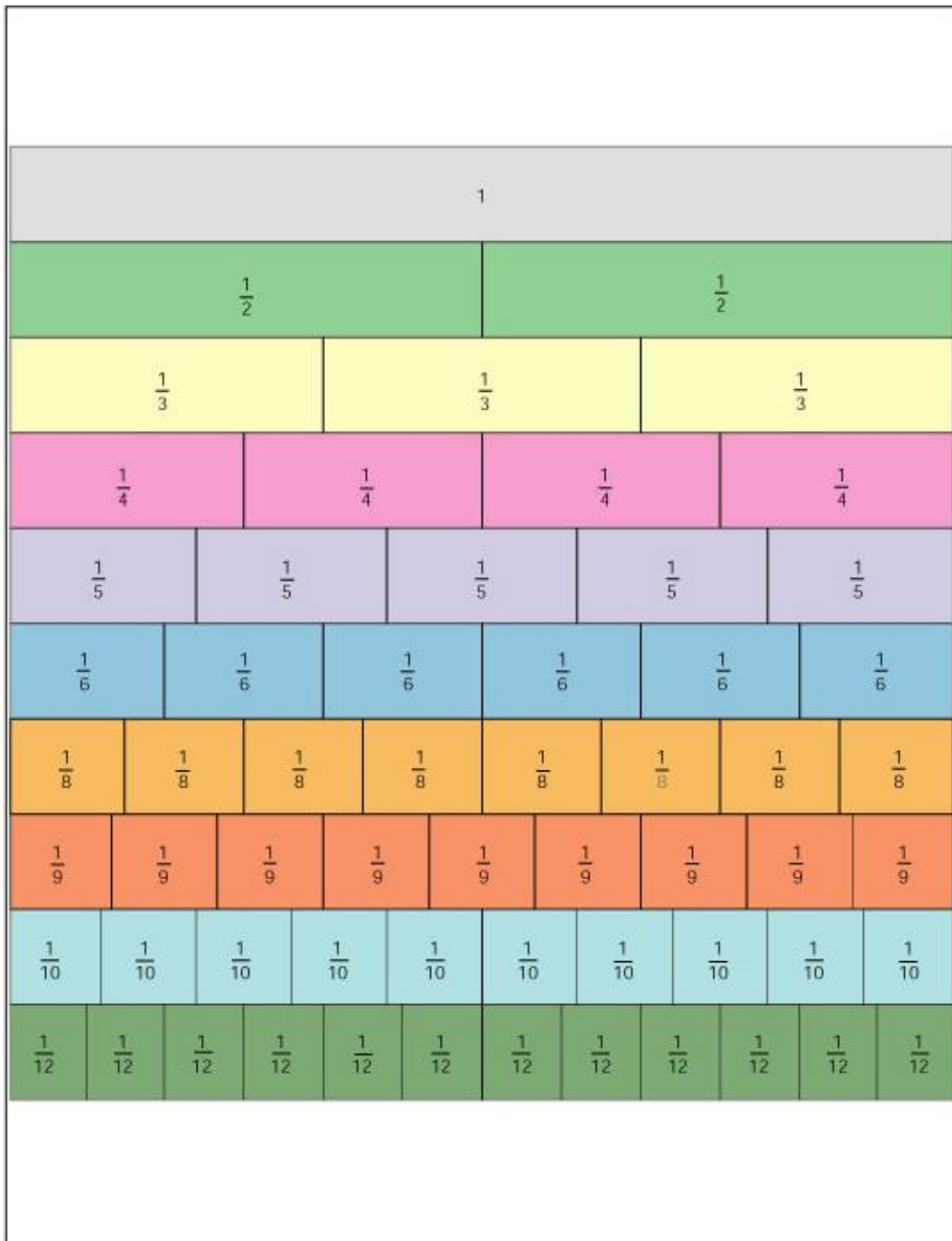
Subtracting Fractions

Example 1: Find 11/12 – 5/12. Simplify, if necessary.

$$\frac{11}{12}$$
$$-\frac{5}{12}$$
$$\frac{6}{12} = \frac{1}{2}$$

$$\frac{6}{12} \div \frac{6}{6} = \frac{1}{2}$$

Thus, 11/12 – 5/12 = 1/2.

Example 2: Find 7/8 – 5/6. Simplify, if necessary.

Find the LCD of 8 & 6.

List multiples of 8
8 = {8, 16, **24**, 32 ...}
List multiples of 6
6 = {6, 12, 18, **24**, 30 ...}

The **LCD** is the first common factor in both sets.

LCD = 24

$$\frac{7}{8} = \frac{21}{24}$$
$$-\frac{5}{6} = \frac{20}{24}$$
$$\frac{1}{24}$$

$$\frac{7}{8} \times \frac{3}{3} = \frac{21}{24}$$ or say 8 divides into 24, 3 times, $7 \times 3 = 21$.

$$\frac{5}{6} \times \frac{4}{4} = \frac{20}{24}$$ or say 6 divides into 24,4 times, $5 \times 4 = 20$.

Subtracting Mixed Fractions Using Fraction Bars

Study the two subtraction problems below. To subtract fractions with unlike denominators, express the fractions into equivalent fractions with the same denominator.

$$5\frac{3}{4} \quad = \quad 5\frac{6}{8}$$

$$-\,2\frac{3}{8} \quad = \quad 2\frac{3}{8}$$

$$3\frac{3}{8}$$
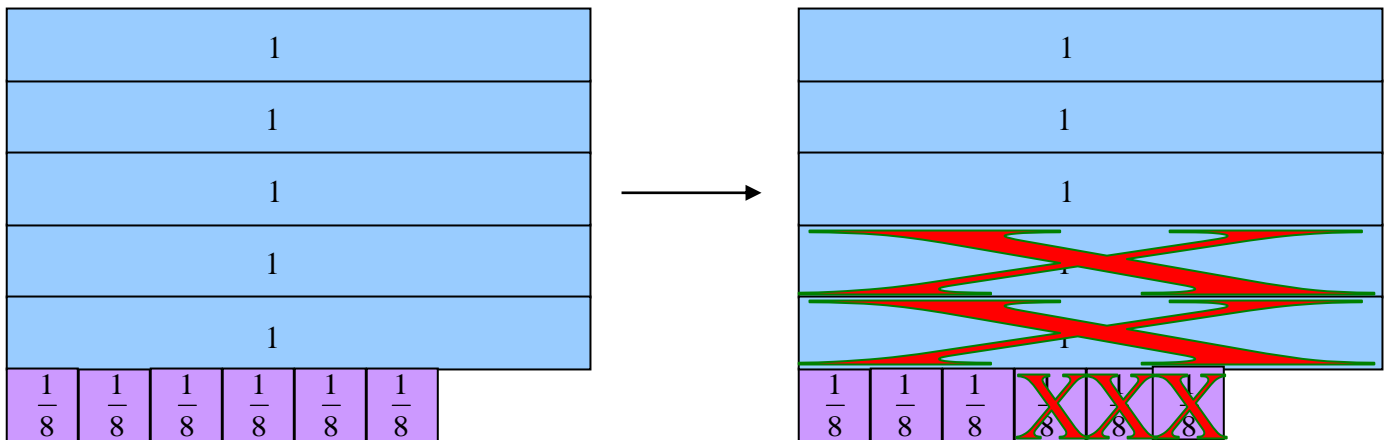
Subtracting Mixed Fractions

Example 1: Find 8 14/15 – 2 3/5. Simplify, if necessary.

Find the LCD of 15 & 5.

List multiples of 15
15 = {**15**, 30, 45 ...}
List multiples of 5
5 = {5, 10, **15**, 20 ...}

The **LCD** is the first common factor in both sets.

LCD = **15**

$$8\frac{14}{15} = 8\frac{14}{15}$$

$$-2\frac{3}{5} = 2\frac{9}{15}$$

$$6\frac{5}{15} \textbf{ reduces to } 6\frac{1}{3}$$

$$\frac{3}{5} \times \frac{3}{3} = \frac{9}{15}$$
or
say 5 divides into 15, 3 times, 3 × 3 = 9.
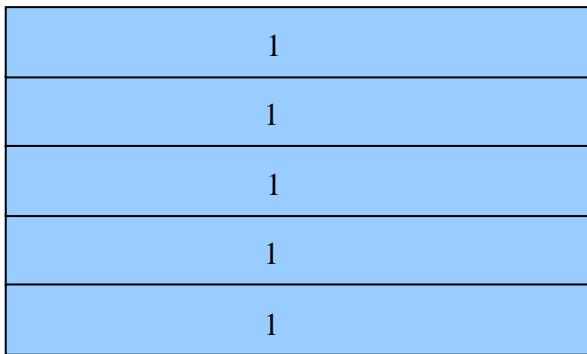
$$\frac{5}{15} \div \frac{5}{5} = \frac{1}{3}$$

Thus, 8 14/15 – 2 3/5 = 6 1/3.

Subtracting Mixed Fractions from Whole Numbers Using Fraction Bars

Study the subtraction problem below. To subtract a mixed fraction from a whole number, express the whole number as 1 less and the rename the 1 as a fraction equivalent to **one**, and has the same denominator as the mixed number.

$$5 \quad = \quad 4\frac{5}{5} \quad (5 = 4 + 1 = 4 + \frac{5}{5})$$

$$-2\frac{3}{5} \quad = \quad 2\frac{3}{5}$$

$$2\frac{2}{5}$$
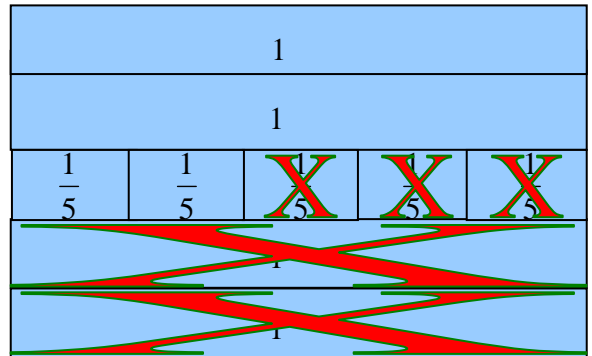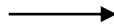
Subtracting Mixed Fractions from Whole Numbers

Find $7 - 2\dfrac{4}{13}$

$$7 \quad = 6\dfrac{13}{13}$$
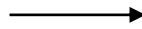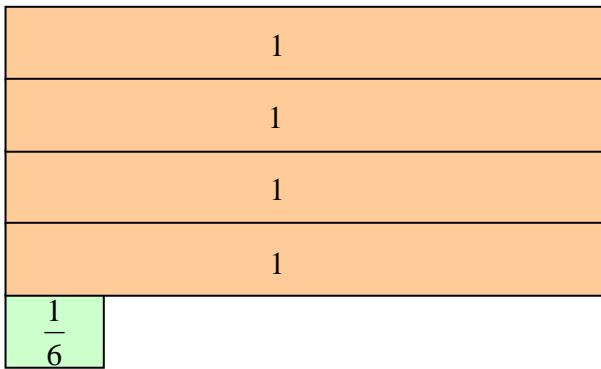
$$-2\dfrac{4}{13} = 2\dfrac{4}{13}$$

$$4\dfrac{9}{13}$$

Borrow

$(7 = 6 + 1 = 6 + \dfrac{13}{13} = 6\dfrac{13}{13}$)

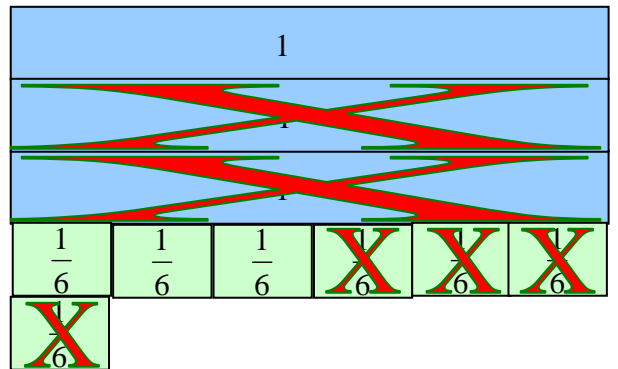## Subtracting Mixed Fractions with Borrowing Using Fraction Bars

$$4\frac{1}{6} \quad = \quad 4\frac{1}{6} \quad = \quad 3\frac{7}{6} \qquad (4\frac{1}{6}=3+1+\frac{1}{6}=3+\frac{6}{6}+\frac{1}{6}=3\frac{7}{6})$$

$$-2\frac{2}{3} \quad = \quad 2\frac{4}{6} \quad = \quad 2\frac{4}{6}$$

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

Subtracting Mixed Fractions with Borrowing

Example 1: Find 9 3/8 – 4 7/8. Simplify, if necessary.

$$9\frac{3}{8} = 8\frac{11}{8}$$

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

$$4\frac{4}{8} \text{ reduces to } 4\frac{1}{2}$$

Borrow

$$9\frac{3}{8} = 8+1+\frac{3}{8} = 8+\frac{8}{8}+\frac{3}{8} = 8\frac{11}{8}$$

A shortcut to find the numerator, 11 in $\frac{11}{8}$, is to add the 3 + 8, in $\frac{3}{8}$ and write it over 8.

Thus, 9 3/8 – 4 7/8 = 4 1/2.

Example 2: Find 5 5/12 – 2 11/18. Simplify, if necessary.

$$\frac{5}{12} \times \frac{3}{3} = \frac{15}{36} \text{ or say 12 divides into 36, 3 times, 5} \times 3 = 15.$$

Find the LCD of 12 & 18.

List multiples of 18
18 = {18, **36**, 54 ...}
List multiples of 12
12 = {12, 24, **36**, 48 ...}

The **LCD** is the first common factor in both sets.

LCD = **36**

$$5\frac{5}{12} = 5\frac{15}{36} = 4\frac{51}{36}$$

$$-2\frac{11}{18} = 2\frac{22}{36} = 2\frac{22}{36}$$

$$2\frac{29}{36}$$

Borrow

$$5\frac{15}{36} = 4+1+\frac{15}{36} = 4+\frac{36}{36}+\frac{15}{36} = 4\frac{51}{36}$$

A shortcut to find the numerator, 51, in $\frac{51}{36}$, is to add the 15 + 36, in $\frac{15}{36}$ and write it over 36.

$$\frac{11}{18} \times \frac{2}{2} = \frac{22}{36} \text{ or say 18 divides into 36, 2 times, 11} \times 2 = 22.$$

Thus, 5 5/12 – 2 11/18 = 2 29/36.