

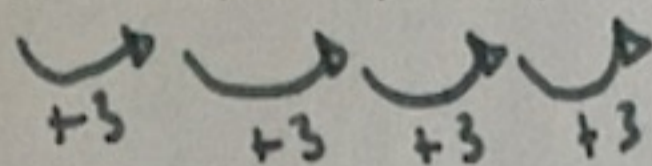
Math 9 - Fractions Continued

Adding and Subtracting Fractions

What do we mean when we say "a multiple of a number"?

It is when you count up by ~~an~~ the same # each time:

Ex: 3, 6, 9, 12, 15, ...



or: 6, 12, 18, 24, ...

(6x1) (6x2) (6x3) (6x4) ...

**The Lowest Common Multiple**

Method 1: Listing Multiples

Ex. Find the LEAST COMMON MULTIPLE (LCM) of 6 and 15:

List the multiples of 6:

6, 12, 18, 24, **30**, 36, 42, ...

List the multiples of 15:

15, **30**, 45, 60, 75, 90, ...

LCM of 6 and 15:

Find the smallest # that both lists have in common:

LCM = 30

Ex. Find the LCM of the following numbers by listing multiples

a) 3 and 8

3	8
6	16
9	<b>24</b>
12	32
15	40
18	48
21	⋮
24	⋮

LCM = 24

b) 9 and 15

9	15
18	30
27	<b>45</b>
36	60
45	⋮
54	⋮

LCM = 45

c) 10 and 18

10	18
20	36
30	54
40	72
50	<b>90</b>
60	⋮
70	⋮
80	⋮
90	⋮

LCM = 90

d) 15 and 20

15	20
30	40
45	<b>60</b>
60	⋮

LCM = 60

Method 2: Prime Factorization

A **prime number** is:

Ex. Determine the LEAST COMMON MULTIPLE of 6 and 14 using prime factorization.

LCM =

Ex. Determine the LCM of 18 and 24 by prime factorization.

LCM =

**You try!**

Determine the least common multiple for the following numbers using the two methods shown above: listing multiples and prime factorization.

a) 8 and 12

*Listing Multiples*

8	12
16	24
24	36
32	48
40	
48	

LCM = 48

*Prime Factorization*

b) 15, 6 and 10

*Listing Multiples*

15	6	10
30	12	20
45	18	30
60	24	40
	30	50
	36	60
	48	
	54	
	60	

LCM = 60

*Prime Factorization*

c) 2, 12, and 20

*Listing multiples*

2	12	20
4	24	40
6	36	60
8	48	
10	60	
...		
60		

*Prime Factorization*

I know 2 has 60 as a multiple since 60 is an even # and therefore is divisible by 2. So LCM = 60

## Adding Fractions

When adding fractions we need to find the **lowest common denominator (LCD)** between the two fractions. This is the same as finding the LCM of the two denominators.

Let's try:

Ex. Find the lowest common denominator for the fractions  $\frac{2}{5}$  and  $\frac{3}{8}$

We're looking for the LCM of 5 and 8

5: 5 10 15 20 25 30 35 40

8: 8 16 24 32 40

LCM = LCD = 40

Ex. Find the lowest common denominator for the fractions  $\frac{5}{9}$  and  $\frac{4}{3}$

9: 9 18 27 36

3: 6 9

LCD = 9

Once you have found the lowest common denominator, you must **change the fractions to this new denominator**.

But what does that mean...? Let's take a look at an example

Ex. Using the lowest common denominator for the fractions  $\frac{2}{5}$  and  $\frac{3}{8}$ , re-write both fractions so that their denominators are the LCD

$$\frac{2}{5} = \frac{16}{40}$$

*(Handwritten: 2 x 8 = 16, 5 x 8 = 40)*

$$\frac{3}{8} = \frac{15}{40}$$

*(Handwritten: 3 x 5 = 15, 8 x 5 = 40)*

The 2 new fractions are  $\frac{16}{40}$  and  $\frac{15}{40}$

**QUESTION:** are these new fractions the same or different from the originals?

They are the same!  $\frac{2}{5}$  and  $\frac{16}{40}$  are equivalent which means they represent the same amount.

Once your fractions have the same denominator, you can safely add them! Simply add the numerators together **BUT DO NOT ADD THE DENOMINATORS TOGETHER!**

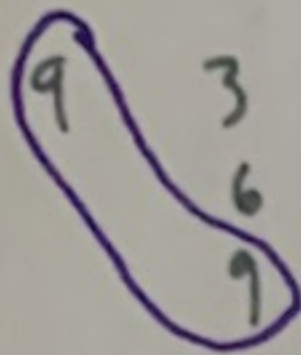
Ex: Add the following:  $\frac{2}{5} + \frac{3}{8}$

Add the 2 new fractions:

$$\frac{16}{40} + \frac{15}{40} = \frac{31}{40} \leftarrow \text{make sure you don't change the denominator.}$$

Ex. Add the following:  $\frac{5}{9} + \frac{4}{3}$  (Don't forget to change the denominators and numerators first!)

step 1: Find LCD



LCD = 9

step 2: change the Fractions

$\frac{5}{9}$  doesn't need to be changed since the denominator is already 9.

$$\frac{4}{3} = \frac{12}{9}$$

x3

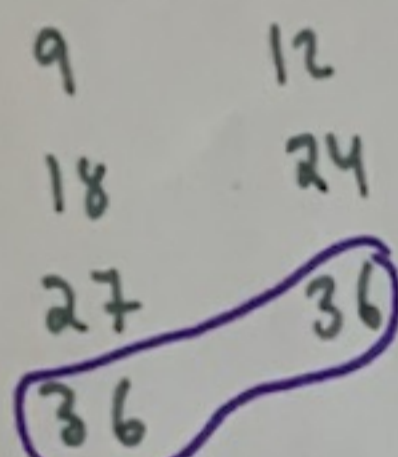
step 3: add the fractions

$$\frac{5}{9} + \frac{12}{9} = \frac{17}{9}$$

Hint: always add the 2 fractions with the same denominators.

You try! Add the following:  $\frac{2}{9} + \frac{5}{12}$

step 1



LCD = 36

step 2

$$\frac{2}{9} = \frac{8}{36}$$

x4

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

x3

$$\frac{8}{36} + \frac{15}{36} = \frac{23}{36}$$

You try! Add the following:  $\frac{3}{8} + \frac{13}{15}$  (Hint: use prime factorization if it is a large denominator)

step 1

8: 8 16 24 32 40 48 56 64 72  
80 88 96 104 112 (120)

15: 15 30 45 60 75 90 105  
(120)

LCD = 120

step 2

$$\frac{3}{8} = \frac{45}{120}$$

x15

$$\frac{13}{15} = \frac{104}{120}$$

x8

step 3

$$\frac{45}{120} + \frac{104}{120} = \frac{149}{120}$$

## Subtracting Fractions

Subtracting fractions is the same as adding fractions. You must follow the same steps:

1. Find the LCD
2. Change the fractions into an equivalent fraction with the LCD
3. Subtract the numerators

Ex. Subtract the following:  $\frac{7}{8} - \frac{2}{3}$

step 1

8 16 24  
3 6 9 12 15 18 21 24

step 2

$$\frac{7}{8} = \frac{21}{24}$$

x3

$$\frac{2}{3} = \frac{16}{24}$$

x8

step 3

$$\frac{21}{24} - \frac{16}{24} = \boxed{\frac{5}{24}}$$

\*make sure you keep the order correct. (The  $\frac{7}{8}$  fraction which became  $\frac{21}{24}$  must be the 1st fraction.)

## Adding and Subtracting Mixed Numbers

Rule: \_\_\_\_\_

Ex. Add the following and give your answer as an *improper fraction* and *mixed number*.

$$5\frac{1}{4} + 3\frac{5}{6}$$