

CORE CURRICULUM

Introduction to Construction Math 00102-15



Session 1: Whole Numbers and Fractions

Introduction to Construction Math 00102-15



Session One Objectives

When trainees have completed this session, they should be able to do the following:

1. Identify whole numbers and demonstrate how to work with them mathematically.
 - a. Identify different whole numbers and their place values.
 - b. Demonstrate the ability to add and subtract whole numbers.
 - c. Demonstrate the ability to multiply and divide whole numbers.
2. Explain how to work with fractions.
 - a. Define equivalent fractions and show how to find lowest common denominators.
 - b. Describe improper fractions and demonstrate how to change an improper fraction to a mixed number.
 - c. Demonstrate the ability to add and subtract fractions.
 - d. Demonstrate the ability to multiply and divide fractions.



Sections 1.1.0 and 1.1.1 – Place Values

Understanding place value is essential to speaking numbers correctly and accurately.

5	,	3	1	6	,	2	4	7
MILLIONS		HUNDRED THOUSANDS	TEN THOUSANDS	THOUSANDS		HUNDREDS	TENS	ONES

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Sections 1.1.0 and 1.1.1 – Place Values

4. A supervisor estimates that a commercial building will require sixteen thousand, five hundred feet of copper piping to complete all of the restroom facilities. How would you write this value as a whole number?
- a. 1,650
 - b. 16,500
 - c. 160,500
 - d. 16,000,500



Section 1.2.0 – Addition

ADDITION

Step 1 Align numbers vertically.

Step 2 Begin with the column to the right and work towards the left.

Step 3 Carry the 1 over to the next column for numbers over 10. Note that this number may be larger than 1 when adding more than two numbers.

Step 4 Complete the final column on the left.

$$\begin{array}{r} 1 \\ 723 \\ + 84 \\ \hline 807 \end{array}$$



Section 1.2.0 –Subtraction

SUBTRACTION

Step 1 Align numbers vertically.

Step 2 Begin with the column to the right and work towards the left. Borrow a 1 from the next column when the number on the bottom is larger than the one above. Reduce the value of that column by 1 to compensate.

Step 3 Complete the final columns.

$$\begin{array}{r} \overset{6}{\cancel{7}} \overset{1}{6}6 \\ -1,483 \\ \hline 11,283 \end{array}$$



Section 1.2.1 – Addition and Subtraction

1. In calculating a bid for a roof restoration, a contractor estimates that he will need \$847 for lumber, \$456 for roofing shingles, and \$169 for hardware. What is the total cost for the materials portion of the bid?

\$1,472.00



Section 1.2.1 – Addition and Subtraction

4. A general contractor ordered three different sized windows to complete a job on a residential home. She ordered a bow window that cost \$874; one 36" × 36" double-hung window that cost \$67; and one 36" × 54" double-hung window that cost \$93. If she had set aside \$1,250 to purchase the windows in her estimate, how much will she have left after buying them?

\$216.00



Section 1.3.0 – Multiplication

MULTIPLICATION

- Align the digits.
- Start at the right. Multiply all top digits, one at a time, by the lower number.
- When the result of each multiplication equals or exceeds 10, carry over the left digit and add it to the next product.
- If either number in the problem is greater than 10, some addition is required at the end to determine the final answer.

$$\begin{array}{r} \overset{1}{3}74 \\ \times 26 \\ \hline 2,244 \text{ product of } 6 \times 374 \\ +7,480 \text{ product of } 20 \times 374 \\ \hline 9,724 \text{ final product} \end{array}$$



Section 1.3.0 – Multiplication and Division

DIVISION

- Set up the problem correctly.
- Begin dividing into the number(s) on the left end of the dividend.
- Record the resulting multiplier at the top and record the result of the multiplication under the dividend, properly aligned.
- Continue the process until the problem is complete. The remainder represents a fraction (part of a whole), in this case $22/24$ ths.

$$\begin{array}{r} 0 \ 10? \\ 24 \overline{)2,638} \\ \underline{-24} \downarrow \\ 0 \ 23 \downarrow \\ \underline{-000} \downarrow \\ 0 \ 238 \end{array}$$

$$\begin{array}{r} 0 \ 109 \ r22 \\ 24 \overline{)2,638} \\ \underline{-24} \downarrow \\ 0 \ 23 \downarrow \\ \underline{-000} \downarrow \\ 0 \ 238 \\ \underline{-0216} \\ 22 \end{array}$$



Sections 1.3.1 and 1.3.2 – The Order of Operations

$$6 + 3 \times 5 = A$$

MDAS

Multiplication

Division

Addition

Subtraction



Sections 1.3.1 and 1.3.2 – The Order of Operations

3. If one plumbing job requires 45 meters of PVC pipe, and a second job requires 30 meters, how many lengths of pipe will you need if it comes in 6-meter lengths? Remember that you cannot order a partial length of pipe; only orders for whole lengths are generally accepted.

13 lengths of pipe

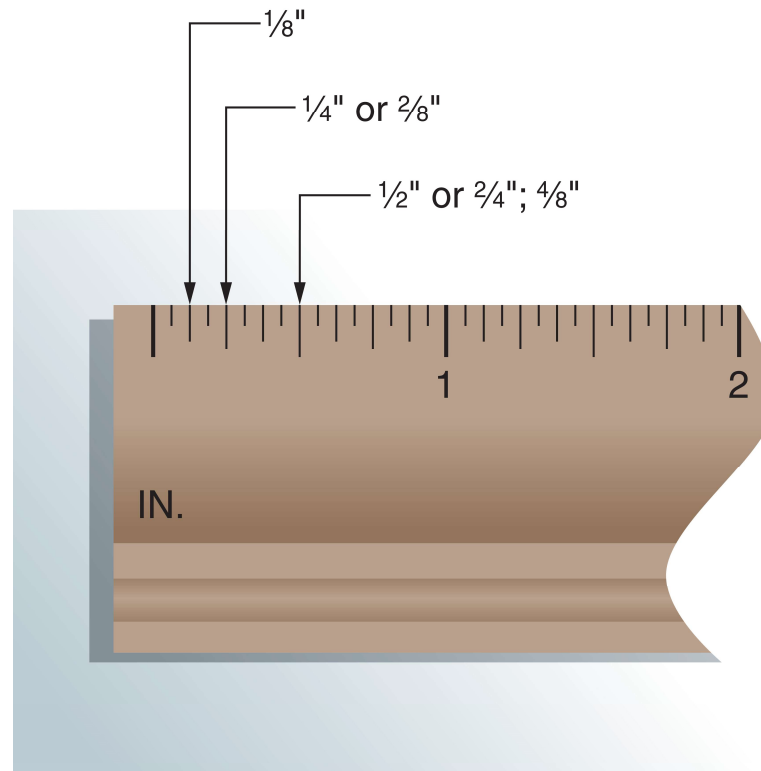
How much pipe will be left over, assuming there are no errors?

3 meters



Sections 2.1.0 to 2.1.2 – Fractions

Although fractions such as $\frac{2}{4}$ and $\frac{1}{2}$ are equal, they must share a denominator for addition and subtraction.



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Sections 2.1.0 to 2.1.2 – Fractions

REDUCING TO LOWEST TERMS

$$\frac{4 \div 4}{16 \div 4} = \frac{1}{4}$$

Determine the largest number that will divide evenly into both the numerator and denominator. In this case, it is 4.
Then divide both by this number.



Sections 2.1.3 and 2.1.4 – Fractions

Which is larger?

$$\frac{3}{4} \text{ or } \frac{5}{8}$$

A common denominator is required for comparison. It does not need to be the lowest common denominator though; common denominators at any level allows for comparison.

$$\frac{3}{4} \times \frac{8}{8} = \frac{24}{32}$$

$$\frac{5}{8} \times \frac{4}{4} = \frac{20}{32}$$



Sections 2.1.3 and 2.1.4 – Fractions

3. $\frac{3}{4}$ equals how many eighths?

a. $\frac{2}{8}$

b. $\frac{4}{8}$

c. $\frac{5}{8}$

d. $\frac{6}{8}$



Sections 2.1.3 and 2.1.4 – Fractions

Find the lowest common denominator for this pair of fractions.

14. $\frac{1}{4}$ and $\frac{3}{16}$.

- a. 8
- b. 16
- c. 18
- d. 20



Section 2.3.0 – Fractions

ADDING FRACTIONS

- Find a common denominator; it does not have to be the lowest, but the final answer will need to be converted to its lowest common denominator. Before or after is fine.
- Convert the fractions to the same denominator.
- Add the numerators *only*.

$$\begin{array}{l} \frac{3}{4} \times \frac{8}{8} = \frac{24}{32} \\ \frac{5}{8} \times \frac{4}{4} = \frac{20}{32} \end{array} \quad \frac{24}{32} + \frac{20}{32} = \frac{44}{32}$$

- Reduce to the lowest common denominator, and then to a mixed number, if necessary.



Section 2.3.0 – Fractions

SUBTRACTING FRACTIONS

- Find a common denominator. Like addition, it does not need to be the lowest.
- Convert the fractions to the same denominator.
- Subtract the numerators *only*.

$$\frac{7}{8} - \frac{2}{8} = \frac{5}{8}$$

- Reduce to the lowest terms if necessary.



Section 2.3.1 – Fractions

Find the answers to the following addition problems. Remember to reduce the sum to the lowest terms and change any improper fractions to mixed numbers.

$$1. \quad 1/8 + 4/16 = \underline{3/8}$$

$$2. \quad 4/8 + 6/16 = \underline{7/8}$$



Section 2.3.1 – Fractions

Find the answers to the following subtraction problems. Remember to reduce the differences to the lowest terms.

$$6. \quad 3/8 - 5/16 = \underline{1/16}$$

$$7. \quad 11/16 - 5/8 = \underline{1/16}$$



Section 2.4.0 – Fractions

MULTIPLYING FRACTIONS

- No need to find a common denominator!
- Multiply the numerators, and then multiply the denominators.

$$\frac{4}{8} \times \frac{5}{6} = \frac{20}{48}$$

- Reduce the resulting fraction to its lowest terms.



Section 2.4.0 – Fractions

DIVIDING FRACTIONS

- Again, no need to find a common denominator.
- Identify the divisor and invert it. Then change the operation to multiplication.

$$\frac{1}{2} \div \frac{3}{4} = \frac{1}{2} \times \frac{4}{3}$$

- Now proceed with multiplication and reduce the result to its lowest terms.

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

$$\frac{4}{6} \text{ reduces to } \frac{2}{3}$$



Section 2.4.1 – Fractions

Find the answers to the following multiplication problems without using a calculator. Reduce the products to their lowest terms and change improper fractions to mixed numbers.

1. $\frac{4}{16} \times \frac{5}{8} = \underline{\frac{5}{32}}$

2. $\frac{3}{4} \times \frac{7}{8} = \underline{\frac{21}{32}}$



Section 2.4.1 – Fractions

Find the answers to the following division problems without using a calculator. Reduce the quotients to their lowest terms and change improper fractions to mixed numbers.

$$6. \quad \frac{3}{8} \div 3 = \underline{\frac{1}{8}}$$

$$7. \quad \frac{5}{8} \div \frac{1}{2} = \underline{1\frac{1}{4}}$$



Next Session...

DECIMALS; TAKING MEASUREMENTS

Read Sections 2.0.0 through 4.2.4 to prepare for the next session. Also complete the Section Review for Sections 1.0.0 through 4.0.0.

