Instructor's Manual

Modules 6 & 8: Adding Fractions and Mixed Numbers

What Students Should Gain from this Module

At the end of this module, students should be able to:

- Explain what a common denominator* is
- Find common denominators*
- Add fractions
- Add mixed numbers

*"Bottom number" is used in place of "denominator" in this module.

Recommended Timing for this Module   3 hours

Required Equipment and Materials

- An LCD projector and a Windows computer or laptop. The computer should have high speed internet access, a recent version of PowerPoint, an updated Internet browser, and speakers
- Cords for connecting the LCD projector to the computer
- A wireless presenter which allows you to move around the room while controlling the PowerPoint presentation
- A screen visible to all in the room

- Three sets of fraction strips per student. The strips should be separated from one another. For example, each set of fraction strips should consist of sixteen 1/16ths separated from one another, not a single row of connected 1/16ths.

- The *Adding Fractions* PowerPoint file

- A copy of the *Adding Fractions* handout for each student and instructor
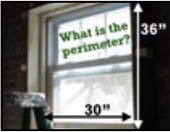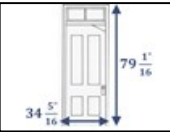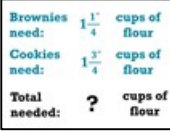
Set Up

- Set up the computer and projector.

Optional Materials

At Math-Aids.com http://www.math-aids.com you can create and print a wide variety of practice problem sets (and answer keys) for students who want or need additional practice. You can also create problem sets that offer a higher degree of challenge for students who want an additional challenge. Be sure to confirm that your use of the Math-Aids resources complies with its usage guidelines.

Note to the Instructor

Some of the slides for this module require you to "Click" or press enter on the keyboard to reveal additional information on the slide. Especially where there is a lot of information on a slide, this will help you guide students' attention to the information you are addressing. In other cases, it engages students by giving them a chance to think through their own answer or strategy for solving a problem before the answer is revealed on the slide.
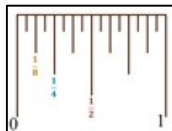
Time	Activity	Materials	What to Do
10	**Introduction**	**Handout:** *Adding Fractions*	*Note: Due to the time constraints for this training, and because students will most often use halves, fourths, eighths, and sixteenths, only one method for finding common denominators (for use with denominators that are divisible by one another) is taught in this module is the one.*
			Pass out the handout.
			Ask students what the perimeter of this window would be in inches.
			Write out the calculation and answer on the board.
			Say that, in construction, materials, spaces, and plans - like this door frame in an old house - often don't equal whole numbers, so there will be many times when they will need to be able to add fractions.
			Review the objective.
			Say that they might already be used to adding fractions in everyday life, like determining how much flour they need to make brownies and cookies for a pot luck.

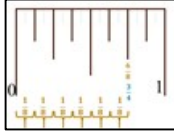| 40	Adding Fractions & Mixed Numbers with Common Denominators	Adding fractions is very different than multiplying fractions.	**Say** that adding fractions is very different than multiplying fractions.
		$\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$	**Ask** what amount you get when you multiply 1/2 x 1/4 **CLICK** **Point out** that, when multiplying fractions, they multiply the top numbers, then multiply the bottom numbers. **Ask** whether 1/8 is more or less than 1/2.
			Have students write in where 1/2, 1/4, and 1/8 are on the number line in their handout. **CLICK** **Have students correct their answers** (if necessary) on their handout. **Point out** that 1/8 is less than 1/2.
		In construction, multiplying fractions can result in a smaller number. but Adding fractions *never* results in a smaller number.	**Say** to remember that, in construction, multiplying fractions can result in a smaller number, like 1/2 x 1/4 = 1/8. **Ask** if adding two positive numbers ever results in a smaller amount. **CLICK** **Say** that, in construction, whenever they are adding fractions, they should always expect the result to be larger than any of the numbers being added.

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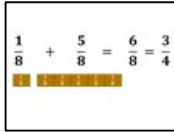
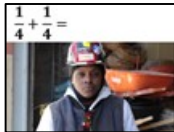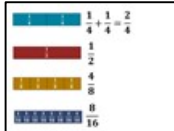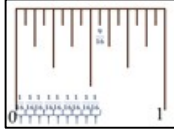|	
$\frac{1}{8} + \frac{5}{8} =$	**Have students** use their fraction strips and the number line in their handout (the image of the slide) to add 1/8 + 5/8.
$\frac{1}{8}$ + $\frac{5}{8}$ = $\frac{6}{8}$ = $\frac{3}{4}$	**Point out** that 1/8 + 5/8= 6/8 and that 6/8 (which can be simplified to 3/4) and is larger than both 1/8 and 5/8.
	Show how 1/8 + 5/8= 6/8 (or 3/4) on the number line as well. **CLICK**
	Point out that 6/8 (or 3/4) is a larger than 1/8.
$\frac{1}{4} + \frac{1}{4} =$	**Have students** use their fraction strips and the number line in their handout (the image of the slide) to add 1/4 + 1/4.
$\frac{1}{4} + \frac{1}{4} = \frac{2}{4}$ $\frac{1}{2}$ $\frac{4}{8}$ $\frac{8}{16}$	**Show how** 1/4 + 1/4 equals 2/4, which is the same amount as 1/2 when simplified.
	Point out that 1/2 is a larger than 1/4.
	Point out that students might also have noticed that 1/4 + 1/4 is the same amount as **CLICK**
	4/8ths or **CLICK**
	8/16ths because they are all the same amount.
	Point how 1/4 + 1/4 = 1/2 on the number line as well **CLICK**

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Have students use their fraction strips and the number line in their handout (the image of the slide) to add these fractions.

Show how 5/16 + 1/16 + 3/16 = 9/16 and that is larger than 5/16, 1/16, or 3/16.

Point how 5/16 + 1/16 + 3/16 = 9/16 on the number line as well **CLICK**

Have students use their fraction strips to add 3/4 + 3/4 and write their answer on their handout.

Point out the six fourths and how it is larger than 3/4.

Ask how 6/4 would be written as a mixed number. **CLICK**

Point out the one whole and two fourths represented by the fraction strips.

Ask how 1 2/4 would be simplified. **CLICK**

Have students correct their answer (if necessary) on their handout.

Have students use their fraction strips to add 11/16 + 9/16 + 3/16 and write their answer on their handout.

$\frac{11}{16} + \frac{9}{16} + \frac{3}{16} = \frac{23}{16} = 1\frac{7}{16}$

Point out the 23 sixteenths and how it is larger than either 11/16, 9/16 or 3/16.

Ask how 23 sixteenths would be written as a mixed number. **CLICK**

Point out the one whole and seven sixteenths. Have students compare the sixteen sixteenths to their whole fraction strip.

Have students correct their answer (if necessary) on their handout.

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

$\frac{1}{8} + \frac{7}{8} =$

$\frac{5}{16} + \frac{7}{16} =$

Have students write their answers on their handout, simplifying the answer if necessary. Encourage them to use their fraction strips to visualize the fractions.

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

$\frac{1}{8} + \frac{7}{8} = \frac{8}{8} = 1$

$\frac{5}{16} + \frac{7}{16} = \frac{12}{16} = \frac{3}{4}$

Have students correct their answers (if necessary) on their handout.

Brownies need:	$1\frac{1}{4}$	cups of flour
Cookies need:	$1\frac{3}{4}$	cups of flour
Total needed:	**?**	cups of flour

Say that when adding mixed numbers, they only need to add the whole numbers first, then add the fractions.

Add whole numbers first, then the fractions, then combine.

1 C + 1C = 2C

$\frac{1}{4}$ C + $\frac{3}{4}$ C = $\frac{4}{4}$ C = 1C

Total needed: 2 C + 1C = 3C of flour

Show where the whole cups came from. **CLICK**

Show where the quarter cups came from. **CLICK**

Point out the importance of including the units.

$1\frac{1}{8} + 2\frac{3}{8} =$

Have students use their fraction strips to add these fractions and write their answer on their handout, simplifying the answer if necessary.

$1\frac{1}{8} + 2\frac{3}{8} = 3\frac{4}{8} = 3\frac{1}{2}$

Point out the three wholes and four eighths, and how it simplifies to 3 1/2.

Have students correct their answer (if necessary) on their handout.

Note: One common mistake that students might make when adding mixed numbers is to give the whole numbers the same denominator as the fractions.

$1\frac{5}{16} + 2\frac{1}{16} + \frac{7}{16} =$

Have students use their fraction strips to add these fractions and write their answer on their handout.
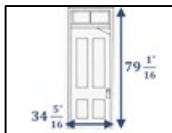
$1\frac{5}{16} + 2\frac{1}{16} + \frac{7}{16} = 3\frac{13}{16}$

Point out the three wholes and 13 sixteenths.

Have students correct their answer (if necessary) on their handout.

$79\frac{1}{16}$ $34\frac{5}{16}$

Have students calculate the perimeter of this door frame and write their answer on their handout.

Add whole numbers first, then the fractions, then combine.

$34" + 34" + 79" + 79" = 226"$

$\frac{5}{16} + \frac{5}{16} + \frac{1}{16} + \frac{1}{16} = \frac{12}{16} = \frac{3}{4}$

Perimeter $= 226\frac{3}{4}$

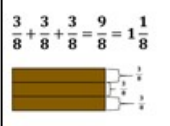**Show** how the whole number was calculated. **CLICK**

Show how the fraction was calculated. **CLICK**

Point out the importance of including the units.

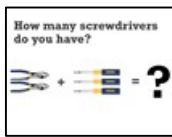Three pieces of 3/8" thick plywood are stacked on each other. What is the total thickness of the three pieces?

Have students use their fraction strips to add these fractions and write their answer on their handout, simplifying the answer if necessary.
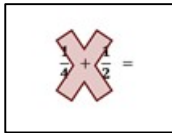
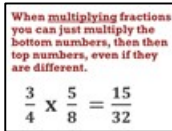|			
		$\frac{3}{8} + \frac{3}{8} + \frac{3}{8} = \frac{9}{8} = 1\frac{1}{8}$	Have students correct their answer (if necessary) on their handout.
15	**Practice Adding Fractions and Mixed Numbers with Common Denominators**	**Handout:** *Adding Fractions*	**Have students form groups** of 3 or 4. **Say** to remember that, in class or on the job, they will need to work as a team, which means supporting and encouraging one another. It is not enough for the group to get the right answers. Instead, they should take responsibility for helping one another until each member of the group has mastered the process and feels confident in her ability to solve the problems on her own. **Say** that they should remember the goal(s) they set for themselves, what they pledged to do to "Commit to Grit" in the *Being Gritty* handout at the beginning of the course, and the importance of maintaining a growth mindset if they have difficulty or get frustrated. **Say** that you can provide additional problem sets for students who want additional practice or additional challenge. See the information about Math-Aids under Optional Materials above. **Have students** work through problems 1 - 8 in the Adding Fractions Practice pages which follow the slides in the *Adding Fractions* handout. As they do, check in with groups to answer questions and ensure that no individual(s) in the group is being left behind. **Review the answers**, answer questions, and review content students are struggling with**.**

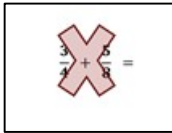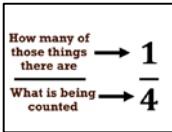| 60	Adding Fractions & Mixed Numbers with Different Denominators	How many screwdrivers do you have?	**Ask**, if they put two pliers and three screwdrivers in their tool belt, how many screwdrivers would they have?
			Say that, just as you can't add pliers and screwdrivers, you can't add fractions if their bottom numbers are different. **CLICK**
		When multiplying fractions you can just multiply the bottom numbers, then then top numbers, even if they are different. $\frac{3}{4} \times \frac{5}{8} = \frac{15}{32}$	**Point out** that, adding fractions is different than multiplying fractions. In multiplication, you can just multiply the bottom numbers, then then top numbers, even if they are different.
			Say that you cannot do that when adding fractions. **CLICK**
		How many of those things there are → 1 What is being counted → 4	**Say** to remember that the bottom number tells you what is being counted and the top number tells you how many of those things there are.
		There is one → 1 Fourth → 4	**Say** that the fraction 1/4 means that there is one fourth.
		There is one → 1 Half → 2	**Say** that the fraction 1/2 means that there is one half.
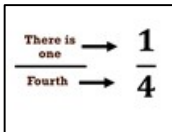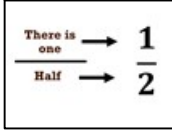
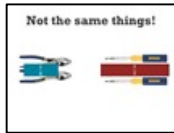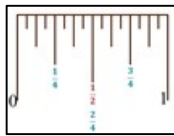**Say** that, just as pliers and screwdrivers are both tools, but are different kinds of tools, **CLICK**

halves and fourths are both amounts, but different kinds of amounts.

Ask what needs to happen in order to add fractions with different bottom numbers.

Point out, using the number line, that 2/4 is the same as 1/2.
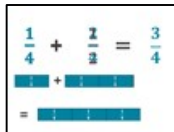
Say that you are not changing the amount, you are only renaming 1/2 as 2/4 so you now have all of the same thing (fourths) **CLICK**

Say that now you have all fourths so you can add them. **CLICK**

Show that, when 1/2 is renamed 2/4, both the top and bottom number changed.

Say that whenever renaming a fraction in this way, both the top and bottom number have to change.

Point out that 1/2 and 2/4 are the same amount but because 2/4 has the same bottom number as 1/4, the fractions can be added.

Have students use their fraction strips to add these fractions and write their answer on their handout.

Show, using the number line, that 6/8 is the same as 3/4.

Say that to add 3/4 and 5/8 they need to have the same bottom number. **CLICK**

Show that 3/4 is the same amount as 6/8 and, now that both fractions (5/8 and 6/8) have the same bottom number, **CLICK**
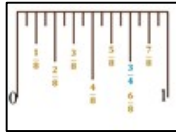
you can add the fractions.

Point out that, when 3/4 is renamed 6/8, both the top and bottom number changed.

Say that whenever renaming a fraction in this way, both the top and bottom number have to change.
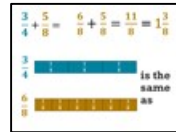
Have students use their fraction strips to add these fractions and write their answer on their handout.

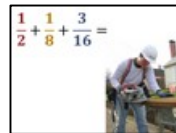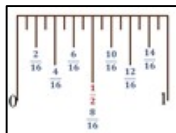**Show**, using the number line, that 8/16 is the same as 1/2.
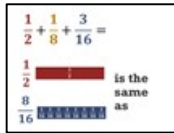
Point out that 1/2 is the same amount as 8/16.

Point out that, when 1/2 is renamed 8/16, both the top and bottom number changed.

Say that whenever they are renaming a fraction in this way, both the top and bottom number have to change.
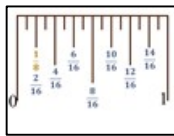
Point out, using the number line, that 2/16 is the same as 1/8.
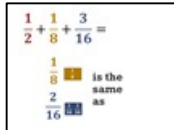
Point out that 1/8 is the same amount as 2/16.

Point out that, when 1/8 renamed 2/16, both the top and bottom number changed.

Say that whenever they are renaming a fraction in this way, both the top and bottom number have to change.
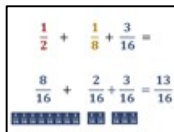
Show how 1/2 + 1/8 + 3/16 is the same as 8/16 + 2/16 + 3/16, which equals 13/16.

Have students correct their answer (if necessary) on their handout.

Say that they will need to be able to add fractions with different bottom numbers without using fraction strips.

To add fractions with different bottom numbers, rename one (or more) of the fractions so they all have the same bottom number.

Say that, to add fractions with different bottom numbers, they have to rename one of the fractions (or more if more than two fractions are being added) so that all fractions have the same bottom number.

When you rename a fraction, the amount stays the same!

Say that renaming a fraction doesn't change its amount.

$\frac{1}{2}$

$\frac{2}{4}$

Point out how, in a previous example, 1/2 was renamed 2/4 but the amount stayed the same.
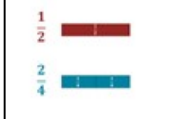
If the bottom number of one (or more) of the fractions divides evenly into the bottom number of another fraction, rename the fraction(s) so they all have the larger bottom number.

Say that one way to rename fractions so they all have the same bottom number is to see if one bottom number divides evenly into the other. If it does, the fractions should be renamed so they will all have that (larger) bottom number.

Say that they can use this method with most of the fractions they will work with.

Point out that they have to rename fractions without changing the amount.

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$\frac{1}{4} + \left(\frac{1}{2}\right) =$

$$\frac{1 \times 2 = 2}{2 \times 2 = 4}$$

Say that, for example, two divides evenly into four so they should rename the 1/2 to fourths. **CLICK**

Ask what they would have to multiply the two in the 1/2 by to make it fourths. **CLICK**

Say that, when renaming a fraction like this, they need to do the same thing to the top and bottom number. **CLICK**

Say that, by multiplying the top and bottom numbers by two, 1/2 is renamed 2/4 without changing the amount. **CLICK**

Note: It might be helpful to refer students to their fraction strips to confirm that 1/2 and 2/4 are the same amount.

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

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

Point out that 1/2 has been renamed 2/4 but they are the same amount.

Say that, now that both fractions have the same bottom number, they can be added.

$\dfrac{3}{4} + \dfrac{5}{8} =$

$\dfrac{3 \times 2 = 6}{4 \times 2 = 8}$

Ask which of the two fractions should be renamed. **CLICK**

Ask what they would have to multiply the four in the 3/4 by to make it eighths. **CLICK**

Say that, when renaming a fraction like this, they need to do the same thing to the top and bottom number. **CLICK**

Say that, by multiplying the top and bottom numbers by two, 3/4 is renamed 6/8 without changing the amount. **CLICK**

Note: It might be helpful to refer students to their fraction strips to confirm that 3/4 and 6/8 are the same amount.

$\dfrac{3}{4} + \dfrac{5}{8} =$

$\dfrac{6}{8} + \dfrac{5}{8} = \dfrac{11}{8} = 1\dfrac{3}{8}$

Point out that 3/4 has been renamed 6/8 but they are the same amount.

Say that, now that both fractions have the same bottom number, they can be added.

$$\frac{1}{2} + \frac{1}{8} + \frac{3}{16} =$$

$$\frac{1 \times 8 = 8}{2 \times 8 = 16}$$

Ask which fractions should be renamed. **CLICK**

Ask what they would have to multiply the two in the 1/2 by to make it sixteenths. **CLICK**

Say that, when renaming a fraction like this, they need to do the same thing to the top and bottom number. **CLICK**

Say that, by multiplying the top and bottom numbers by eight, 1/2 is renamed 8/16 without changing the amount. **CLICK**

Note: It might be helpful to refer students to their fraction strips to confirm that 1/2 and 8/16 are the same amount.

$$\frac{1}{2} + \frac{1}{8} + \frac{3}{16} =$$

$$\frac{1 \times 2 = 2}{8 \times 2 = 16}$$

Ask what they would have to multiply the eight in the 1/8 by to make it sixteenths. **CLICK**

Say that, when renaming a fraction like this, they need to do the same thing to the top and bottom number. **CLICK**

Say that, by multiplying the top and bottom numbers by two, 1/8 is renamed 2/16 without changing the amount. **CLICK**

Note: It might be helpful to refer students to their fraction strips to confirm that 1/8 and 2/16 are the same amount.

$\frac{1}{2} + \frac{1}{8} + \frac{3}{16} =$

$\frac{8}{16} + \frac{2}{16} + \frac{3}{16} = \frac{13}{16}$

Point out that 1/2 has been renamed 8/16 but they are the same amount, and that 1/8 has been renamed 2/16 but they are the same amount.

Say that, now that all fractions have the same bottom number, they can be added.

Add whole numbers first, then fractions, then combine.

$3\frac{9}{16} + 22\frac{3}{4} + 14\frac{1}{2} =$

Say that, just as with fractions in which the bottom numbers are the same, mixed numbers with different bottom numbers are added by adding the whole numbers first, then the fractions, then combining.

$3\frac{9}{16} + 22\frac{3}{4} + 14\frac{1}{2} =$

$3 + 22 + 14 = 39$

Show how the whole numbers equal 39.

$\frac{9}{16} + \frac{3}{4} + \frac{1}{2} =$

$\frac{3 \times 4 = 12}{4 \times 4 = 16}$

Ask which fractions should be renamed. **CLICK**

Ask what they would have to multiply the four in the 3/4 by to make it sixteenths. **CLICK**

Say that, when renaming a fraction like this, they need to do the same thing to the top and bottom number. **CLICK**

Say that, by multiplying the top and bottom numbers by four, 3/4 is renamed 12/16 without changing the amount. **CLICK**

Note: It might be helpful to refer students to their fraction strips to confirm that 3/4 and 12/16 are the same amount.

$\frac{9}{16} + \frac{3}{4} + \left(\frac{1}{2}\right) =$ $\dfrac{1 \times 8 = 8}{2 \times 8 = 16}$	**Ask** what they would have to multiply the two in the 1/2 by to make it sixteenths. **CLICK** **Say** that, when renaming a fraction like this, they need to do the same thing to the top and bottom number. **CLICK** **Say** that, by multiplying the top and bottom numbers by eight, 1/2 is renamed 8/16 without changing the amount. **CLICK** ***Note: It might be helpful to refer students to their fraction strips to confirm that 1/2 and 8/16 are the same amount.***
$\frac{9}{16} + \frac{3}{4} + \frac{1}{2} =$ $\frac{9}{16} + \frac{12}{16} + \frac{8}{16} = \frac{29}{16} = 1\frac{13}{16}$	**Point out** that 3/4 has been renamed 12/16 but they are the same amount, and that 1/2 has been renamed 8/16 but they are the same amount. **Say** that, now that all fractions have the same bottom number, they can be added.
$1\frac{13}{16} + 39 = 40\frac{13}{16}$	**Show** where the 1 13/16 and the 39 came from.
$\frac{1}{4} + \frac{15}{16} + 9\frac{7}{8} =$	**Have students write** out the problem and their answer on their handout.
$\left(\frac{1}{4}\right) + \frac{15}{16} + 9\frac{7}{8} =$ $\dfrac{1 \times 4 = 4}{4 \times 4 = 16}$	**Show** how 1/4 was renamed 4/16.

$$\frac{1}{4} + \frac{15}{16} + 9\frac{7}{8} =$$

$$\frac{7 \times 2 = 14}{8 \times 2 = 16}$$

Show how 7/8 was renamed 14/16.

$$\frac{1}{4} + \frac{15}{16} + 9\frac{7}{8} =$$

$$\frac{4}{16} + \frac{15}{16} + 9\frac{14}{16} =$$

Show where the lower equation came from.

$$\frac{19}{16} + 9\frac{14}{16} = 9\frac{33}{16} = 11\frac{1}{16}$$

Show where the numbers in the equation came from.

Have students correct their answers (if necessary) on their handout.

$$67\frac{1}{4}" \times 3\frac{5}{8}"$$

Have students find the perimeter of this kitchen island and write their answer on their handout.

$$67" + 67" + 3" + 3" = 140"$$

Show where the whole numbers came from.

$$\frac{1"}{4} + \frac{1"}{4} + \frac{5"}{8} + \frac{5"}{8} =$$

$$\frac{2"}{8} + \frac{2"}{8} + \frac{5"}{8} + \frac{5"}{8} = \frac{14"}{8} = 1\frac{6"}{8} = 1\frac{3"}{4}$$

Show where the 2/8s came from and how the 1 ¾ was calculated.

$$140" + 1\frac{3"}{4} = 141\frac{3"}{4}$$

Have students correct their answers (if necessary) on their handout.

For a tiling job you have the following amounts of grout. What is the total amount of grout you have?

$$2\frac{3}{4} \text{ lbs.}$$

$$7\frac{1}{2} \text{ lbs.}$$

$$15\frac{1}{4} \text{ lbs.}$$

Have students find the total amount and write their answer on their handout.

$$2\frac{3}{4} \text{ lbs.} + 7\frac{1}{2} \text{ lbs.} + 15\frac{1}{4} \text{ lbs.} =$$

$$2 \text{ lbs.} + 7 \text{ lbs.} + 15 \text{ lbs.} = 24 \text{ lbs.}$$

Show how the 24 lbs. was determined.

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	$2\frac{3}{4}$ lbs. $+ 7\frac{1}{2}$ lbs. $+15\frac{1}{4}$ lbs. $=$ $\frac{3}{4}$ lbs. $+$ $\frac{1}{2}$ lbs. $+$ $\frac{1}{4}$ lbs. $=$ $\frac{3}{4}$ lbs.$+\frac{2}{4}$ lbs.$+\frac{3}{4}$ lbs. $= \frac{6}{4}$ lbs. $= 1\frac{1}{2}$ lbs.	**Show** where the 2/4 lbs. came from and how the 1 1/2 was determined.
	2 lbs. $+$ 7 lbs. $+15$ lbs. $= 24$ lbs. $\frac{3}{4}$ lbs.$+\frac{2}{4}$ lbs.$+\frac{3}{4}$ lbs. $= \frac{6}{4}$ lbs. $= 1\frac{1}{2}$ lbs. 24 lbs. $+ 1\frac{1}{2}$ lbs. $= 25\frac{1}{2}$ lbs.	**Show** how the total was determined.
45	**Practice Adding Fractions with Different Denominators**	**Handout:** *Adding Fractions*	**Have students form groups** of 3 or 4. **Say** to remember that, in class or on the job, they will need to work as a team, which means supporting and encouraging one another. It is not enough for the group to get the right answers. Instead, they should take responsibility for helping one another until each member of the group has mastered the process and feels confident in her ability to solve the problems on her own. **Say** that they should remember the goal(s) they set for themselves, what they pledged to do to "Commit to Grit" in the *Being Gritty* handout at the beginning of the course, and the importance of maintaining a growth mindset if they have difficulty or get frustrated. **Say** that you can provide additional problem sets for students who want additional practice or additional challenge. See the information about Math-Aids under Optional Materials above. **Have students** work through problems 9 – 24 in the Adding Fractions Practice pages which follow the slides in the in the *Adding Fractions* handout. As they do, check in with groups to answer questions and ensure that no individual(s) in the group is being left behind.

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			Review the answers, answer questions, and review content students are struggling with**.
10	**Planning to Apply their Learning**		**Have students reflect** on the learning from this module and note in their journal what they have learned that will be useful to them on the job, what they want to remember, tips, etc., and when they have demonstrated grit or a growth mindset.