

UNITED STATES MARINE CORPS
ENGINEER EQUIPMENT INSTRUCTION COMPANY
MARINE CORPS DETACHMENT
1706E EAST 8TH STREET
FORT LEONARD WOOD, MISSOURI 65473-8963

LESSON PLAN

MATHEMATICS REVIEW

EEO/EEC-B03

WARRANT OFFICER/CHIEF COURSE

A16ACN1/A1613E1

REVISED 9/2/2014

APPROVED BY _____ **DATE** _____

(ON SLIDE #1)

INTRODUCTION

(10 MIN)

1. **GAIN ATTENTION:** A knowledge of mathematics is required for the successful completion of various courses offered in the engineer field. The degree of knowledge varies somewhat from course to course. The minimum goal of this mathematics instruction is to attain the requisite skill necessary for logistical estimation, production estimation, and construction management.

(ON SLIDE #2)

2. **OVERVIEW:** Good morning/afternoon, my name is _____ . The purpose of this lesson is to re-introduce you to basic algebraic and geometric equations.

INSTRUCTOR NOTE

Introduce the learning objectives.

(ON SLIDE #3)

3. **LEARNING OBJECTIVE(S):**

INSTRUCTOR NOTE

Have students read learning objectives to themselves.

a. **TERMINAL LEARNING OBJECTIVE:**

(1) Provided a horizontal construction mission, resources, and references, manage/supervise horizontal construction project production and logistical requirements to develop project estimates in support of mission requirements. (1310-HORZ-2002/1349-HORZ-2002)

b. **ENABLING LEARNING OBJECTIVE:**

(1) Given mathematical problems, a calculator, and without the aid of references, solve each problem per the MCI 13341. (1310-HORZ-2002a/1349-HORZ-2002a)

(2) Given basic order of operation equations, a calculator, and without the aid of references, solve each problem per the MCI 13341. (1310-HORZ-2002b/1349-HORZ-2002b)

(3) Given area and volume equations, a calculator, and without the aid of references, solve each problem per the MCI 13341. (1310-HORZ-2002c/1349-HORZ-2002c)

(ON SLIDE #4)

4. **METHOD/MEDIA:** This period of instruction will be taught using the lecture method with aid of power point presentation, instructor demonstrations, and practical applications.

INSTRUCTOR NOTE

Explain Instructional Rating Forms and Safety Questionnaire to students.

(ON SLIDE #5)

5. **EVALUATION:**

You will be evaluated by a written exam at the time indicated on the training schedule.

(ON SLIDE #6)

6. **SAFETY/CEASE TRAINING (CT) BRIEF.**

There are no safety / cease training concerns for this period of instruction.

INSTRUCTOR NOTE

Ensure to explain Crane Shed fire and inclement weather procedures.

(ON SLIDE #7)

TRANSITION: Are there any questions over what is going to be taught, how it will be taught, or how you the student will be evaluated? We will begin this class with basic math principles such as addition, subtraction, multiplication, and division.

INSTRUCTOR/EVALUATOR/INSPECTOR NOTE

DEMONSTRATION. (1 HR) Each student and/or class will have varying degrees of knowledge using mathematical equations. **DEMONSTRATIONS WILL BE USED AS NEEDED BASED ON THE CLASS UNDERSTANDING OF EACH SECTION.** Instructor will answer questions as they arise and assist students having difficulty. Instructor will also be prepared to formulate further examples of problems using the dry erase board.

BODY

(15 HOURS 30 MIN)

(ON SLIDE #8)

1. **BASIC MATH** (4 Hrs, 30 Min)

(ON SLIDE #9)

a. **Addition:** The process of uniting two or more numbers into one sum, represented by a symbol.

(1). Addends - The numbers that are to be added.

(2). Sum - The result of addition.

(ON SLIDE #10)

Examples:	7 Addend	Addends	Sum
	6 Addend	125 + 57 + 872 + 2,793 =	3,847
	+ 1 Addend		
	<u>14</u> Sum		

INTERIM TRANSITION: So far we have discussed addition. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

(ON SLIDE #11)

PRACTICAL APPLICATION (1). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 17 basic addition problems in the student handout for the students to complete. The addition problems are within the tens, hundreds, and thousands place.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the addition problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over addition? In order to progress further, you must have an understanding of basic math.

INSTRUCTOR NOTE

-Allow the students time to take their breaks during the Practical Application time.

-Display and review the answers to the addition problems in the student handout.

(ON SLIDES #12,13)

Addition Problems - Work out the following addition problems, utilizing the adding machine.

$$\begin{array}{r} 81 \\ +15 \\ \hline 96 \end{array} \quad \begin{array}{r} 346 \\ +252 \\ \hline 598 \end{array} \quad \begin{array}{r} 45 \\ +42 \\ \hline 87 \end{array} \quad \begin{array}{r} 3,720 \\ +4,256 \\ \hline 7,976 \end{array} \quad \begin{array}{r} 51,084 \\ +27,505 \\ \hline 78,589 \end{array} \quad \begin{array}{r} 3,817 \\ +4,162 \\ \hline 7,979 \end{array}$$

$$\begin{array}{r} 946 \\ + 32 \\ \hline 978 \end{array} \quad \begin{array}{r} 415 \\ + 61 \\ \hline 476 \end{array} \quad \begin{array}{r} 723 \\ + 75 \\ \hline 798 \end{array} \quad \begin{array}{r} 302 \\ + 83 \\ \hline 385 \end{array} \quad \begin{array}{r} 729 \\ + 50 \\ \hline 779 \end{array} \quad \begin{array}{r} 655 \\ + 43 \\ \hline 698 \end{array}$$

$$\begin{array}{r} 518 \\ 782 \\ 762 \\ 202 \\ + 843 \\ \hline 3,107 \end{array} \quad \begin{array}{r} 78 \\ + 490 \\ \hline 580 \end{array} \quad \begin{array}{r} 7,360 \\ 4,108 \\ + 7,068 \\ \hline 18,536 \end{array} \quad \begin{array}{l} 93 + 55 + 34 = 182 \\ 7 + 24 + 806 + 63 = 900 \end{array}$$

(ON SLIDE #14)

TRANSITION: We have just discussed the process of addition. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

2. QUESTIONS TO THE CLASS:

Q. What is the process of uniting two or more numbers into a sum?

A. Addition

Now that we understand the process of addition, let's move on to subtraction.

(ON SLIDE #15)

b. Subtraction: The operation or process of finding the difference between two numbers or quantities.

(1). Minuend - The number from which another is to be subtracted.

(2). Subtrahend - The number that is to be subtracted.

(3). Remainder (Difference) - That which remains after subtraction.

(ON SLIDE #16)

Examples:

7 Minuend				
- 6 Subtrahend		Minuend	Subtrahend	Remainder
<u>1</u> Remainder		525	- 25	= 500

(ON SLIDE #17)

INTERIM TRANSITION: We have just discussed subtraction. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

PRACTICAL APPLICATION (2). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 24 basic subtraction problems in the student handout for the students to complete. The subtraction problems are within the tens, hundreds, and thousands place.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the subtraction problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over subtraction? In order to progress further, you must have an understanding of this basic math.

INSTRUCTOR NOTE

-Allow the students time to take their breaks during the Practical Application time.

-Display and review the answers to the addition problems in the student handout.

(ON SLIDE #18,19)

Subtraction Problems - Work out the following subtraction problems, utilizing the adding machine.

$\begin{array}{r} 34 \\ - 22 \\ \hline 12 \end{array}$	$\begin{array}{r} 69 \\ - 35 \\ \hline 34 \end{array}$	$\begin{array}{r} 38 \\ - 31 \\ \hline 7 \end{array}$	$\begin{array}{r} 52 \\ - 32 \\ \hline 20 \end{array}$	$\begin{array}{r} 75 \\ - 51 \\ \hline 24 \end{array}$	$\begin{array}{r} 81 \\ - 40 \\ \hline 41 \end{array}$
$\begin{array}{r} 364 \\ - 263 \\ \hline \end{array}$	$\begin{array}{r} 751 \\ - 401 \\ \hline \end{array}$	$\begin{array}{r} 523 \\ - 231 \\ \hline \end{array}$	$\begin{array}{r} 952 \\ - 940 \\ \hline \end{array}$	$\begin{array}{r} 540 \\ - 230 \\ \hline \end{array}$	$\begin{array}{r} 686 \\ - 251 \\ \hline \end{array}$

101 350 292 12 310 435

896	692	546	695	588	482
<u>- 88</u>	<u>- 85</u>	<u>- 37</u>	<u>- 88</u>	<u>- 79</u>	<u>- 75</u>
808	607	509	607	509	407

$$4,080 - 493 = 3,587 \quad 6,070 - 576 = 5,494 \quad 2,050 - 288 = 1,762$$

$$8,004 - 483 = 7,521 \quad 40,003 - 927 = 39,076 \quad 9,002 - 605 = 8,397$$

(ON SLIDE #20)

TRANSITION: We have just discussed the process of subtraction. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. **QUESTIONS FROM THE CLASS**

2. **QUESTIONS TO THE CLASS:**

Q. What is the operation of finding the difference between two numbers or quantities?

A. Subtraction

Now that we understand the process of subtraction, let's move on to multiplication.

(ON SLIDE #21)

c. **Multiplication:** A mathematical operation signifying, when **A** and **B** are positive integers, that **A** is to be added to itself as many times as there are units in **B**.

(1) Multiplicand - the number that is to be multiplied.

(2) Multiplier - The multiplying number.

(3) Product - The result of multiplication.

(ON SLIDE #22)

Examples:

$$\begin{array}{r} 7 \text{ Multiplicand} \\ \times 6 \text{ Multiplier} \\ \hline 42 \text{ Product} \end{array}$$

Multiplicand		Multiplier		Product
27	x	10	=	270

(ON SLIDE #23)

INTERIM TRANSITION: We have just discussed multiplication. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

PRACTICAL APPLICATION (3). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 22 multiplication problems in the student handout for the students to complete.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the multiplication problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over multiplication? In order to progress further, you must have an understanding of this basic math.

INSTRUCTOR NOTE

-Allow the students time to take their breaks during the Practical Application time.

-Display and review the answers to the addition problems in the student handout.

(ON SLIDE #24,25)

$8 \times 4 = 32$ $7 \times 8 = 56$ $3 \times 7 = 21$ $28 \times 35 = 980$

$$\begin{array}{r} 32,021 \times 231 = \\ 7,396,851 \end{array}$$

$$\begin{array}{r} 80,011 \times 497 = \\ 39,765,467 \end{array}$$

$$\begin{array}{r} 50,112 \times 314 = \\ 15,735,168 \end{array}$$

$10,220 \times 123 = 1,257,060$

$71,011 \times 856 = 60,785,416$

$82,159 \times 792 = 65,069,928$

$$\begin{array}{r} 401 \\ \times 6 \\ \hline 2,406 \end{array}$$

$$\begin{array}{r} 312 \\ \times 4 \\ \hline 1,248 \end{array}$$

$$\begin{array}{r} 821 \\ \times 7 \\ \hline 5,747 \end{array}$$

$$\begin{array}{r} 611 \\ \times 9 \\ \hline 5,499 \end{array}$$

$$\begin{array}{r} 502 \\ \times 4 \\ \hline 2,008 \end{array}$$

$$\begin{array}{r} 601 \\ \times 8 \\ \hline 4,808 \end{array}$$

$$\begin{array}{r} 110 \\ \times 78 \\ \hline 8,580 \end{array}$$

$$\begin{array}{r} 178 \\ \times 65 \\ \hline 11,570 \end{array}$$

$$\begin{array}{r} 125 \\ \times 20 \\ \hline 2,500 \end{array}$$

$$\begin{array}{r} 532 \\ \times 11 \\ \hline 5,852 \end{array}$$

$$\begin{array}{r} 987 \\ \times 29 \\ \hline 28,623 \end{array}$$

$$\begin{array}{r} 581 \\ \times 43 \\ \hline 24,983 \end{array}$$

(ON SLIDE #26)

TRANSITION: We have just discussed the operation of multiplication. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. **QUESTIONS FROM THE CLASS**

2. **QUESTIONS TO THE CLASS:**

Q. What are the three components of a multiplication problem?

A. Multiplicand, multiplier, and product

Now that we understand the process of multiplication, let's move on to division.

(ON SLIDE #27)

d. **Division:** The operation of determining the number of times or the extent to which one number or quantity, the divisor, is contained in another, the dividend, the result being the quotient.

(1) Divisor - the number that is divided into another.

(2). Dividend - The number that is being divided.

(3) Quotient - the result of division.

(ON SLIDE #28)

Examples:

$$\begin{array}{r} 6 \\ \text{Divisor } 6 \overline{) 36} \end{array} \quad \begin{array}{l} \text{Quotient} \\ \text{Dividend} \end{array}$$

$$\begin{array}{r} \text{Dividend} \\ 36 \end{array} \div \begin{array}{r} \text{Divisor} \\ 6 \end{array} = \begin{array}{r} \text{Quotient} \\ 6 \end{array}$$

$$36 / 6 = 6$$

(ON SLIDE #29)

INTERIM TRANSITION: We have just discussed division. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

PRACTICAL APPLICATION (4). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 16 division problems in the student handout for the students to complete.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the division problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over division? In order to progress further, you must have an understanding of this basic math.

(ON SLIDE #30)

INSTRUCTOR NOTE

-Allow the students time to take their breaks during the Practical Application time.

-Display and review the answers to the addition problems in the student handout.

Division Problems - Work out the following division problems, utilizing the adding machine.

$$27 \div 9 = 3 \quad 54 \div 6 = 9 \quad 15 \div 5 = 3 \quad 18 \div 3 = 6$$

$$518 / 74 = 7 \quad 260 / 52 = 5 \quad 456 / 38 = 12 \quad 164 / 41 = 4$$

$$\begin{array}{r} \underline{54} \\ 3)162 \end{array}$$

$$\begin{array}{r} \underline{89} \\ 9)801 \end{array}$$

$$\begin{array}{r} \underline{63} \\ 2)126 \end{array}$$

$$\begin{array}{r} \underline{84} \\ 6)504 \end{array}$$

$$\begin{array}{r} \underline{2,727} \\ 8)21,816 \end{array}$$

$$\begin{array}{r} \underline{19,633} \\ 5)98,165 \end{array}$$

$$\begin{array}{r} \underline{15,547} \\ 4)62,188 \end{array}$$

$$\begin{array}{r} \underline{6,426} \\ 7)44,982 \end{array}$$

(ON SLIDE #31)

TRANSITION: We have just discussed the operation of division. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. **QUESTIONS FROM THE CLASS**

2. **QUESTIONS TO THE CLASS:**

Q. What are the three components of a division problem?

A. Divisor, dividend, and quotient

Now that we understand the process of division, let's move on to fractions.

(ON SLIDE #32)

e. **Fractions:** A part of any object, quantity, or digit.

(1). Numerator - the top number, which indicates a proportion of the whole or group.

(2). Denominator - The bottom number, which indicates how many equal parts there are in the whole or in the group.

(3). Fraction Line - Indicates that the top number is to be divided by the bottom number.

f. **Types of Fractions:** There are 3 types of fractions, examples of which are shown below.

(ON SLIDE #33)

(1). Proper Fraction - A fraction in which the numerator is smaller than the denominator.

7	Numerator
-----	Fraction Line
13	Denominator

(ON SLIDE #34)

(2). Improper Fraction - A fraction in which the numerator is larger or equal to the denominator.

14	3	Numerator
-----	-----	Fraction Line
6	3	Denominator

(ON SLIDE #35)

(3). Mixed Number Fraction - A fraction that contains both a whole number, and a fraction.

1	Numerator
2 ---	Fraction Line
7	Denominator

(ON SLIDE #36)

g. **Converting Fractions:**

(1). Changing Mixed Number Fractions to Improper Fractions - This can be done by using the following steps:

(a) Multiply the whole number by the denominator of the fraction.

(b) Add the product to the numerator.

(c) Place the sum over the denominator of the fraction.

Example:

$$2 \frac{1}{7} = \frac{(2 \times 7) + 1}{7} = \frac{15}{7}$$

(ON SLIDE #37)

(2). Changing Improper Fractions to Mixed Number Fractions - This can be done by using the following steps:

(a) Divide the denominator into the numerator; the quotient is the whole number.

(b) Place the remainder over the denominator.

Example:

$$\frac{17}{3} = 3 \overline{) 17} = 5 \frac{2}{3}$$

(ON SLIDE #38)

(3). Reducing Fractions - This is done by dividing the numerator, and the denominator, by the same number.

Example:

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

(ON SLIDE #39)

h. Mathematical Operations with Fractions:

(1). Adding Fractions -

(a) Fractions with common denominators are added by doing the following:

1. Add the Numerators
2. Keep common Denominator

Example:

$$\frac{1}{2} + \frac{5}{2} + \frac{3}{2} = \frac{9}{2} = 4 \frac{1}{2}$$

(ON SLIDE #40)

(b) Fractions with unlike denominators are added using the following procedures.

1. Change the fractions to fractions with common denominators.
2. Add the numerators.
3. Keep the common Denominator

Example:

$$\frac{1}{2} + \frac{3}{4} + \frac{2}{8} = \frac{4}{8} + \frac{6}{8} + \frac{2}{8} = \frac{12}{8} = 1 \frac{1}{2}$$

(ON SLIDE #41)

(c) Mixed Number Fractions may be added in the following manner.

1. Change fractions to fractions with common denominators.
2. Add fractions.
3. Add whole numbers.
4. If fraction is improper, change it to a mixed number fraction.
5. Combine whole numbers, reduce

Example:

$$\begin{array}{r}
 2 \\
 2 \frac{2}{3} \\
 4 \frac{5}{6} \\
 + \quad 6 \\
 \hline
 \end{array}
 =
 \begin{array}{r}
 4 \\
 2 \frac{4}{6} \\
 4 \frac{5}{6} \\
 \hline
 9 \frac{1}{6}
 \end{array}
 = 7 \frac{1}{2}$$

(ON SLIDE #42)

INTERIM TRANSITION: We have just discussed adding fractions. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

PRACTICAL APPLICATION (5). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 28 addition of fractions problems in the student handout for the students to complete.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the fraction problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over adding fractions? In order to progress further, you must have an understanding of this basic math.

INSTRUCTOR NOTE

-Allow the students time to take their breaks during the Practical Application time.

-Display and review the answers to the addition problems in the student handout.

(ON SLIDE #43)

Add and reduce

	<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>
1)	$\begin{array}{r} \frac{2}{9} \\ + \frac{3}{9} \\ \hline \frac{5}{9} \end{array}$	$\begin{array}{r} \frac{3}{7} \\ + \frac{1}{7} \\ \hline \frac{4}{7} \end{array}$	$\begin{array}{r} \frac{4}{8} \\ + \frac{3}{8} \\ \hline \frac{7}{8} \end{array}$	$\begin{array}{r} \frac{5}{12} \\ + \frac{2}{12} \\ \hline \frac{7}{12} \end{array}$	$\begin{array}{r} \frac{4}{13} \\ + \frac{6}{13} \\ \hline \frac{10}{13} \end{array}$
2)	$\begin{array}{r} \frac{3}{11} \\ + \frac{1}{11} \\ + \frac{2}{11} \\ \hline \frac{6}{11} \end{array}$	$\begin{array}{r} \frac{5}{9} \\ + \frac{2}{9} \\ + \frac{1}{9} \\ \hline \frac{8}{9} \end{array}$	$\begin{array}{r} \frac{2}{15} \\ + \frac{7}{15} \\ + \frac{4}{15} \\ \hline \frac{13}{15} \end{array}$	$\begin{array}{r} \frac{8}{17} \\ + \frac{8}{17} \\ + \frac{5}{17} \\ \hline 1 \frac{4}{17} \end{array}$	$\begin{array}{r} \frac{2}{19} \\ + \frac{9}{19} \\ + \frac{5}{19} \\ \hline \frac{16}{19} \end{array}$
3)	$\begin{array}{r} 2 \\ 4 \text{ ---} \\ 5 \end{array}$	$\begin{array}{r} 3 \\ 6 \text{ ---} \\ 10 \end{array}$	$\begin{array}{r} 4 \\ 5 \text{ ---} \\ 11 \end{array}$	$\begin{array}{r} 7 \\ 8 \text{ ---} \\ 13 \end{array}$	
	$\begin{array}{r} 1 \\ 3 \text{ ---} \\ + 5 \\ \hline 7 \frac{3}{5} \end{array}$	$\begin{array}{r} 6 \\ 8 \text{ ---} \\ + 10 \\ \hline 14 \frac{9}{10} \end{array}$	$\begin{array}{r} 5 \\ 4 \text{ ---} \\ + 11 \\ \hline 9 \frac{9}{11} \end{array}$	$\begin{array}{r} 4 \\ 6 \text{ ---} \\ + 13 \\ \hline 14 \frac{11}{13} \end{array}$	

(ON SLIDE #44)

	<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>
4)	$\begin{array}{r} \frac{3}{4} \\ + \frac{1}{4} \\ \hline 1 \frac{1}{4} \end{array}$	$\begin{array}{r} \frac{2}{3} \\ + \frac{5}{6} \\ \hline 1 \frac{1}{2} \end{array}$	$\begin{array}{r} \frac{7}{8} \\ + \frac{3}{4} \\ \hline 1 \frac{5}{8} \end{array}$	$\begin{array}{r} \frac{5}{6} \\ + \frac{1}{3} \\ \hline 1 \frac{1}{6} \end{array}$	$\begin{array}{r} \frac{5}{9} \\ + \frac{2}{3} \\ \hline 1 \frac{2}{9} \end{array}$
5)	$\begin{array}{r} \frac{3}{8} \\ + \frac{3}{4} \\ \hline \end{array}$	$\begin{array}{r} \frac{1}{6} \\ + \frac{5}{12} \\ \hline \end{array}$	$\begin{array}{r} \frac{2}{5} \\ + \frac{2}{2} \\ \hline \end{array}$	$\begin{array}{r} \frac{2}{3} \\ + \frac{5}{12} \\ \hline \end{array}$	$\begin{array}{r} \frac{3}{5} \\ + \frac{1}{3} \\ \hline \end{array}$

$$\begin{array}{r} \frac{1}{2} \\ + \\ \hline 1 \frac{5}{8} \end{array}$$

$$\begin{array}{r} \frac{3}{4} \\ + \\ \hline 1 \frac{1}{3} \end{array}$$

$$\begin{array}{r} \frac{9}{10} \\ + \\ \hline 2 \frac{3}{10} \end{array}$$

$$\begin{array}{r} \frac{1}{4} \\ + \\ \hline 1 \frac{1}{3} \end{array}$$

$$\begin{array}{r} \frac{4}{15} \\ + \\ \hline 1 \frac{1}{5} \end{array}$$

6)

$$\begin{array}{r} 4 \\ 14 \text{ ---} \\ 5 \end{array} \quad \begin{array}{r} 5 \\ 7 \text{ ---} \\ 9 \end{array} \quad \begin{array}{r} 1 \\ 9 \text{ ---} \\ 2 \end{array} \quad \begin{array}{r} 3 \\ 3 \text{ ---} \\ 7 \end{array}$$

$$\begin{array}{r} 8 \\ 7 \text{ ---} \\ + \frac{11}{55} \\ \hline 22 \frac{29}{55} \end{array} \quad \begin{array}{r} 11 \\ 6 \text{ ---} \\ + \frac{18}{6} \\ \hline 14 \frac{1}{6} \end{array} \quad \begin{array}{r} 15 \\ 5 \text{ ---} \\ + \frac{24}{8} \\ \hline 15 \frac{1}{8} \end{array} \quad \begin{array}{r} 31 \\ 18 \text{ ---} \\ + \frac{42}{6} \\ \hline 22 \frac{1}{6} \end{array}$$

(ON SLIDE #45)

TRANSITION: We have just discussed the operation of adding fractions. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

2. QUESTIONS TO THE CLASS:

Q. What must be done to add fractions with different denominators?

A. Find common denominators for both fractions, add the numerators, and keep the denominators.

Now that we understand the process of adding fractions, let's move on to subtracting fractions.

(ON SLIDE #46)

(2) Subtracting Fractions:

(a) To subtract fractions with common denominators, use the following steps.

1. Subtract the numerators.

2. Keep the common denominators.

Example:

$$\begin{array}{r} 5 \\ \hline 8 \\ 3 \\ \hline - 8 \\ \hline 2 \end{array} \quad \begin{array}{r} 1 \\ \hline 4 \end{array}$$
$$\frac{\quad}{8} = \frac{\quad}{4}$$

(ON SLIDE #47)

(b) To subtract fractions, having unlike denominators, use the following steps.

1. Change fractions to common denominator.

2. Subtract the numerators.

3. Keep the common denominator.

Example:

$$\begin{array}{r} 3 \quad 6 \\ \hline 4 \quad 8 \\ 3 \quad 3 \\ \hline - 8 \quad 8 \\ \hline 3 \end{array}$$
$$\frac{\quad}{8}$$

(ON SLIDE #48)

(c) To subtract mixed number fractions, use the following steps.

1. Change fractions to lowest common denominators.

2. Subtract fractions.

3. If subtrahend fraction is larger than minuend fraction, borrow one from the whole number.

4. Subtract whole numbers.

Example:

$$\begin{array}{r} 1 \\ 7 \text{ ---} = 7 \text{ ---} = 6 \text{ ---} \\ 5 \\ 1 \\ - 4 \text{ ---} = 4 \text{ ---} = 4 \text{ ---} \\ 2 \\ \hline 2 \\ 10 \end{array}$$

(ON SLIDE #49)

INTERIM TRANSITION: We have just discussed subtracting fractions. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

PRACTICAL APPLICATION (6). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 27 subtraction of fractions problems in the student handout for the students to complete.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the fraction problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over subtracting fractions? In order to progress further, you must have an understanding of this basic math.

INSTRUCTOR NOTE

-Allow the students time to take their breaks during the Practical Application time.

-Display and review the answers to the addition problems in the student handout.

(ON SLIDE #50)

Subtract and reduce

	<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>
1)	$\begin{array}{r} \frac{5}{9} \\ - \frac{2}{9} \\ \hline \frac{1}{3} \end{array}$	$\begin{array}{r} \frac{7}{10} \\ - \frac{6}{10} \\ \hline \frac{1}{10} \end{array}$	$\begin{array}{r} \frac{5}{8} \\ - \frac{1}{8} \\ \hline \frac{1}{2} \end{array}$	$\begin{array}{r} \frac{4}{13} \\ - \frac{1}{13} \\ \hline \frac{3}{13} \end{array}$	$\begin{array}{r} \frac{9}{11} \\ - \frac{3}{11} \\ \hline \frac{6}{11} \end{array}$

2)	$\begin{array}{r} \frac{13}{15} \\ - \frac{8}{15} \\ \hline \frac{1}{3} \end{array}$	$\begin{array}{r} \frac{15}{16} \\ - \frac{6}{16} \\ \hline \frac{9}{16} \end{array}$	$\begin{array}{r} \frac{23}{24} \\ - \frac{11}{24} \\ \hline \frac{1}{2} \end{array}$	$\begin{array}{r} \frac{11}{19} \\ - \frac{8}{19} \\ \hline \frac{3}{19} \end{array}$	$\begin{array}{r} \frac{17}{20} \\ - \frac{13}{20} \\ \hline \frac{1}{5} \end{array}$
----	--	---	---	---	---

	a	b	c	d
3)	$\begin{array}{r} 6 \\ 8 \text{ ---} \\ 7 \end{array}$	$\begin{array}{r} 5 \\ 10 \text{ ---} \\ 8 \end{array}$	$\begin{array}{r} 8 \\ 7 \text{ ---} \\ 9 \end{array}$	$\begin{array}{r} 9 \\ 13 \text{ ---} \\ 10 \end{array}$
	$\begin{array}{r} 2 \\ 5 \text{ ---} \\ - 7 \\ \hline 3 \frac{4}{7} \end{array}$	$\begin{array}{r} 5 \\ 4 \text{ ---} \\ - 8 \\ \hline 6 \end{array}$	$\begin{array}{r} 5 \\ 6 \text{ ---} \\ - 9 \\ \hline 1 \frac{1}{3} \end{array}$	$\begin{array}{r} 5 \\ 9 \text{ ---} \\ - 10 \\ \hline 4 \frac{2}{5} \end{array}$

(ON SLIDE #51)

4)	$\begin{array}{r} \frac{3}{4} \\ - \frac{1}{4} \\ \hline \frac{1}{4} \end{array}$	$\begin{array}{r} \frac{5}{8} \\ - \frac{1}{4} \\ \hline \frac{3}{8} \end{array}$	$\begin{array}{r} \frac{5}{6} \\ - \frac{1}{3} \\ \hline \frac{1}{2} \end{array}$	$\begin{array}{r} \frac{3}{4} \\ - \frac{3}{16} \\ \hline \frac{9}{16} \end{array}$
5)	11	5	4	3

$$\begin{array}{r} 8 \text{ ---} \\ 12 \end{array} \quad \begin{array}{r} 9 \text{ ---} \\ 7 \end{array} \quad \begin{array}{r} 12 \text{ ---} \\ 5 \end{array} \quad \begin{array}{r} 11 \text{ ---} \\ 4 \end{array}$$

$$\begin{array}{r} 3 \\ 2 \text{ ---} \\ - \quad 8 \\ \hline 6 \text{ } 13/24 \end{array} \quad \begin{array}{r} 1 \\ 3 \text{ ---} \\ - \quad 2 \\ \hline 6 \text{ } 3/14 \end{array} \quad \begin{array}{r} 2 \\ 5 \text{ ---} \\ - \quad 9 \\ \hline 7 \text{ } 26/45 \end{array} \quad \begin{array}{r} 7 \\ 8 \text{ ---} \\ - \quad 10 \\ \hline 3 \text{ } 1/20 \end{array}$$

6)

$$\begin{array}{r} 1 \\ 28 \text{ ---} \\ 6 \end{array} \quad \begin{array}{r} 3 \\ 15 \text{ ---} \\ 4 \end{array} \quad \begin{array}{r} 1 \\ 30 \text{ ---} \\ 4 \end{array} \quad \begin{array}{r} 3 \\ 19 \text{ ---} \\ 11 \end{array}$$

$$\begin{array}{r} 3 \\ 17 \text{ ---} \\ - \quad 5 \\ \hline 10 \text{ } 17/30 \end{array} \quad \begin{array}{r} 7 \\ 8 \text{ ---} \\ - \quad 8 \\ \hline 6 \text{ } 7/8 \end{array} \quad \begin{array}{r} 5 \\ 16 \text{ ---} \\ - \quad 12 \\ \hline 13 \text{ } 5/6 \end{array} \quad \begin{array}{r} 1 \\ 18 \text{ ---} \\ - \quad 2 \\ \hline 17/22 \end{array}$$

TRANSITION: We have just discussed the operation of subtracting fractions. Are there any questions?

(ON SLIDE #52)

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

2. QUESTIONS TO THE CLASS:

Q. In a mixed number fraction, what must be done if the subtrahend fraction is larger than minuend fraction?

A. Borrow one from the whole number.

Now that we understand the process of subtracting fractions, let's move on to multiplying fractions.

(ON SLIDE #53)

i. Multiplication of Fractions:

1. Common fractions may be multiplied by using the 2 methods shown below.

a. Multiplication Method - Multiply the numerators, then multiply the denominators.

Example:

$$\frac{2}{3} \times \frac{1}{3} = \frac{2}{9} \qquad \frac{1}{2} \times \frac{4}{1} = \frac{4}{2} = 2$$

(ON SLIDE #54)

2. Cancellation Method - Numbers in the numerator may be canceled by numbers in the denominator. Cross divide the numerator or denominator by numbers that will equally go into each. This method will reduce the fraction to its lowest terms during the mathematical operation.

Example:

$$\frac{2}{3} \times \frac{3}{4} \times \frac{8}{9} = \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{1}{\cancel{3}}}{\underset{2}{\cancel{4}}} \times \frac{\overset{4}{\cancel{8}}}{\underset{9}{\cancel{9}}} = \frac{4}{9}$$

(ON SLIDE #55)

3. Mixed fractions are multiplied by first changing the fraction to an improper fraction, and then multiplying as above.

Example:

add

$$3\frac{1}{3} \times 4\frac{1}{5} = \frac{10}{3} \times \frac{21}{5} = 14$$

multiply

INTERIM TRANSITION: We have just discussed multiplying fractions. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

(ON SLIDE #56)

PRACTICAL APPLICATION (7). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 25 multiplication of fractions problems in the student handout for the students to complete.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the fraction problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over multiplying fractions? In order to progress further, you must have an understanding of this basic math.

INSTRUCTOR NOTE

Display and review the answers to the problems in the student handout.

(ON SLIDE #57)

Multiply and reduce

$$\begin{array}{l} 1) \quad \frac{2}{3} \times \frac{a}{5} = \frac{2a}{15} = \mathbf{8/15} \quad \frac{5}{7} \times \frac{b}{9} = \frac{5b}{63} = \mathbf{10/63} \quad \frac{1}{8} \times \frac{c}{10} = \frac{c}{80} = \mathbf{7/80} \quad \frac{3}{11} \times \frac{d}{8} = \frac{3d}{88} = \mathbf{15/88} \\ \\ 2) \quad \frac{7}{9} \times \frac{2}{5} = \frac{14}{45} = \mathbf{14/45} \quad \frac{3}{8} \times \frac{7}{8} = \frac{21}{64} = \mathbf{21/64} \quad \frac{1}{6} \times \frac{5}{6} = \frac{5}{36} = \mathbf{5/36} \quad \frac{8}{9} \times \frac{2}{9} = \frac{16}{81} = \mathbf{16/81} \end{array}$$

$$3) \quad \frac{3}{5} \times \frac{1}{2} \times \frac{3}{4} = \frac{9}{40} \quad \frac{5}{7} \times \frac{7}{3} \times \frac{1}{2} = \frac{5}{6} \quad \frac{2}{3} \times \frac{1}{3} \times \frac{5}{9} = \frac{10}{81}$$

$$4) \quad \frac{4}{5} \times \frac{4}{5} \times \frac{1}{3} = \frac{16}{75} \quad \frac{2}{5} \times \frac{7}{9} \times \frac{1}{3} = \frac{14}{135} \quad \frac{1}{3} \times \frac{4}{7} \times \frac{2}{3} = \frac{8}{63}$$

(ON SLIDE #58)

$$5) \quad a \quad \frac{2}{5} \times \frac{3}{4} = \frac{3}{10}$$

$$b \quad \frac{4}{9} \times \frac{3}{7} = \frac{4}{21}$$

$$c \quad \frac{5}{8} \times \frac{7}{10} = \frac{7}{16}$$

$$d \quad \frac{6}{7} \times \frac{5}{12} = \frac{5}{14}$$

$$6) \quad a \quad \frac{4}{9} \times \frac{3}{8} = \frac{1}{6}$$

$$b \quad \frac{5}{12} \times \frac{9}{10} = \frac{3}{8}$$

$$c \quad \frac{7}{22} \times \frac{11}{14} = \frac{1}{4}$$

$$d \quad \frac{5}{6} \times \frac{9}{10} = \frac{3}{4}$$

$$7) \quad a \quad \frac{7}{24} \times \frac{2}{3} \times \frac{16}{35} = \frac{4}{45}$$

$$b \quad \frac{11}{12} \times \frac{5}{11} \times \frac{8}{15} = \frac{2}{9}$$

$$c \quad \frac{3}{20} \times \frac{18}{25} \times \frac{8}{15} = \frac{36}{625}$$

(ON SLIDE #59)

TRANSITION: We have just discussed the operation of multiplying fractions. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

2. QUESTIONS TO THE CLASS:

Q. What method of multiplying fractions will reduce it to its' lowest form during the mathematical operation?

A. The cancellation method.

Now that we understand the process of multiplying fractions, let's move on to division of fractions.

(ON SLIDE #60)

j. Division of Fractions:

1. Common Fractions - May be divided by first inverting the divisor and proceed as in the multiplication of fractions.

Example:

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

(ON SLIDE #61)

2. Mixed Number Fractions - May be divided by first changing the fraction to an improper fraction, then proceed as in the multiplication of fractions.

Example:

$$3 \frac{1}{3} \div 2 \frac{1}{4} = \frac{10}{3} \div \frac{9}{4} = \frac{10}{3} \times \frac{4}{9} = \frac{40}{27} = 1 \frac{13}{27}$$

INTERIM TRANSITION: We have just discussed division of fractions. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

(ON SLIDE #62)

PRACTICAL APPLICATION (8). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 19 division of fractions problems in the student handout for the students to complete.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the fraction problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over dividing fractions? In order to progress further, you must have an understanding of this basic math.

INSTRUCTOR NOTE

-Allow the students time to take their breaks during the Practical Application time.

-Display and review the answers to the addition problems in the student handout.

(ON SLIDE #63)

Divide and reduce

$$1 \quad a \quad \frac{3}{7} \div \frac{2}{5} = 1 \frac{1}{14}$$

$$c \quad \frac{4}{9} \div \frac{2}{3} = \frac{2}{3}$$

$$b \quad \frac{5}{12} \div \frac{10}{11} = \frac{11}{24}$$

$$d \quad \frac{7}{15} \div \frac{4}{5} = \frac{7}{12}$$

$$2 \quad a \quad 12 \div \frac{2}{5} = 30$$

$$b \quad 45 \div \frac{18}{19} = 47 \frac{1}{2}$$

$$c \quad 15 \div \frac{10}{11} = 16 \frac{1}{2}$$

$$d \quad 12 \div \frac{9}{10} = 13 \frac{1}{3}$$

$$3 \quad a \quad \frac{3}{5} \div 9 = \frac{1}{15}$$

$$b \quad \frac{10}{13} \div 30 = \frac{1}{39}$$

$$c \quad 21$$

$$\frac{3}{22} \div 28 = \frac{3}{88}$$

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

b $1 \frac{2}{3} \div \frac{2}{3} = 2 \frac{1}{2}$

c $2 \frac{3}{4} \div \frac{5}{3} = 1 \frac{13}{20}$

d $4 \frac{1}{3} \div \frac{2}{9} = 19 \frac{1}{2}$

5 a $7 \frac{1}{2} \div 3 \frac{1}{5} = 2 \frac{11}{32}$

b $3 \frac{5}{9} \div 2 \frac{5}{19} = 1 \frac{221}{387}$

c $5 \frac{5}{6} \div 3 \frac{5}{12} = 1 \frac{29}{41}$

d $10 \frac{5}{8} \div 2 \frac{1}{4} = 4 \frac{13}{18}$

(ON SLIDE #64)

TRANSITION: We have just discussed the operation of dividing fractions. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

2. QUESTIONS TO THE CLASS:

Q. What must be done to the divisor when dividing fractions?

A. The divisor must be inverted and change the division operation to a multiplication operation.

Now that we understand the process of dividing fractions, let's move on to decimals.

(ON SLIDE #65)

k. **Decimals:** The representation of the fraction whose denominator is some power of ten.

(ON SLIDE #66)

(1) Converting decimals to fractions can be accomplished by using the following steps.

(a) Count the number of digits to the right of the decimal point, then insert the number, less the decimal point, as the numerator.

(b) Put the number (1) plus a zero for each digit to the right of the decimal for the denominator.

Examples:

$$.7 = \frac{7}{10}$$

$$.241 = \frac{241}{1000}$$

(ON SLIDE #67)

(2) Converting fractions to decimals can be done by dividing the denominator into the numerator.

Examples:

$$\begin{array}{r} 1 \\ \text{---} = 4 \overline{) 1.00} \\ 4 \\ \hline 8 \\ 20 \\ \hline 20 \\ 0 \end{array}$$

$$\begin{array}{r} 7 \\ \text{---} = 8 \overline{) 7.0000} \\ 8 \\ \hline 64 \\ 60 \\ \hline 56 \\ 40 \\ \hline 40 \end{array}$$

(ON SLIDE #68)

(3) To add or subtract decimals, line up the decimal point and add or subtract as with whole numbers.

Examples:

$$\begin{array}{r} 1.234 \\ + 3.630 \\ \hline 4.864 \end{array}$$

$$\begin{array}{r} 2.86 \\ - 1.70 \\ \hline 1.16 \end{array}$$

(ON SLIDE #69)

(4) To multiply decimal numbers:

(a) Multiply the numbers just as if they were whole numbers.

(b) Line up the numbers on the right - do not align the decimal points.

(c) Starting on the right, multiply each digit in the top number by each digit in the bottom number, just as with whole numbers.

(d) Add the products.

(e) Place the decimal point in the answer by starting at the right and moving a number of places equal to the sum of the decimal places in both numbers multiplied.

Example:

$$\begin{array}{r} 1.234 \\ \times 3.6 \\ \hline 7404 \\ 37020 \\ \hline 4.4424 \end{array}$$

↓ ↓ ↓ 123 places
↓ ↓ ↓ 4 places

↑ ↑ ↑ ↑ 4 places

(ON SLIDE #70)

(5) To divide decimals:

(a) Show the problem in long division form.

(b) Move the decimal point in the divisor all the way to the right (to make it a whole number).

(c) Move the decimal point in the dividend the same number of places. Add zeros for every sequential number until the remainder results in zero or repeats.

Example:

2.6

$$16.9 \div 6.5 = 6.5 \overline{)16.9} = 65 \overline{)169.0}$$

$$\begin{array}{r} - 130 \\ \hline 390 \\ - 390 \\ \hline 0 \end{array}$$

Therefore $16.9 \div 6.5 = 2.6$

(ON SLIDE #71)

(6) To change percent to decimal:

(a) Move the decimal 2 places to the left.

(b) Divide percentage by 100 and remove the percentage sign.

INTERIM TRANSITION: We have just discussed decimals. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

(ON SLIDE #72)

PRACTICAL APPLICATION (9). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 30 problems involving decimals in the student handout for the students to complete.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the decimal problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over mathematical operations using decimals? In order to progress further, you must have an understanding of this basic math.

INSTRUCTOR NOTE

-Allow the students time to take their breaks during the Practical Application time.

-Display and review the answers to the addition problems in the student handout.

(ON SLIDE #73)

Change to Fractions:

- 1) a $.85 = \mathbf{17/20}$ b $.324 = \mathbf{81/250}$
c $.375 = \mathbf{3/8}$ d $9.86 = \mathbf{9 \ 43/50}$
e $.0048 = \mathbf{3/625}$ f $5.08 = \mathbf{5 \ 2/25}$

Change each of the following to decimals.

- 2) $\frac{1}{4} = \mathbf{.25}$ $\frac{2}{5} = \mathbf{.4}$
 $\frac{5}{8} = \mathbf{.63}$ $\frac{1}{3} = \mathbf{.33}$
- 3) $\frac{2}{9} = \mathbf{.22}$ $\frac{6}{25} = \mathbf{.24}$
 $\frac{1}{6} = \mathbf{.17}$ $\frac{3}{8} = \mathbf{.38}$

(ON SLIDE #74)

Multiply the following.

- 4) $\begin{array}{r} 3.8 \\ \times 4 \\ \hline 15.20 \end{array}$ $\begin{array}{r} .92 \\ \times 9 \\ \hline 8.28 \end{array}$ $\begin{array}{r} 59 \\ \times .09 \\ \hline 5.31 \end{array}$ $\begin{array}{r} 86 \\ \times .4 \\ \hline 34.40 \end{array}$ $\begin{array}{r} 19 \\ \times .06 \\ \hline 1.14 \end{array}$
- 5) $\begin{array}{r} 906 \\ \times .07 \\ \hline 63.42 \end{array}$ $\begin{array}{r} 44.7 \\ \times 30 \\ \hline 1,341 \end{array}$ $\begin{array}{r} 8.01 \\ \times 70 \\ \hline 560.7 \end{array}$ $\begin{array}{r} 917 \\ \times 60 \\ \hline 55,020 \end{array}$

Subtract the following.

- 6) $4.2 - 3.76 = \mathbf{.44}$ $.804 - .1673 = \mathbf{.64}$ $5 - 2.493 = \mathbf{2.51}$

Divide the following.

$$\begin{array}{r} 7) \quad \underline{9.6} \\ 76.8 \end{array} \quad \begin{array}{r} \underline{38} \\ .7) 26.6 \end{array} \quad \begin{array}{r} \underline{.7} \\ .6) 0.42 \end{array} \quad \begin{array}{r} \underline{6.9} \\ .4) 2.76 \end{array}$$

(ON SLIDE #75)

TRANSITION: We have just discussed working math problems with decimals. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

Now that we understand math with decimals, let's move on to order of operations.

(ON SLIDE #76)

2. ORDER OF OPERATIONS (1 Hr)

a. To evaluate an expression means to find a single value for it. If you are asked to evaluate $8+2 \times 3$, would your answer be 30 or 14? Since an expression has a unique value, a specific order of operations must be followed. The current value of $8+2 \times 3$ is 14 because multiplication should be done before addition.

b. To change the expression so that the value is thirty, write $(8+2) \times 3$. Now the operation within the parenthesis must be done first.

c. Sometimes you are given the value of a variable. You can evaluate the expression by substituting

(ON SLIDE #77)

Examples:

1. $12 - 2 \times 5 = 2$

2. $9(12 + 8) = 180$

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

4. $r(r - 2) = 24$ if $r = 6$

5. $7p - 1/2q = 27$

if $p = 4$ and $q = 2$

INTERIM TRANSITION: We have just discussed the order of operations. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

PRACTICAL APPLICATION (10). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: There are 23 problems using the order of operations in the student handout for the students to complete.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for the equations in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments over the order of operations? In order to progress further, you must have an understanding of this basic math.

INSTRUCTOR NOTE

- Allow the students time to take their breaks during the Practical Application time.
- Display and review the answers to the problems in the student handout.

1c. $(4 + 6) = 10$

1c. $4 + 6 \times 8 = 52$

2a. $\frac{4 + 8}{3} = 4$

b. $\frac{7 + 9}{4} = 4$

c. $\frac{11(2) + 18}{8} = 5$

d. $\frac{10 - 2(3)}{2} = 2$

3. a. $1/2(6 + 26) = 16$

b. $1/2(6) + 1/2(26) = 16$

c. $2/3(18) + 9 = 21$

d. $2/3(18 + 9) = 18$

Evaluate each expression if $a = 9$, $b = 3$, $c = 7$

4. $4a + 7 = 43$ $c (c + 3) = 70$

$7b + 2b = 27$ $(7 + 2) b = 27$

5. $2bc = 42$ $ab + ac = 90$

$a(b + c) = 90$ $ab + c = 34$

6. $\frac{a + b}{2} = 6$ $\frac{2a + 2b}{4} = 6$ $\frac{a + 9}{b} = 6$

(ON SLIDE #79)

TRANSITION: We have just discussed the order of operations. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

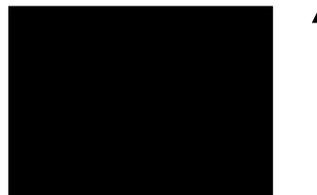
Now that we understand the order of operations, let's move on to areas and volumes.

(ON SLIDE #80, 81)

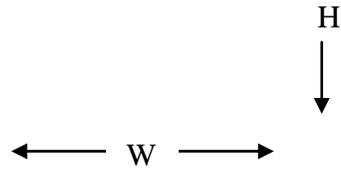
3. AREAS AND VOLUME (4 Hrs)

a. **Area:** To measure an area, find how much surface is taken up by a plane figure. Knowing just how much surface there is in a plane becomes important when you wish to cover a surface such as a road. Areas are measured in square units, i.e. square yards, square feet. To compute the area of planes most closely associated with production estimation, use the formulas below. When working with feet, divide your answer by 9 to convert the answer to square yards. Nine is a constant. We use 9 because there are three feet to one yard and nine feet to one square yard. (i.e.) 3 feet X 3 feet = 9 feet/1 square yard.

(1) Squares and Rectangles

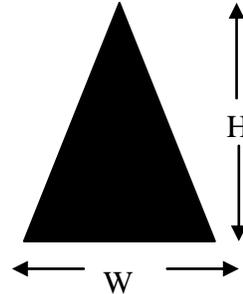


$$W \times H = \text{AREA}$$



(2) Triangles

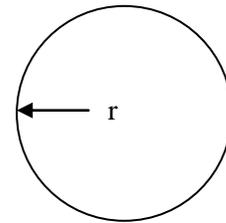
$$\frac{W \times H}{2} = \text{AREA}$$



NOTE: WE USE 2 BECAUSE A TRIANGLE IS ONE HALF OF A SQUARE. ANY TIME WE DIVIDE BY 2, WE GET ONE HALF OF THE SUM.

(3) Circles

$$3.14 (r^2) = \text{AREA}$$



NOTE: RADIUS = 1/2 THE DIAMETER OF THE CIRCLE

(ON SLIDE #82)

b. **Volume:** is the space occupied by a three-dimensional figure as measured in units.

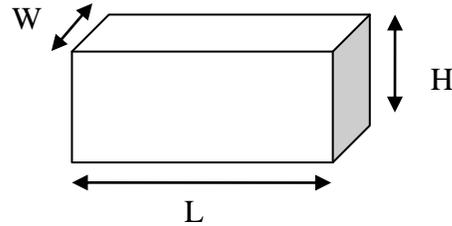
(1) When figuring production, the unit of measure used is **cubic yards (CY)**. The volume must be changed into cubic yards. To do this, use the following formulas. Your dimension of Length, Width, and Height must be measured in feet for the formula to work. There are three feet in a yard and three dimensions in volume.

THERE IS 27 SQUARE FEET IN ONE SQUARE YARD.

Note: (3 feet X 3 sides X 3 dimensions = 27). *The number 27 is a constant and will convert your figure into cubic yards.*

(2) The formula to calculate the cubic yards of squares and rectangles.

$$\frac{L \times W \times H}{27} = (\text{CY})$$



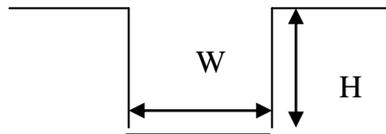
(ON SLIDE #83)

Example: Determine the cubic yards of a trench with the following dimensions.

SQUARE OR RECTANGLE:

$$\frac{700' \times 20' \times 10'}{27} = 5185.19 \text{ OR } 5186 (\text{CY})$$

NOTE: ROUND UP CY WHEN DETERMINING AMOUNT TO BE REMOVED



$$\begin{aligned} L &= 700' \\ W &= 20' \\ H &= 10' \end{aligned}$$

NOTE * IF YOUR MEASUREMENTS ARE IN INCHES YOU MUST CHANGE THEM INTO FEET. THIS CAN BE DONE BY DIVIDING INCHES BY TWELVE.

$$6" \div 12" = .5 \text{ FEET}$$

INTERIM TRANSITION: We have just discussed areas and volumes. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

PRACTICAL APPLICATION (11). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: Determine the areas and volumes for the following problems.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems.

Upon completion instructor will progress to the next power point slide which contains the answers for the area and volume problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments covering areas and volumes? In order to conduct accurate production estimations, you must be able to determine the areas and volumes for spaces.

INSTRUCTOR NOTE

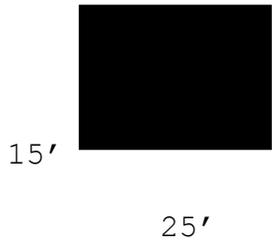
-Allow the students time to take their breaks during the Practical Application time.
-Display and review the answers to the addition problems in the student handout.

(ON SLIDE #84)

WHAT HAVE YOU LEARNED (AREA) :

FIND THE AREA OF THE FOLLOWING:

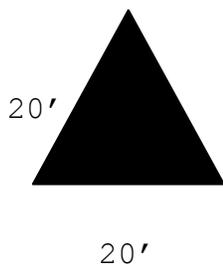
A)



YOUR SOLUTION:

$$15' \times 25' = 375 \text{ sqft.}$$

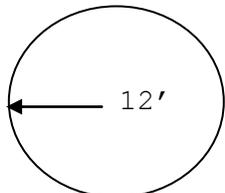
B)



YOUR SOLUTION:

$$\frac{20' \times 20'}{2} = 200 \text{ sqft.}$$

C)



YOUR SOLUTION:

$$3.14(12^2) = 452.16 \text{ sqft.}$$

(ON SLIDE #85)

WHAT HAVE YOU LEARNED (VOLUME) :

PROBLEM #1: You have been assigned to dig two (2) trenches. Figure the total cubic yards of material to be removed from each trench.

TRENCH # 1:

600' Long, 70' Wide, 25' Deep

YOUR SOLUTION ?

$$\frac{600' \times 70' \times 25'}{27} = 38,888.89 \text{ OR } 38,889 \text{ CY}$$

TRENCH # 2:

350' Long, 22' Wide, 12' 8" Deep

YOUR SOLUTION ?

$$8 \div 12 = .67'$$

$$\frac{350' \times 22' \times 12.67'}{27} = 3,613.3 \text{ OR } 3,614 \text{ CY}$$

(ON SLIDE #86)

TRANSITION: We have just discussed determining areas and volumes for basic shapes. Are there any questions?

OPPORTUNITY FOR QUESTIONS:

1. **QUESTIONS FROM THE CLASS**

2. **QUESTION TO THE CLASS**

Q. What is the formula for determining the area of a triangle?

A. $W \times H / 2$

Q. What is the formula for determining the volume of a circle?

A. $3.14 \times r^2$

Now that we understand how to determine areas and volumes for basic shapes, let's look at determining the volume for more complex shapes such as a berm.

(ON SLIDE #87)

c. Volume of a Berm

(1) The volume of a berm can be calculated with the use of two formulas.

- The formula to calculate the cubic yards of a **CONE**

$$\frac{3.14 (r^2) H}{3} = \frac{\text{CUBIC FEET (CF)}}{27} = (\text{CY})$$

* NOTE: RADIUS = 1/2 THE WIDTH OF THE BERM *

- The formula to calculate the cubic yards of a **PRISM**

$$\frac{W \times H}{2} = \text{AREA} \quad \frac{(A) \times L}{27} = (\text{CY})$$

(ON SLIDE #88)

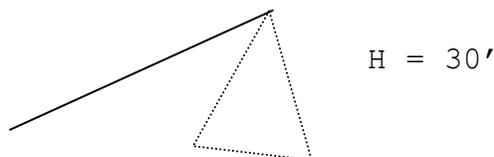
Example: Determine the cubic yards of a berm with the following dimensions.

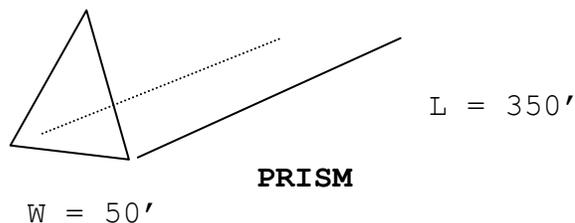
(Step 1) MEASURE: The Length, Width, and Height in feet

$$\begin{aligned} L &= 400' \\ W &= 50' \\ H &= 30' \end{aligned}$$

(ON SLIDE #89)

(Step 2) LENGTH OF PRISM: Mathematically dissect the berm into three portions. This is done by cutting half the width of the berm off of each end, thus creating a prism and two half cones. After cutting off the ends, **the remaining length**, is the length of the prism.

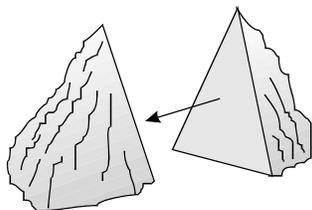




(ON SLIDE #90)

(Step 3) RADIUS OF CONE: Take the two half cones and put them together to make a mathematical cone. Remember that half the width of the berm will always be the radius of the cone, FOR EXAMPLE, THE WIDTH OF THIS BERM IS 50' THIS MEANS THAT THE RADIUS OF THIS CONE IS 25'.

HALF CONE + HALF CONE



(ON SLIDE #91)

(Step 4) FORMULATE THE CONE:

NOTE: RADIUS = 1/2 WIDTH OF BERM, AND IN THIS FORMULA THE RADIUS IS SQUARED, THIS MEANS THAT YOU WILL MULTIPLY IT BY ITSELF.

EXAMPLE: 25 X 25 = 625

$$\frac{3.14 (25r^2) 30' H}{3} = \frac{19,625 \text{ CF}}{27} = \underline{726.85 \text{ CONE CY}}$$

NOTE: DO NOT ROUND OFF AMOUNT OF MATERIAL UNTIL THE CONE AND PRISM ARE ADDED TOGETHER

(ON SLIDE #92)

(Step 5) FORMULATE THE PRISM:

$$\frac{W \ 50' \ X \ 30'H}{2} = \frac{A \ 750 \ X \ 350 \ L}{27} = \underline{9,722.22}$$

PRISM CY

NOTE: DO NOT ROUND OFF AMOUNT OF MATERIAL UNTIL THE CONE AND PRISM ARE ADDED TOGETHER

(ON SLIDE #93)

(Step 6) **ADD CONE TO PRISM:**

$$726.85 + 9,722.22 = 10,449.07 \quad \text{OR} \quad \mathbf{10,450}$$

$$\text{CONE CY} + \text{PRISM CY} = \text{BERM CY}$$

NOTE: ROUND UP TO THE NEXT FULL CUBIC YARD WHEN REMOVING SOIL.

(ON SLIDE #94)

INTERIM TRANSITION: We have just discussed determining the volume of berm by breaking it down into prisms and cones. Are there any questions? Let's move on to the practical application by doing the problems in the student handout.

PRACTICAL APPLICATION (12). (25 MIN) Have the students complete the problems in the student handout.

PRACTICE: Determine the areas and volumes for the following problems.

PROVIDE-HELP: Instructor will answer questions as they arise and assist students having difficulty.

1. Safety Brief: There are no safety concerns.

2. Supervision & Guidance: Instructor will walk around the classroom and answer questions as they may arise. Instructor may use the dry-erase board to walk through the math problems. Upon completion instructor will progress to the next power point slide which contains the answers for volumes of a prism and cone problems in the student handout. Clarify understanding of the material and answer any questions.

3. Debrief: Are there any comments covering areas and volumes? In order to conduct accurate production estimations, you must be able to determine the areas and volumes for spaces.

INSTRUCTOR NOTE

-Allow the students time to take their breaks during the Practical Application time.
-Display and review the answers to the addition problems in the student handout.

(ON SLIDE #95)

WHAT HAVE YOU LEARNED:

PROBLEM #2: You have been assigned to remove a berm. What is the total cubic yards of soil to be removed?

BERM DIMENSIONS: 650' Long, 61' Wide, 40' High

CONE FIRST

$$\frac{3.14 (30.5^2) 40H}{3} = \frac{38,946.47CF}{27} = \frac{1442.46}{\text{CONE CY}}$$

NOTE: DO NOT ROUND OFF

PRISM

$$650' - 61' = 589'$$

$$\frac{61W \times 40H}{2} = \frac{(1,220A) \times 589L}{27} = \frac{26,614.07}{\text{PRISM CY}}$$

NOTE: DO NOT ROUND OFF

TOTAL BERM

$$\frac{1442.46}{\text{CONE CY}} + \frac{26,614.07}{\text{PRISM CY}} = \frac{28,056.53 \text{ OR } 28,057}{\text{TOTAL CY OF BERM}}$$

NOTE: ROUND UP TO THE NEXT FULL CUBIC YARD, WHEN DETERMINING THE AMOUNT OF SOIL TO BE REMOVED

TRANSITION: We have just discussed determining the volume for a berm. Are there any questions?

(ON SLIDE #96)

OPPORTUNITY FOR QUESTIONS:

1. QUESTIONS FROM THE CLASS

We now understand how to determine the volume for a berm. If there are no questions we can summarize this period of instruction.

(ON SLIDE #97)

Summary

(10 MIN)

During this period of instruction we have covered basic mathematical operations with whole numbers, fractions, and decimals. We have also covered calculating areas for basic shapes such as rectangles, triangles, and circles and volumes for those basic shapes as well as more complex shapes such as cones and prisms. What you have learned in this period of instruction will allow you to be able to conduct accurate production estimations for earthmoving equipment and material requirements for horizontal construction projects.

INSTRUCTOR NOTE

Ensure to collect all IRF's and safety questionnaires handed out.

(BREAK - 10 Min)

REFERENCES:

MCI 1327 ENGINEER ESTIMATIONS
MCI 13341 MATH FOR MARINES