Medical Math

Curriculum

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Author

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This curriculum and accompanying products will help students refresh their knowledge of math basics.

Curriculum Structure

The *Medical Math Curriculum* is composed of the following lessons. Approximate lesson times are included. Times will vary depending on implementation and students' skill levels.

Lesson	Title	Approximate Time
One	Math Review: Fractions, Decimals, Ratios, and Percentages	60 minutes
Two	Math Review: Measurement Systems	60 minutes
Three	Math Review: Conversions	60 minutes
Four	Health Science Math: Methods and Oral Medications	60 minutes
Five	Health Science Math: Pediatric Calculations	60 minutes
Six	Health Science Math: Injection Calculations	60 minutes
Seven	Health Science Math: Infusion Calculations	60 minutes
	Total	**7 hours**

Lesson Structure

Each lesson begins with a Lesson Overview, Lesson Objectives, and a Lesson at a Glance table which lists the lesson activities, materials required, suggested preparation steps, and approximate class time.

Lesson Sections

The actual lesson follows the overview, which will contain some of the sections described below. Most lessons are designed to be completed within an hour.

FOCUS
Every lesson begins with a FOCUS activity intended to capture participants' attention. This may be in the form of a small or large class discussion, a game, a review of previous lesson information, or a demonstration. During this activity, participants are introduced to the topic of the lesson.

LEARN
The LEARN activity in each lesson varies in its presentation mode. It may be a slide presentation, group activity, or demonstration.

REVIEW
The majority of lessons end with a REVIEW activity intended to briefly review the lesson's key messages or main points.

Lesson One – Math Review: Fractions, Decimals, Ratios, and Percentages

Lesson Overview

In lesson one, participants will learn to calculate using fractions, decimals, ratios/proportions, and percentages. After the lesson, participants will take part in activities based on what they have learned.

Lesson Objectives

After completing this lesson, participants will be able to:

- Add, subtract, multiply, and divide fractions
- Add, subtract, multiply, and divide decimals
- Round decimals
- Convert fractions, decimals, ratios, and percentages
- Calculate using the ratio-proportion method

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• *Medical Math Student Workbook* • *Math Review: Fractions, Decimals, Ratios, and Percentages Pre-Quiz* – Answer Key	• Access *Math Review: Fractions, Decimals, Ratios, and Percentages* pages in the student workbook	10 minutes
LEARN	• *Math Review: Fractions, Decimals, Ratios, and Percentages* slide presentation • *Medical Math Student Workbook* • *Math Review: Fractions, Decimals, Ratios, and Percentages Online Lesson*	• Prepare *Math Review: Fractions, Decimals, Ratios, and Percentages* slide presentation for viewing	30 minutes
REVIEW	• *Medical Math Student Workbook* • *Math Review: Fractions, Decimals, Ratios, and Percentages* – Answer Key	• None	20 minutes (can be completed during lecture)

Lesson One – Math Review: Fractions, Decimals, Ratios, and Percentages

FOCUS: Math Review: Fractions, Decimals, Ratios, and Percentages Pre-Quiz

10 minutes

Purpose:

To assess participants' current knowledge of fractions, decimals, ratios, and percentages.

Materials:

- *Medical Math Student Workbook – Math Review: Fractions, Decimals, Ratios, and Percentages*
- *Math Review: Fractions, Decimals, Ratios, and Percentages Pre-Quiz* – Answer Key

Facilitation Steps:

1. Instruct participants to complete the *Math Review: Fractions, Decimals, Ratios, and Percentages Pre-Quiz*, located in the student workbook, prior to or at the start of the class.
2. Have the *Math Review: Fractions, Decimals, Ratios, and Percentages Pre-Quiz* – Answer Key available for instructor reference.
3. Have participants pair up and compare answers.

Fractions, Decimals, Ratios, and Percentages Pre-Quiz – Answer Key

Read each question and calculate the correct answer.

1) Which is larger? $\frac{8}{11}$ $\frac{5}{9}$

$\frac{8\ (x\ 9)}{11\ (x\ 9)} = \frac{72}{99}$

$\frac{5\ (x\ 11)}{9\ (x\ 11)} = \frac{55}{99}$

$\frac{72}{99}$ is larger than $\frac{52}{99}$

$\frac{8}{11}$ is larger than $\frac{5}{9}$ = A

2) Add: $\frac{8}{9} + \frac{5}{7} =$

$\frac{8\ (x\ 7)}{9\ (x\ 7)} + \frac{5\ (x\ 9)}{7\ (x\ 9)} = \frac{56}{63} + \frac{45}{63} = \frac{101}{63} =$ **$1\frac{38}{63}$ = D**

3) Subtract: $\frac{7}{9} - \frac{3}{10} =$

$\frac{7\ (x\ 10)}{9\ (x\ 10)} - \frac{3\ (x\ 9)}{10\ (x\ 9)} = \frac{70}{90} - \frac{27}{90} =$ **$\frac{43}{90}$ = C**

4) Multiply: $3\frac{4}{7} \times \frac{8}{13} =$

$3\frac{4}{7} = \frac{(7 \times 3)+4}{7} = \frac{25}{7}$

$\frac{25}{7} \times \frac{8}{13} = \frac{25 \times 8}{7 \times 13} = \frac{200}{91} =$ **$2\frac{18}{91}$ = B**

5) Divide: $\frac{1}{6} \div \frac{4}{5} =$

$\frac{1}{6} \div \frac{4}{5} = \frac{1}{6} \times \frac{5}{4} =$ **$\frac{5}{24}$ = C**

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6) Round 0.318 to the tenths.

0.3 – round up because 8 is greater than 5 = D

7) Subtract: 0.96 – 0.4 =

0.96

\- 0.40

0.56 = A

8) Multiply: 5.19 x 2.3 =

5.19 two decimals

x 2.3 one decimal

1557

+ 10380

11.937 = D three decimals

9) Convert $\frac{5}{9}$ to a percentage.

5 ÷ 9 = 0.556

0.556 x 100 = **55.6% = C**

10) Solve for *x*: $\frac{3}{4} = \frac{25}{x}$

25 x 4 = 100 3 x *X* = 3*x*

$\frac{3x}{3} = \frac{100}{3} = \mathbf{33.3 = B}$

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Lesson One – Math Review: Fractions, Decimals, Ratios, and Percentages Slide Presentation

LEARN: Math Review: Fractions, Decimals, Ratios, and Percentages Slide Presentation

30 minutes

Purpose:

Participants will learn how to calculate using fractions, decimals, ratios, and percentages.

Materials:

- *Math Review: Fractions, Decimals, Ratios, and Percentages* slide presentation
- *Medical Math Student Workbook – Math Review: Fractions, Decimals, Ratios, and Percentages Workbook* (optional – may complete practice problems as part of lecture)
- *Math Review: Fractions, Decimals, Ratios, and Percentages* – Answer Key
- *Math Review: Fractions, Decimals, Ratios, and Percentages Online Lesson*

Facilitation Steps:

1. Share the following information with participants as you show the slide presentation. Optional: You may complete practice problems in the student workbook as part of lecture.
2. Note to instructor: In lieu of the slide presentation, you may assign the *Math Review: Fractions, Decimals, Ratios, and Percentages Online Lesson*. It covers all the same content but allows participants to learn at a self-paced mode.

Slide 1: Introduction slide.

Slide 2: At the end of this lecture, you should be able to:

- Add, subtract, multiply, and divide fractions
- Add, subtract, multiply, and divide decimals
- Round decimals
- Convert fractions, decimals, ratios, and percentages
- Calculate using ratio-proportion method

Slide 3: Fractions title slide.

Slide 4: A fraction represents a part of a whole or division of one number by another. The top number is the numerator (part of the whole) and the bottom number is the denominator (whole).

Slide 5: Let's compare fractions by size. It is important to know if one fraction is less than, greater than, or equal to another. A whole is the same number in the numerator as the denominator. For example, 1/1 = 1 whole.

When the denominators are both the same, the fraction with the larger numerator has the greater value. For example, 1/8 is smaller than 3/8.

When the numerators are the same, the fraction with the smaller denominator has the greater value. For example, 1/2 is greater than 1/8.

Slide 6: Let's practice with size.

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Which is smaller: 1/4 or 1/2? *1/4 is smaller. When the numerators are the same, the fraction with the smaller denominator has the greater value.*

Which is larger: 1/4 or 3/4? *3/4 is larger. When the denominators are both the same, the fraction with the larger numerator has the greater value.*

Slide 7: When the numerators and the denominators are different, you will need to find the common denominator of the two fractions.

1. To find a common denominator, multiply the numerator and denominator of the first fraction by the denominator of the second fraction.
2. Next, multiply the numerator and denominator of the second fraction by the denominator of the first fraction.

Slide 8: Now try this practice problem on your own. Remember to find the common denominator!

Slide 9: Find a common denominator:
Multiply the numerator and denominator of the first fraction by 4 (the denominator of the second fraction).
Multiply the numerator and denominator of the second fraction by 5 (the denominator of the first fraction).
Compare the numerators. Because 16 is greater than 15, it means that 4/5 is greater than 3/4. The patient ate more for breakfast.

Slide 10: Sometimes large fractions can be simplified. This is called reducing a fraction to lowest terms.

Find the largest number that will divide evenly into both the numerator and the denominator. For example, to reduce 15/25 to lowest terms, divide the largest number (5) that goes evenly into both the numerator and the denominator.

Optional video: Reducing Fractions
https://www.youtube.com/watch?v=IlHP0niNflA

Slide 11: Sometimes fractions are written with whole numbers. To create an improper fraction (where the numerator is larger than the denominator), multiply the denominator by the whole number and add the numerator; then place that number over the existing denominator. To create a mixed number, divide the numerator by the denominator.

Slide 12: If common denominators exist, add the numerators but keep the common denominator. Reduce to lowest terms. To add fractions without common denominators, determine a common denominator. You may have to multiply one or both denominators. Add the numerators but keep the common denominator. Reduce to lowest terms or create a proper fraction.

Slide 13: If common denominators exist, subtract the numerators but keep the common denominator. Reduce to lowest terms. To subtract fractions without common denominators, determine a common denominator. You may have to multiply one or both denominators. Subtract the numerators but keep the common denominator. Reduce to lowest terms or create a proper fraction.

Optional video: Add and Subtract Fractions
https://www.youtube.com/watch?v=nnO3-SGdGhc

Slide 14: In multiplication, you must convert any mixed numbers to improper fractions, if needed.

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Multiply the numerators and multiply the denominators.
Reduce to lowest terms if necessary.

Slide 15: In division, you also must convert any mixed numbers to improper fractions, if needed.
Invert the divisor by placing the denominator over the numerator.
Cancel terms if needed.
Multiply the inverted divisor by the dividend.
Reduce, if necessary.

Optional video: Multiply and Divide Fractions
https://www.youtube.com/watch?v=MVqV8qQ0BF8

Slide 16: Decimals title slide.

Slide 17: Decimals are another way of displaying fractions and are used to display values less than one. The metric system is a decimal-based system. As you can see here, numbers left of the decimal point are whole numbers. To the right, they are the fractional parts.

Slide 18: If rounding to whole number, end value will be whole.
If rounding to tenths, end value is in tenths.
If rounding to hundredths, end value is in hundredths.

Look at the number one decimal place to the right of the desired end value. For example, if rounding to the tenths, look at the hundredths value.
Round up if the number right of the end value is 5 or higher. Delete all numbers to the right of the end value. For example, 1.75 rounded to the nearest tenth becomes 1.8.
If the number to the right of the end value is 4 or less, leave the number in your end value unchanged. Delete all numbers to the right of the end value. For example, 1.233 rounded to the nearest hundredth becomes 1.23.

Optional video: Rounding Decimals
https://www.youtube.com/watch?v=AH6JMQ2Z9ho

Slide 19: To add decimals, align the decimals so the decimal point is the same. Add zeros at the end to make all the decimals the same length. Then add.

Slide 20: Subtraction is like addition. Align the decimals so the decimal point is the same. Add zeros at the end to make all the decimals the same length. Then subtract.

Optional video: Adding and Subtracting Decimals
https://www.youtube.com/watch?v=NPDI4BVYn0E

Slide 21: In multiplication, you do not need to align the decimals. Multiply the numbers together. This symbol (*) is a placeholder but you may use zero as well. Count the total number of decimal places of the numbers and move the decimal point by that many spaces to the left.

Slide 22: In division, first create whole numbers by multiplying the decimal by 10, 100, or 1,000 or moving the decimal to the right until a whole number is created. Do the same to the other number. For example, if you moved the decimal one place to the right then move the decimal one place to the right on the other number. Then divide.

Optional video: Multiplying and Dividing Decimals
https://www.youtube.com/watch?v=Nz2iuCUgHRc

Slide 23: Ratios and Percentages title slide.

Slide 24: A ratio indicates how much of one number is contained in another. It is a comparison between two items.

Example: There are 3 apples, 8 bananas, and 1 orange in a bowl. The ratio of apples to bananas is 3:8. The ratio of oranges to total number of fruits is 1:12. It can also be written 3/8 or 1/12 like a fraction.

Slide 25: A percentage is a fraction or ratio expressed as part of 100.
Example: Amanda has 100 apples. Steve takes 25 apples. The ratio of apples taken compared to amount remaining is 25:100. The percentage is 25%.

Slide 26: Ratios can be converted in percentages. First, divide the first number by the second number then multiply by 100. Add the % symbol.

Slide 27: To convert fractions to percentages, divide the numerator by the denominator, multiply by 100, and then add the percent (%) symbol.

Optional video: Review of Basic Percentages
https://www.youtube.com/watch?v=Z229RysttR8

Slide 28: Using Ratio Proportion Method title slide.

Slide 29: Cross multiplication is used to calculate if two fractions are the same value. Multiply the numerator of the first fraction by denominator of second. Multiply the numerator of the second fraction by denominator of first. If the results are the same, the fractions are equal.

Optional video: Equivalent Fractions and Cross Products
https://www.youtube.com/watch?v=S0znSQL1BOA

Slide 30: To find the value of *x* in a proportion, set up the equation for cross multiplication. Cross multiply. To get "x" alone, divide each side by the number next to the "x". Solve.

Slide 31: To change a fraction into a percentage, use the formula as seen here. Partial quantity is represented as *P* over the whole quantity represented as *W*. The second fraction will be "x" over 100 since the whole quantity is 100 in a percentage. Solve by finding "x".

Slide 32: Closing slide.

Lesson One – Math Review: Fractions, Decimals, Ratios, and Percentages

REVIEW: Math Review: Fractions, Decimals, Ratios, and Percentages

20 minutes

Purpose:

Participants will practice math questions using fractions, decimals, ratios, and percentages.

Materials:

- *Medical Math Student Workbook – Math Review: Fractions, Decimals, Ratios, and Percentages*
- *Math Review: Fractions, Decimals, Ratios, and Percentages* – Answer Key

Facilitation Steps (this may have been completed as part of lecture):

1. Have participants complete the practice questions in the *Math Review: Fractions, Decimals, Ratios, and Percentages* section of the student workbook.
2. Answer any questions participants may have on the calculations.
3. Have participants self-check or peer-check their answers as you share them from the *Math Review: Fractions, Decimals, Ratios, and Percentages* – Answer Key.

Fractions, Decimals, Ratios, and Percentages - Answer Key

Fractions

Estimating Size

- When the denominators are both the same, the fraction with the larger numerator has the greater value. For example, 1/8 is smaller than 3/8.
- When the numerators are the same, the fraction with the smaller denominator has the greater value. For example, 1/2 is greater than 1/8.
- If the numerators and denominators are different, you will need to find the common denominator.
    - To find a common denominator, multiply the numerator and denominator of the first fraction by the denominator of the second fraction.
    - Next, multiply the numerator and denominator of the second fraction by the denominator of the first fraction.

$$\frac{7\ (\text{x}\ 6)}{10\ (\text{x}\ 6)} = \frac{42}{60}$$

$$\frac{5\ (\text{x}\ 10)}{6\ (\text{x}\ 10)} = \frac{50}{60}$$

$\frac{50}{60}$ is larger than $\frac{42}{60}$

$\frac{5}{6}$ is larger than $\frac{7}{10}$

Practice Questions

1) Which is larger: 5/7 or 6/7?

   6/7 because the numerator is larger.

2) The patient had $\frac{2}{3}$ of breakfast and $\frac{3}{5}$ of lunch. Did the patient eat more for breakfast or for lunch?

$$\frac{2\ (\text{x}\ 5)}{3\ (\text{x}\ 5)} = \frac{10}{15}$$

$$\frac{3\ (\text{x}\ 3)}{5\ (\text{x}\ 3)} = \frac{9}{15}$$

$\frac{10}{15}$ is larger than $\frac{9}{15}$

$\frac{2}{3}$ is larger than $\frac{3}{5}$

Reducing Fractions

- To reduce to lowest term, find the largest number that will divide evenly into both the numerator and the denominator.

$$\frac{15\ (\div 5)}{25\ (\div 5)} = \frac{3}{5}$$

Mixed Numbers

- To create an improper fraction, multiply the denominator by the whole number and add the numerator; then place that number over the existing denominator.
- To create a mixed number, divide the numerator by the denominator.

$$3\frac{4}{5} = \frac{(5 \text{ x } 3)+4}{5} = \frac{19}{5}$$

$$\frac{19}{5} = 19 \div 5 = 3\frac{4}{5}$$

Adding Fractions

- If there are common denominators, add the numerators but keep the denominator.
- If the denominators are not the same, find the common dominator and add the numerators.
- Reduce to lowest terms.

$$\frac{7}{12} + \frac{3}{12} = \frac{10}{12} = \frac{5}{6}$$

$$\frac{9}{10} + \frac{4}{5} = ? \qquad \frac{4\ (\text{x } 2)}{5\ (\text{x } 2)} = \frac{8}{10} \qquad \frac{9}{10} + \frac{8}{10} = \frac{17}{10} = 1\frac{7}{10}$$

Subtracting Fractions

- If there are common denominators, subtract the numerators but keep the denominator.
- If the denominators are not the same, find the common dominator and subtract the numerators.
- Reduce to lowest terms.

$$\frac{5}{7} - \frac{2}{7} = \frac{3}{7}$$

$$\frac{4}{5} - \frac{2}{3} = ? \qquad \frac{4\ (\text{x } 3)}{5\ (\text{x } 3)} = \frac{12}{15} \qquad \frac{2\ (\text{x } 5)}{3\ (\text{x } 5)} = \frac{10}{15}$$

$$\frac{12}{15} - \frac{10}{15} = \frac{2}{15}$$

Practice Questions

3) Reduce $\frac{3}{12}$ to lowest terms.

$$\frac{3\ (\div 3)}{12\ (\div 3)} = \mathbf{\frac{1}{4}}$$

4) Reduce $\frac{18}{45}$ to lowest terms.

$$\frac{18\ (\div 9)}{45\ (\div 9)} = \mathbf{\frac{2}{5}}$$

5) What is the improper fraction for $5\frac{3}{8}$?

$$5\frac{3}{8} = \frac{(8 \text{ x } 5)+3}{8} = \mathbf{\frac{43}{8}}$$

6) What is the mixed number of $\frac{36}{8}$?

$$\frac{36}{8} = 36 \div 8 = \mathbf{4\frac{1}{2}}$$

7) $\frac{9}{15} + \frac{3}{15} = \mathbf{\frac{12}{15}} = \mathbf{\frac{4}{5}}$

8) $\frac{1}{9} + \frac{2}{7} = \frac{1\ (\text{x } 7)}{9\ (\text{x } 7)} + \frac{2\ (\text{x } 9)}{7\ (\text{x } 9)} = \frac{7}{63}$

$+ \frac{18}{63} = \mathbf{\frac{25}{63}}$

9) $\frac{4}{5} - \frac{2}{5} = \mathbf{\frac{2}{5}}$

10) $\frac{12}{15} - \frac{2}{9} = \frac{12\ (\text{x } 3)}{15\ (\text{x } 3)} - \frac{2\ (\text{x } 5)}{9\ (\text{x } 5)}$

$\frac{36}{45} - \frac{10}{45} = \mathbf{\frac{26}{45}}$

Multiplying Fractions

- Convert any mixed numbers to improper fractions, if needed.
- Multiply the numerators and multiply the denominators.
- Reduce to lowest terms.

$$2\frac{6}{7} \text{ x } \frac{5}{8} = ?$$

$$2\frac{6}{7} = \frac{(7 \text{ x } 2)+6}{7} = \frac{20}{7}$$

$$\frac{20}{7} \text{ x } \frac{5}{8} = \frac{20 \text{ x } 5}{7 \text{ x } 8} = \frac{100}{56}$$

$$\frac{100}{56} = 1\frac{11}{14}$$

Dividing Fractions

- Convert any mixed numbers to improper fractions, if needed.
- Place the denominator over the numerator.
- Cancel, if needed.
- Multiply across.
- Reduce to lowest terms.

$$\frac{3}{5} \div \frac{7}{10} = ?$$

$$\frac{3}{5} \div \frac{7}{10} = \frac{3}{5} \text{ x } \frac{10}{7} = \frac{3}{\cancel{5}\,1} \text{ x } \frac{\cancel{10}\,2}{7} = \frac{3}{1} \text{ x } \frac{2}{7} = \frac{3 \text{ x } 2}{1 \text{ x } 7} = \frac{6}{7}$$

Practice Questions

11) $\frac{9}{10} \text{ x } 4\frac{4}{9} =$

$$4\frac{4}{9} = \frac{(9 \text{ x } 4)+4}{9} = \frac{40}{9}$$

$$\frac{40}{9} \text{ x } \frac{9}{10} = \frac{40 \text{ x } 9}{9 \text{ x } 10} =$$

$$\frac{360}{90} = \mathbf{4}$$

12) $9\frac{1}{2} \text{ x } \frac{3}{4} =$

$$9\frac{1}{2} = \frac{(2 \text{ x } 9)+1}{2} = \frac{19}{2}$$

$$\frac{19}{2} \text{ x } \frac{3}{4} = \frac{19 \text{ x } 3}{2 \text{ x } 4} =$$

$$\frac{57}{8} = \mathbf{7\frac{1}{8}}$$

13) $2\frac{1}{8} \div \frac{2}{7} =$

$$2\frac{1}{8} = \frac{(8 \text{ x } 2)+1}{8} = \frac{17}{8}$$

$$\frac{17}{8} \text{ x } \frac{7}{2} = \frac{119}{16} = \mathbf{7\frac{7}{16}}$$

14) $\frac{19}{12} \div \frac{1}{3} =$

$$\frac{19}{12} \text{ x } \frac{3}{1} = \frac{57}{12} = \mathbf{4\frac{3}{4}}$$

Decimals

Rounding

- Determine end value.
- Look at number to the right of the end value.
  - Round up if 5 or higher; If 4 or less, number stays the same.

Adding Decimals

- Align the decimals.
- Add zeros to make them the same length.
- Add.

Add 0.91, 0.4, and 1.65

```
    0.91
    0.40
+   1.65
    2.96
```

Subtracting Decimals

- Align the decimals.
- Add zeros to make them the same length.
- Subtract.

Subtract 1.5 from 2.35

```
    2.35
-   1.50
    0.85
```

Practice Questions

1) Round 0.258 to the tenths.

   0.3

2) Round 1.9 to the nearest whole number.

   2

3) 8.2 + 0.07 + 11 =

   8.20 + 0.07 +11.00 = **19.27**

4) 0.25 + 1.2 + 3.86 =

   0.25 + 1.20 + 3.86 = **5.31**

5) 6.75 – 0.5 =

   6.75 – 0.50 = **6.25**

6) 0.41 – 0.2 =

   0.41 – 0.20 = **0.21**

Multiplying Decimals

- Multiply the numbers together.
- This symbol (*) is a placeholder, you may use zero as well.
- Count the number of decimal places.
- Move the decimal point.

Multiply 2.8 by 0.13

	2.8	one decimal
x	0.13	two decimals
	84	
	28*	
	+00 **	
	0.364	three decimals

Dividing Decimals

- Create whole numbers by multiplying decimal by 10.
- Do the same thing to both numbers and divide.

10 ÷ 0.5

Convert 0.5 to a whole number by moving the decimal one place to the right. Do the same with 10.

100 ÷ 5 = 20

therefore

10 ÷ 0.5 = 20

Practice Questions

7) 3.5 x 0.27 =

	3.5	one decimal
x	0.27	two decimals
	245	
+	700	
	0.945	three decimals

8) 6.12 x 1.5 =

	6.12	two decimals
x	1.5	one decimal
	3060	
+	6120	
	9.180	three decimals

= 9.18

9) 6 ÷ 0.25 =

6 x 100 = 600

0.25 x 100 = 25

600 ÷ 25 = **24**

10) 9 ÷ 0.333 =

9 x 1000 = 9000

0.333 x 1000 = 333

9000 ÷ 333 = **27.027**

Ratios, Proportions, and Percentages

Converting Ratio to a Percentage

- Divide the first number by the second number.
- Multiply by 100.
- Add the % symbol.

Convert 5:6 to a percent

5 ÷ 6 = 0.83333

0.8333 x 100 = 83.33%

Converting Fraction to a Percentage

- Divide the numerator by the denominator.
- Multiply by 100.
- Add the % symbol.

Convert $\frac{3}{5}$ to a percent

3 ÷ 5 = 0.6

0.6 x 100 = 60%

Practice Questions

1) Convert 7:10 to a percent.

   7 ÷ 10 = 0.7
   0.7 x 100 = **70%**

2) Convert $\frac{6}{7}$ to a percent.

   6 ÷ 7 = 0.857
   0.857 x 100 = **85.7%**

Cross Multiplying

- Multiply the numerator of the first fraction by denominator of second.
- Multiply the numerator of the second fraction by denominator of first.

Does $\frac{3}{4} = \frac{12}{16}$?

3 x 16 = 48

12 x 4 = 48

So yes, they are equal.

Solve for *X* with Fractions

- To solve for "*x*", cross multiply.
- Divide each side to get *X* alone.

$\frac{2}{6} = \frac{9}{x}$?

$\frac{2}{6} \quad \frac{9}{x}$

9 x 6 = 54

2 x *X* = 2*x*

$\frac{2x}{2} = \frac{54}{2} = 27$

Practice Questions

3) Does $\frac{2}{9} = \frac{16}{27}$?

2 x 27 = 54

16 x 9 = 144

No, they are not equal.

4) $\frac{8}{9} = \frac{10}{x}$

$\frac{8}{9} = \frac{10}{x}$?

$\frac{8}{9} \quad \frac{10}{x}$

9 x 10 = 90

8 x *X* = 8*x*

$\frac{8x}{8} = \frac{90}{8} =$

$\mathbf{11.25\ OR\ 11\frac{1}{4}}$

Realityworks
Live it. Learn it.

Calculating Percentages

- Partial quantity = *P* over whole quantity = *W*.
- The second fraction will be "x" over 100 since the whole quantity is 100 in a percentage.
- Solve for "x".

$\frac{1}{8} = \frac{x}{100}$

1 x 100 = 100

8 x *X* = 8x

$\frac{8x}{8} = \frac{100}{8} = 12.5\%$

Practice Questions

5) $\frac{9}{13} = \frac{x}{100}$

Express *x* as a percentage.

9 x 100 = 900

13 x *X* = 13x

$\frac{13x}{13} = \frac{900}{13} = \mathbf{69.2\%}$

Lesson Two – Math Review: Measurement Systems

Lesson Overview

In lesson two, participants will learn about common measurement systems. After the lesson, participants will take part in activities based on what they have learned.

Lesson Objectives

After completing this lesson, participants will be able to:

- Calculate between measurements in the metric system
- Convert apothecary and household measurements
- Calculate time using standard and military time

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• *Medical Math Student Workbook* • *Math Review: Measurement Systems Pre-Quiz* – Answer Key	• Access *Math Review: Measurement Systems* section in the student workbook	10 minutes
LEARN	• *Math Review: Measurement Systems* slide presentation • *Medical Math Student Workbook* • *Math Review: Measurement Systems Online Lesson*	• Prepare *Math Review: Measurement Systems* slide presentation for viewing	30 minutes
REVIEW	• *Math Review: Measurement Systems Workbook* • *Math Review: Measurement Systems* – Answer Key	• None	20 minutes (can be completed during lecture)

Lesson Two – Math Review: Measurement Systems

FOCUS: Math Review: Measurement Systems Pre-Quiz

10 minutes

Purpose:

To assess participants' current knowledge of measurement systems.

Materials:

- *Medical Math Student Workbook – Math Review: Measurement Systems Workbook*
- *Math Review: Measurement Systems Pre-Quiz* – Answer Key

Facilitation Steps:

1. Instruct participants to complete the *Math Review: Measurement Systems Pre-Quiz,* located in the student workbook, prior to or at the start of the class.
2. Have the *Math Review: Measurement Systems* – Answer Key available for instructor reference.
3. Have participants pair up and compare answers.

Metric, Apothecary, Household, and Time Pre-Quiz – Answer Key

Read each question and calculate the correct answer.

1) Convert 267 micrograms to milligrams.

$\frac{1\text{ mg}}{1000\text{ mcg}} = \frac{x\text{ mg}}{267\text{ mcg}}$ OR Move decimal to left 3 spaces.

1 x 267 = 267

1000 x X = 1000X

$\frac{1000x}{1000} = \frac{267}{1000} = \mathbf{0.267\text{ mg} = A}$

2) Convert 58.9 grams to kilograms.

$\frac{1000\text{ g}}{1\text{ kg}} = \frac{58.9\text{ g}}{x\text{ kg}}$ OR Move decimal to left 3 spaces.

1 x 58.9 = 58.9

1000 x X = 1000X

$\frac{1000x}{1000} = \frac{58.9}{1000} = \mathbf{0.0589\text{ kg} = C}$

3) Convert 4.3 centimeters to millimeters.

$\frac{1\text{ cm}}{10\text{ mm}} = \frac{4.3\text{ cm}}{x\text{ mm}}$ OR Move decimal to the right 1 space.

10 x 4.3 = 43

1 x X = 1X

$\frac{1x}{1} = \frac{43}{1} = \mathbf{43\text{ mm} = B}$

4) Convert 120 milligrams to grains.

$$\frac{1\text{ gr}}{60\text{ mg}} = \frac{x\text{ gr}}{120\text{ mg}}$$

1 x 120 = 120

60 x X = 60X

$$\frac{60x}{60} = \frac{120}{60} = \mathbf{2\text{ gr or gr ii} = C}$$

5) How many teaspoons are in 3 tablespoons?

$$\frac{3\text{ t}}{1\text{ T}} = \frac{x\text{ t}}{3\text{ T}}$$

3 x 3 = 9

1 x X = 1X

$$\frac{1x}{1} = \frac{9}{1} = \mathbf{9\text{ teaspoons} = B}$$

6) Convert 2 quarts to gallons.

$$\frac{4\text{ qts}}{1\text{ gal}} = \frac{2\text{ qts}}{x\text{ gal}}$$

2 x 1 = 2

4 x X = 4X

$$\frac{4x}{4} = \frac{2}{4} = \mathbf{0.5\text{ gallons} = B}$$

7) Convert 8 pounds to ounces.

$$\frac{1\text{ lb}}{16\text{ oz}} = \frac{8\text{ lbs}}{x\text{ oz}}$$

8 x 16 = 128

1 x X = 1X

$$\frac{1x}{1} = \frac{128}{1} =$$ **128 ounces = A**

8) How many feet is 72 inches?

$$\frac{1\text{ ft}}{12\text{ in}} = \frac{x\text{ ft}}{72\text{ in}}$$

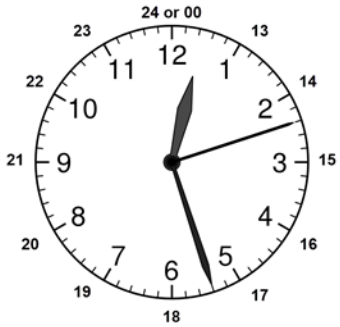
72 x 1 = 72

12 x X = 12X

$$\frac{12x}{12} = \frac{72}{12} =$$ **6 feet = C**

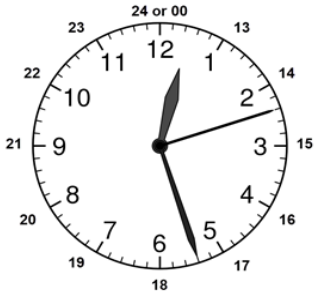
9) Convert 1530 to traditional time.

1530 = **3:30 p.m. = D**



10) Convert 11:59 p.m. to military time.

11:59 p.m. = **2359 = B**



Lesson Two – Math Review: Measurement Systems

LEARN: Math Review: Measurement Systems Slide Presentation

30 minutes

Purpose:

Participants will learn how to calculate using measurement systems.

Materials:

- *Math Review: Measurement Systems* slide presentation
- *Medical Math Student Workbook – Math Review: Measurement Systems Workbook* (optional – may complete practice problems as part of lecture)
- *Math Review: Measurement Systems* – Answer Key
- *Math Review: Measurement Systems Online Lesson*

Facilitation Steps:

1. Share the following information with participants as you show the slide presentation. Optional: Students may complete practice problems in the student workbook as part of lecture.
2. Note to instructor: In lieu of the slide presentation, you may assign the *Math Review: Measurement Systems Online Lesson*. It covers all the same content but allows participants to learn at a self-paced mode.

Slide 1: Introduction slide.

Slide 2: At the end of this lecture, you will be able to:

- Calculate between measurements in the metric system
- Convert apothecary and household measurements
- Calculate time using standard and military time

Slide 3: Metric System title slide.

Slide 4: In healthcare, the metric system is the preferred system of measurement. The metric system uses powers of 10 and the amounts are written as whole numbers or decimals, not fractions.

Metric measures are determined by their prefixes as seen in the image here. When moving from a bigger unit to a smaller unit, multiplication is used, and the decimal point moves to the right. When moving from a smaller to bigger unit, division is used, and the decimal moves to the left.

The metric system includes three base units of measurement – liter (volume), gram (weight), and meter (length).

Slide 5: To convert using the ratio-proportion method, set up the equation keeping the unit of measurement in the numerators and denominators the same. Cross-multiply and divide. Always label your answer with the units.

Slide 6: Another option is to move the decimal point according to the level of metric. To convert a bigger unit to a smaller one, move the decimal to the right. To convert smaller units to bigger, move the decimal to the left.

For example, let's convert 1L to mL. It is going from a bigger quantity to smaller, so the decimal will move to the right. Notice on the picture that Milli- is 3 levels down so move decimal to right three spots. 1L equals 0.001mL. Always remember the preceding zero and to label your answer.

Slide 7: *Have participants solve the conversions using any method.*

Slide 8: *Discuss the answers and methods used*

Slide 9: Apothecary System title slide.

Slide 10: The apothecary system of measurement was used in the United States until 1971, when it was replaced by the metric system. One grain (gr) equals weight of one grain of wheat. It is written using Roman numerals as seen here. Dram (dr) is another measurement in the apothecary system. Since the abbreviation for grain (gr) so closely resembles grams, apothecary abbreviations are on The Joint Commission's Do Not Use List.

Since it is used in pharmacies, you may still see references to the apothecary system. It can also be found on some medicine cups.

Slide 11: Household System title slide.

Slide 12: The household system is based on the apothecary system and used mainly in cooking, as in cups and spoons. The household system is the least accurate measurement system and not recommended for medication administration by the Institute for Safe Medication Practices. It does not use powers of 10 or decimals, but it does use proper fractions. Equivalencies need to be memorized. The household system is used to measure volume, weight, and length. You can use the ratio-proportion method to convert between measurements.

Optional video: Apothecary and Household System
https://www.youtube.com/watch?v=afsN39JyFZA

Slide 13: Volume units include teaspoon (t), tablespoon (T), fluid ounce (fl. oz, commonly known as ounce or oz), cup (c), pint (pt), quart (qt), and gallon (gal). When converting, remember that 3 teaspoons = 1 tablespoon, 2 tablespoons = 1 fluid ounce, and 4 quarts = 1 gallon = 128 fluid ounces. As you can see in the box, fluid ounces can also be converted to cups, pints, and quarts.

Slide 14: Household measurements for weight include ounces (oz), pounds (lbs), and tons. One pound equals 16 ounces. 2,000 pounds equals 1 ton.

Slide 15: Household measurements for length include inch (in), foot (ft), yard (yd), and mile (mi). 12 inches equals 1 foot, 3 feet equals 1 yard, and 5,280 feet equals 1,760 yards which also equals 1 mile.

Slide 16: This is an example of how the ratio-proportion method is used to solve conversion.

Slide 17: Military (International) Time title slide.

Slide 18: Traditional time is based on 12-hour increments. It begins at 12:00 a.m. (midnight) and the next 12 hours begin at 12:00 p.m. (noon). Military time is one long increment of 24 hours. It begins at 0001 and ends at 2400. Both 0000 and 2400 represent midnight and no a.m. or p.m. is used when writing the time. Military time is also known as international time.

Slide 19: To convert traditional time to military time:

- From 12 a.m. to 12:59 a.m., replace 12 with 00, delete colon and "a.m."
    - 12:45 a.m. = 0045
- Up to 9:59 a.m., place a 0 in front of the time, delete colon and "a.m."
    - 8:30 a.m. = 0830
- From 10:00 a.m. to 12:59 p.m., delete colon and "a.m." or "p.m."
    - 11:15 a.m. = 1115
- After 12:59 p.m., delete colon and "p.m.". Add 12 hours to the traditional time
    - 4:23 p.m. = 1623

Slide 20: To convert military time to traditional time:

- Before 1000, remove first zero, add colon and "a.m."
    - 0705 = 7:05 a.m.
- From 1000 to 1159, add colon and "a.m."
    - 1037 = 10:37 a.m.
- From 1200 to 1259, add colon and "p.m."
    - 1251 = 12:51 p.m.
- After 1259 p.m., subtract 1200, add colon and "p.m."
    - 1624 = 4:24 p.m.

Slide 21: *Ask participants to read the clock in traditional time and military time – a.m. and p.m.*

Slide 22: Answers:
Traditional = 12:27 a.m. or 12:27 p.m.
Military = 1227 or 0027

A common time conversion error made by students is to convert times between 12:01 a.m. and 12:59 a.m. to 2401 to 2459. The correct way is 0001 to 0059.

Slide 23: Closing slide.

Lesson Two – Math Review: Measurement Systems

REVIEW: Math Review: Measurement Systems

20 minutes

Purpose:

Participants will practice math questions using measurement systems.

Materials:

- *Medical Math Student Workbook – Math Review: Measurements Systems Workbook*
- *Math Review: Measurement Systems –* Answer Key

Facilitation Steps (these may have been completed as part of lecture):

1. Have the participants complete the practice questions in the *Math Review: Measurement Systems* section of the student workbook.
2. Answer any questions that participants may have on the calculations.
3. Have participants self-check or peer-check their answers as you share them from the *Math Review: Measurement Systems –* Answer Key.

Metric, Apothecary, Household, and Time – Answer Key

Metric System

Metric Conversion

- To convert quantities, use the ratio-proportion method
- Use known equivalencies
- Keep the unit of measurement in the numerators and denominators the same
- Cross-multiply and divide
- Label answer with units

Convert 250 milligrams to grams

$$\frac{1\text{g}}{1000\text{mg}} = \frac{x\text{ g}}{250\text{mg}}$$

$$\frac{1g}{1000mg} \times \frac{x\ g}{250mg}$$

1 x 250 = 250

1000 x X = 1000X

$$\frac{1000x}{1000} = \frac{250}{1000} = 0.25\text{ g}$$

Practice Questions

1) Convert 3000 milliliters to liters.

Move decimal 3 spots to the left = **3 L**

2) Convert 450 kilograms to milligrams.

Move decimal 6 spots to the right = **450, 000, 000 mg**

3) Convert 6.25 meters to millimeters.

Move decimal 3 spots to the right = **6,250 mm**

Apothecary

Converting

- 1 grain (gr) = weight of one grain of wheat
  - 2 grains are written gr ii
  - 1 grain (or gr i) = 60 milligrams
- 1 dram (dr) = 60 grains

Practice Questions

1) Convert 4 grains to milligrams.

$$\frac{1\text{ gr}}{60\text{ mg}} = \frac{4\text{ gr}}{x\text{ mg}}$$

$$4 \text{ x } 60 = 240$$

$$1 \text{ x } X = 1X$$

$$\frac{1x}{1} = \frac{240}{1} = \mathbf{240\text{ mg}}$$

2) Convert 3 drams to milligrams.

$$\frac{1\text{ dr}}{60\text{ gr}} = \frac{3\text{ dr}}{x\text{ gr}} =$$

$$3 \text{ x } 60 = 180$$

$$1 \text{ x } X = 1X$$

$$\frac{1x}{1} = \frac{180}{1} = 180\text{ gr}$$

$$\frac{1\text{ gr}}{60\text{ mg}} = \frac{180\text{ gr}}{x\text{ mg}} =$$

$$180 \text{ x } 60 = 10{,}800$$

$$1 \text{ x } X = 1X$$

$$\frac{1x}{1} = \frac{10800}{1} = \mathbf{10{,}800\text{ mg}}$$

Household

Volume

- Includes teaspoon (t), tablespoon (T), fluid ounce (fl. oz), commonly referred to as ounce (oz), cup (c), pint (pt), quart (qt), and gallon (gal)
- 3 teaspoons = 1 tablespoon
- 2 tablespoons = 1 fluid ounce
- 4 quarts = 1 gallon = 128 fluid ounces

Weight

- Includes ounces (oz), pounds (lbs), and tons
- 1 lb = 16 oz
- 2,000 lbs = 1 ton

Length

- Includes inch (in), foot (ft), yard (yd), and mile (mi)
- 12 inches = 1 foot
- 5,280 feet = 1,760 yards = 1 mile

Practice Questions

1) How many tablespoons are there in 12 fluid ounces?

$$\frac{1 \text{ fl oz}}{2 \text{ T}} = \frac{12 \text{ fl oz}}{x \text{ T}}$$

$$2 \text{ x } 12 = 24$$

$$1 \text{ x X} = 1\text{X}$$

$$\frac{1x}{1} = \frac{24}{1} = \mathbf{24\ T}$$

2) How many ounces are in 4.5 pounds?

$$\frac{16 \text{ oz}}{1 \text{ lb}} = \frac{x \text{ oz}}{4.5 \text{ lbs}}$$

$$16 \text{ x } 4.5 = 72$$

$$1 \text{ x X} = 1\text{X}$$

$$\frac{1x}{1} = \frac{72}{1} = \mathbf{72\ oz}$$

3) A girl is 5 foot 2 inches. How tall is she in inches?

$$\frac{12 \text{ in}}{1 \text{ ft}} = \frac{x \text{ in}}{5 \text{ ft}}$$

$$12 \text{ x } 5 = 60$$

$$1 \text{ x X} = 1\text{X}$$

$$\frac{1x}{1} = \frac{60}{1} = 60 + 2 =$$

62 inches

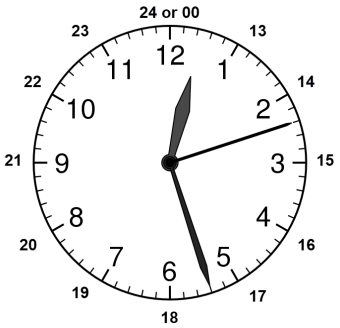
Military/International Time

Traditional time (12 hours)

- Begins at 12:00 a.m. (midnight) and second 12 hours begins at 12:00 p.m. (noon)

Military time (24 hours)

- Begins at 0001 and ends at 2400
- Both 0000 and 2400 represent midnight
- No a.m. or p.m. is used
- No colons are used



Practice Questions

1) Convert 6:15 p.m. to military time.

   1815

2) Convert 1945 to traditional time.

   7:45 p.m.

Lesson Three – Math Review: Conversions

Lesson Overview

In lesson three, participants will learn to convert between measurement systems. After the lesson, participants will take part in activities based on what they have learned.

Lesson Objectives

After completing this lesson, participants will be able to:

- Convert between U.S. customary and metric length measurements
- Convert between household and metric volume measurements
- Convert between household and metric weight measurements
- Convert between U.S. customary and metric temperature measurements

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• *Medical Math Student Workbook* • *Math Review: Conversions Pre-Quiz* – Answer Key	• Access *Math Review: Conversions* section in the student workbook	10 minutes
LEARN	• *Math Review: Conversions* slide presentation • *Medical Math Student Workbook* • *Math Review: Conversions Online Lesson*	• Prepare *Math Review: Conversions* slide presentation for viewing	30 minutes
REVIEW	• *Medical Math Student Workbook* • *Math Review: Conversions* – Answer Key • *Math Review Summative Quiz* • *Math Review Summative Quiz* – Answer Key	• Print off and distribute the *Math Review Summative Quiz*	20 minutes (can be completed during lecture)

Lesson Three – Math Review: Conversions

FOCUS: Math Review: Conversions Pre-Quiz

10 minutes

Purpose:

To assess participants' current knowledge of converting between measurement systems.

Materials:

- *Medical Math Student Workbook – Math Review: Conversions*
- *Math Review: Conversions Pre-Quiz* – Answer Key

Facilitation Steps:

1. Instruct participants to complete the *Math Review: Conversions Pre-Quiz*, located in the student workbook, prior to or at the start of the class.
2. Have the *Math Review: Conversions Pre-Quiz* – Answer Key available for instructor reference.
3. Have participants pair up and compare answers.

Conversions Pre-Quiz – Answer Key

Read each question and calculate the correct answer.

1) Convert 10 centimeters to inches.

   10/2.54 = **3.937 inches = A**

2) Convert 3 feet to yards.

   3 feet = **1 yard = B**

3) Convert 4 meters to feet.

   $\frac{1\text{ ft}}{0.3048\text{ m}} = \frac{\text{x ft}}{4\text{ m}}$

   1 x 4 = 4

   0.3048 x *X* = 0.3048*x*

   $\frac{0.3048\text{x}}{0.3048\text{ x}} = \frac{4}{0.3048}$ = **13.12 feet = D**

4) Convert 15 milliliters to teaspoons.

   1 teaspoon = 5 mL

   15/5 = **3 teaspoons = C**

5) Convert 3 tablespoons to milliliters.

   1 tablespoon = 15 mL

   3 x 15 = **45 milliliters = A**

6) Convert 0.5 liters to fluid ounces.

   32 fluid ounces = 1 L

   0.5 x 32 = **16 fluid ounces = C**

7) Convert 2 kilograms to pounds.

   2.2 pounds = 1 kilogram

   2.2 x 2 = **4.4 pounds = B**

8) Convert 0.5 pounds to grams.

1 pound = 454 grams

454 x 0.5 = **227 grams = D**

9) Convert 102°F to °C.

(°F - 32) x 0.5556 = °C

(102-32) x 0.5556 = **38.9°C = C**

10) Convert 39.2°C to °F.

(°C x 1.8) + 32 = °F

(39.2 x 1.8) + 32 = **102.6°F = D**

Lesson Three – Math Review: Conversions

LEARN: Math Review: Conversions Slide Presentation

30 minutes

Purpose:

Participants will learn how to convert between measurement systems.

Materials:

- *Math Review: Conversions* slide presentation
- *Medical Math Student Workbook – Math Review: Conversions* (optional – participants may complete practice problems as part of the lecture)
- *Math Review: Conversions Workbook* – Answer Key
- *Math Review: Conversions Online Lesson*

Facilitation Steps:

1. Share the following information with participants as you show the slide presentation. Optional: You may complete practice problems in the student workbook as part of the lecture.
2. Note to instructor: In lieu of the slide presentation, you may assign the *Math Review: Conversions Online Lesson*. It covers all the same content but allows participants to learn at a self-paced rate.

Slide 1: Introduction slide.

Slide 2: At the end of this lecture, you will be able to:

- Convert between U.S. customary and metric length measurements
- Convert between household and metric volume measurements
- Convert between household and metric weight measurements
- Convert between U.S. customary and metric temperature measurements

Slide 3: Length title slide.

Slide 4: The units of feet and inches are called United States customary units. It historically comes from the British imperial system that existed before they went to metric. The United States is one of only a few countries that have not fully adopted the metric system. Here are the conversions, but it should be noted that you may find these rounded. For example, 1 inch may be 2.5 cm. In healthcare, accuracy is important, so the extended version is preferred.

Optional video: Metric System Explained Simply
https://www.youtube.com/watch?v=1TlCcW_mugs

Slide 5: Have the participants select the formula and calculate.

Slide 6: Review answer with participants.

Slide 7: Volume title slide.

Slide 8: Household to metric conversions are often seen in liquid measurement. For example, liquid medication cups may have both increments listed.

Realityworks Live it. Learn it.

Slide 9: Have the participants select the formula and calculate.

Slide 10: Review answer with participants.

Slide 11: Weight title slide.

Slide 12: Household to metric weight conversions are used in medication calculations especially in the pediatric populations. Medications may be dosed in mg per kg and weights are sometimes in pounds. A conversion needs to be done.

Slide 13: Have the participants select the formula and calculate.

Slide 14: Review answer with participants.

Slide 15: Temperature title slide.

Slide 16: The Fahrenheit scale is based on 32° for the freezing point of water and 212° for the boiling point of water. The Celsius scale, also called centigrade, is based on 0° for the freezing point of water and 100° for the boiling point of water. Like the potential for errors with weight-based dosing, errors regarding temperature are also common.

Slide 17: *Have the participants select the formula and calculate.*

Slide 18: Review answer with participants. It should be noted that 37°C = 98.6°F. An increase of only 2 degrees in Celsius can indicate a fever!

Slide 19: Closing slide.

Lesson Three – Math Review: Conversions

REVIEW: Math Review: Conversions

20 minutes

Purpose:

Participants will practice converting between measurement systems.

Materials:

- *Medical Math Student Workbook – Math Review: Conversions*
- *Math Review: Conversions* – Answer Key

Facilitation Steps (this may have been completed as part of lecture):

1. Have participants complete the practice questions in the *Math Review: Conversions* section in the student workbook.
2. Answer any questions participants may have on the calculations.
3. Have participants self-check or peer-check their answers as you share them from the *Math Review: Conversions* – Answer Key.

Conversions – Answer Key

Length

U.S. Customary to Metric

- United States customary units are inches and feet.
- 1 inch = 2.54 centimeters
- 1 foot = 0.348 meters = 30.48 centimeters
- 3 feet = 1 yard

Convert 2.5 inches to centimeters.

$$\frac{1 \text{ inch}}{2.54 \text{ cm}} = \frac{2.5 \text{ inches}}{x \text{ cm}}$$

2.5 x 2.54 = 6.35

1 x X = 1 x

$$\frac{1\,x}{1} = \frac{6.35}{1} = 6.35 \text{ cm}$$

Practice Questions

1) Convert 3 meters to feet.

$$\frac{0.3048 \text{ m}}{1 \text{ ft}} = \frac{3 \text{ m}}{x \text{ ft}}$$

3 x 1 = 3

0.3048 x X = 0.3048 x

$$\frac{0.3048\,x}{0.3048} = \frac{3}{0.3048} = \mathbf{9.8\ ft}$$

2) Convert 7 inches to centimeters.

$$\frac{1 \text{ in}}{2.54 \text{ cm}} = \frac{7 \text{ in}}{x \text{ cm}}$$

7 x 2.54 = 17.78

1 x X = 1x

$$\frac{1\,x}{1} = \frac{17.78}{1} = \mathbf{17.78\ ft}$$

Realityworks
Live it. Learn it.

3) Convert 4 feet into yards.

$$\frac{3\text{ ft}}{1\text{ yd}} = \frac{4\text{ ft}}{x\text{ yds}}$$

4 x 1 = 4

3x X = 3x

$$\frac{3x}{3} = \frac{4}{3} = \mathbf{1.33\ yds}$$

Volume

Household to Metric

- 1 teaspoon = 5 milliliters
- 1 tablespoon = 15 milliliters
- 1 fluid ounce = 30 milliliters
- 32 fluid ounces = 1 liter

Convert 3 tablespoons to milliliters,

$$\frac{1\text{ T}}{15\text{ mL}} = \frac{3\text{ T}}{x\text{ mL}}$$

15 x 3 = 45

1 x X = 1 x

$$\frac{1x}{1} = \frac{45}{1} = 45\text{ mL}$$

Practice Questions

1) Convert 60 milliliters to tablespoons.

$$\frac{1\text{ T}}{15\text{ mL}} = \frac{x\text{ T}}{60\text{ mL}}$$

60 x 1 = 60

15 x X = 15x

$$\frac{15x}{15} = \frac{60}{15} = \mathbf{4\ T}$$

2) Convert 2.5 liters to fluid ounces.

$$\frac{1\text{ L}}{32\text{ fl oz}} = \frac{2.5\text{ L}}{x\text{ fl oz}}$$

2.5 x 32 = 80

1 x X = 1x

$$\frac{1x}{1} = \frac{80}{1} = \mathbf{80\ fl.\ oz}$$

Weight

Household to Metric

- 1 pound = 454 grams
- 2.2 pounds = 1 kilogram

Convert 150 pounds to kilograms: $\frac{2.2 \text{ lbs}}{1 \text{ kg}} = \frac{150 \text{ lbs}}{x \text{ kg}}$

1 x 150 = 150

2.2 x X = 2.2x

$\frac{2.2\,x}{2.2} = \frac{150}{2.2}$ = 68.2 kg

Practice Questions

1) Convert 200 grams to pounds.

$$\frac{1 \text{ lb}}{454 \text{ g}} = \frac{x \text{ lbs}}{200 \text{ g}}$$

1 x 200 = 200

454 x X = 454x

$\frac{454x}{454} = \frac{200}{454}$ = **0.44 lbs**

2) Convert 225 pounds to kilograms.

$$\frac{2.2 \text{ lbs}}{1 \text{ kg}} = \frac{225 \text{ lbs}}{x \text{ kg}}$$

1 x 225 = 225

2.2 x X = 2.2x

$\frac{2.2\,x}{2.2} = \frac{225}{2.2}$ = **102.3 kg**

Temperature

U.S. Customary to Metric

- The Fahrenheit scale is based on 32° for the freezing point of water and 212° for the boiling point of water
- The Celsius scale, also called centigrade, is based on 0° for the freezing point of water and 100° for the boiling point of water

Celsius to Fahrenheit

(°C x 1.8) + 32 = °F

Note: $\frac{9}{5}$ can be used instead of 1.8.

Fahrenheit to Celsius

(°F - 32) x 0.5556 = °C

Note: $\frac{5}{9}$ can be used instead of 0.5556.

Practice Questions

1) Convert 99.1°F to °C.

(99.1-32) x 0.5556 = **37.3°C**

2) Convert 38.6°C to °F.

(38.6 x 1.8) + 32 = **101.5°F**

Name: _____ Class: _____

Math Review Summative Quiz

Read each question and calculate the correct answer.

1) Mr. Thomas ate $\frac{7}{8}$ of his meal and Mrs. Thomas ate $\frac{9}{11}$ of her meal. Who ate more of the meal?
   a) Mr. Thomas
   b) Mrs. Thomas
   c) Neither; they ate the same amount

2) Mr. Lambert drank $\frac{4}{5}$ of his water pitcher in the morning and $\frac{1}{6}$ of his water pitcher in the afternoon. How much of the water did he drink in total?
   a) $\frac{29}{30}$
   b) $\frac{15}{18}$
   c) $\frac{5}{11}$
   d) $1\frac{3}{63}$

3) Subtract: $\frac{3}{4} - \frac{4}{7} =$
   a) $1\frac{9}{28}$
   b) $\frac{5}{28}$
   c) $\frac{3}{7}$
   d) $1\frac{5}{16}$
   e) $\frac{4}{90}$

4) Multiply: $\frac{1}{5} \times \frac{6}{16} =$
   a) $\frac{23}{40}$
   b) $\frac{-7}{40}$
   c) $\frac{3}{40}$
   d) $\frac{8}{15}$

5) Divide: $\frac{1}{2} \div \frac{2}{3} =$
   a) $\frac{1}{3}$
   b) $\frac{-1}{6}$
   c) $1\frac{1}{16}$
   d) $\frac{3}{4}$
6) Round 0.259 to the tenths.
   a) 0.3
   b) 0.26
   c) 0.2
   d) 0.25

7) Subtract: 0.583 – 0.21=
   a) 0.562
   b) 0.373
   c) 0.793
   d) 0.41

8) Multiply: 4.36 x 1.25 =
   a) 3.49
   b) 5.61
   c) 5.45
   d) 4.5

9) Convert $\frac{9}{12}$ to a percent.
   a) 7.5%
   b) 75%
   c) 0.75%
   d) 1.3%

10) Solve for *x*: $\frac{5}{6} = \frac{25}{x}$
   a) 30
   b) 1.2
   c) 21
   d) 120

11) Convert 365 micrograms to milligrams.
   a) 0.365
   b) 365,000
   c) 3.65
   d) 3650

12) Convert 26.7 grams to kilograms.
    a) 267,000
    b) 0.267
    c) 0.0267
    d) 2.67

13) Convert 1.25 centimeters to millimeters.
    a) 0.0125
    b) 12.5
    c) 1250
    d) 12,500

14) Convert 20 milligrams to grains.
    a) 0.3
    b) 0.02
    c) 3
    d) 0.5

15) How many teaspoons are in 2 tablespoons?
    a) 12
    b) 9
    c) 6
    d) 0.5

16) Convert 10 quarts to gallons.
    a) 0.25
    b) 0.5
    c) 1.5
    d) 2.5

17) Convert 3 pounds to ounces.
    a) 48
    b) 64
    c) 32
    d) 24

18) How many feet is 108 inches?
    a) 7.5
    b) 8
    c) 8.5
    d) 9

19) A medication was administered at 1945. In traditional time, when was the medication administered?
    a) 7:45 a.m.
    b) 9:45 a.m.
    c) 7:45 p.m.
    d) 9:45 p.m.

20) A medication was administered at 12:05 a.m. In military time, when was the medication administered?
    a) 1205
    b) 2305
    c) 0005
    d) 0105

21) Convert 4 inches to centimeters.
    a) 10.2
    b) 8.6
    c) 20.1
    d) 5.4

22) Convert 3 yards to feet.
    a) 0.5
    b) 1
    c) 6.5
    d) 9

23) Convert 2 meters to feet.
    a) 12.5
    b) 6.6
    c) 24.4
    d) 13.1

24) Convert 10 milliliters to teaspoons.
    a) 1
    b) 2
    c) 3
    d) 4

25) Convert 2 tablespoons to milliliters.
    a) 10
    b) 15
    c) 30
    d) 45

26) Convert 3 liters to fluid ounces.
    a) 32
    b) 36
    c) 48
    d) 101

27) A child weighs 8.8 kilograms. How much does the child weigh in pounds?
    a) 4
    b) 6.6
    c) 19.4
    d) 22

28) Convert 3 pounds to grams.
    a) 151.3
    b) 454
    c) 908
    d) 1361

29) The patient's temperature is 98.6°F. What would the temperature be in °C?
    a) 37
    b) 37.8
    c) 38
    d) 39.3

30) The patient's temperature is 36.8°C. What would the temperature be in °F?
    a) 99.1
    b) 98.2
    c) 100.8
    d) 101

Math Review Summative Quiz – Answer Key

Read each question and calculate the correct answer.

1) Mr. Thomas ate $\frac{7}{8}$ of his meal and Mrs. Thomas ate $\frac{9}{11}$ of her meal. Who ate more of the meal?
   a) Mr. Thomas
   b) Mrs. Thomas
   c) Neither; they ate the same amount.

2) Mr. Lambert drank $\frac{4}{5}$ of his water pitcher in the morning and $\frac{1}{6}$ of his water pitcher in the afternoon. How much of the water did he drink in total?
   a) $\frac{29}{30}$
   b) $\frac{15}{18}$
   c) $\frac{5}{11}$
   d) $1\frac{3}{63}$

3) Subtract: $\frac{3}{4} - \frac{4}{7} =$
   a) $1\frac{9}{28}$
   b) $\frac{5}{28}$
   c) $\frac{3}{7}$
   d) $1\frac{5}{16}$
   e) $\frac{4}{90}$

4) Multiply: $\frac{1}{5} \times \frac{6}{16} =$
   a) $\frac{23}{40}$
   b) $\frac{-7}{40}$
   c) $\frac{3}{40}$
   d) $\frac{8}{15}$

5) Divide: $\frac{1}{2} \div \frac{2}{3} =$
   a) $\frac{1}{3}$
   b) $\frac{-1}{6}$
   c) $1\frac{1}{16}$
   d) $\frac{3}{4}$

6) Round 0.259 to the tenths.
   a) 0.3

b) 0.26
c) 0.2
d) 0.25

7) Subtract: 0.583 – 0.21=
a) 0.562
b) 0.373
c) 0.793
d) 0.41

8) Multiply: 4.36 x 1.25 =
a) 3.49
b) 5.61
c) 5.45
d) 4.5

9) Convert $\frac{9}{12}$ to a percent.
a) 7.5%
b) 75%
c) 0.75%
d) 1.3%

10) Solve for *x*: $\frac{5}{6} = \frac{25}{x}$
a) 30
b) 1.2
c) 21
d) 120

11) Convert 365 micrograms to milligrams.
a) 0.365
b) 365,000
c) 3.65
d) 3650

12) Convert 26.7 grams to kilograms.
a) 267,000
b) 0.267
c) 0.0267
d) 2.67

13) Convert 1.25 centimeters to millimeters.
a) 0.0125
b) 12.5
c) 1250
d) 12,500

14) Convert 20 milligrams to grains.
a) 0.3

b) 0.02
c) 3
d) 0.5

15) How many teaspoons are in 2 tablespoons?
a) 12
b) 9
c) 6
d) 0.5

16) Convert 10 quarts to gallons.
a) 0.25
b) 0.5
c) 1.5
d) 2.5

17) Convert 3 pounds to ounces.
a) 48
b) 64
c) 32
d) 24

18) How many feet is 108 inches?
a) 7.5
b) 8
c) 8.5
d) 9

19) A medication was administered at 1945. In traditional time, when was the medication administered?
a) 7:45 a.m.
b) 9:45 a.m.
c) 7:45 p.m.
d) 9:45 p.m.

20) A medication was administered at 12:05 a.m. In military time, when was the medication administered?
a) 1205
b) 2305
c) 0005
d) 0105

21) Convert 4 inches to centimeters.
a) 10.2
b) 8.6
c) 20.1
d) 5.4

22) Convert 3 yards to feet.
a) 0.5

b) 1
c) 6.5
d) 9

23) Convert 2 meters to feet.
a) 12.5
b) 6.6
c) 24.4
d) 13.1

24) Convert 10 milliliters to teaspoons.
a) 1
b) 2
c) 3
d) 4

25) Convert 2 tablespoons to milliliters.
a) 10
b) 15
c) 30
d) 45

26) Convert 3 liters to fluid ounces.
a) 32
b) 36
c) 48
d) 101

27) A child weighs 8.8 kilograms. How much does the child weigh in pounds?
a) 4
b) 6.6
c) 19.4
d) 22

28) Convert 3 pounds to grams.
a) 151.3
b) 454
c) 908
d) 1361

29) The patient's temperature is 98.6°F. What would the temperature be in °C?
a) 37
b) 37.8
c) 38
d) 39.3

30) The patient's temperature is 36.8°C. What would the temperature be in °F?
a) 99.1

b) 98.2
c) 100.8
d) 101

Appendix A – Conversion Abbreviations

micrograms	**mcg**
milligram	**mg**
gram	**g**
kilogram	**kg**
pound	**lb**
ounce	**oz**
grain	**gr**
dram	**dr**
teaspoon	**tsp**
tablespoon	**T**
milliliters	**mL**
liter	**L**
fluid ounce	**fl oz**
cup	**c**
pint	**pt**
quart	**qt**
gallon	**gal**
inch	**in**
foot	**ft**
yard	**yd**
millimeters	**mm**
centimeters	**cm**
meters	**m**

Appendix B – Conversions

1 milligram	**1,000 micrograms**			
1 gram	**1,000 milligrams**	**15-16 grains**		
1 pound	**454 grams**	**16 ounces**		
1 ton	**2,000 pounds**			
1 kilogram	**1,000 grams**	**2.2 pounds**		
1 grain	**60 milligrams**			
1 dram	**60 grains**			
1 teaspoon	**5 milliliters**			
1 tablespoon	**3 teaspoons**	**15 milliliters**		
1 fluid ounce	**2 tablespoons**	**30 milliliters**		
1 cup	**½ pint**	**8 fluid ounces**		
1 pint	**2 cups**	**16 fluid ounces**	**480 mL**	
1 quart	**2 pints**	**4 cups**	**32 ounces**	**1 liter**
1 gallon	**4 quarts**	**8 pints**	**16 cups**	**128 fluid ounces**
1 inch	**2.54 centimeters**			
1 foot	**12 inches**	**30.48 centimeters**	**0.3048 meters**	
1 yard	**3 feet**			
1 meter	**100 centimeters**	**1000 millimeters**		
1 mile	**5,280 feet**	**1,760 yards**		

Temperature Conversion:

°C	**(°F - 32) x 0.5556**			
°F	**(°C x 1.8) + 32**			

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Lesson Four – Health Science Math: Methods and Oral Medications

Lesson Overview

Participants will learn to calculate using common medication calculation methods. They will also use those methods to calculate oral medication dosages. After the lesson, participants will take part in activities based on what they have learned.

Lesson Objectives

After completing this lesson, participants will be able to:

- Explain three primary methods of calculations
- Use the CSC approach to calculations
- Describe the parts of a drug label
- Calculate oral medication dosages

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• *Medical Math Student Workbook* • *Health Science Math: Methods and Oral Medications Pre-Quiz* – Answer Key	• Access *Health Science Math: Methods and Oral Medications* section in the student workbook	10 minutes
LEARN	• *Health Science Math: Methods and Oral Medications* slide presentation • *Medical Math Student Workbook* • *Health Science Math: Methods and Oral Medications Online Lesson*	• Prepare *Health Science Math: Methods and Oral Medications* slide presentation for viewing	30 minutes
REVIEW	• *Medical Math Student Workbook* • *Health Science Math: Methods and Oral Medications* – Answer Key	• None	20 minutes (can be completed during lecture)

Lesson Four – Health Science Math: Methods and Oral Medications

FOCUS: Health Science Math: Methods and Oral Medications Pre-Quiz

10 minutes

Purpose:

To assess participants' current knowledge of oral medication calculations.

Materials:

- *Medical Math Student Workbook – Health Science Math: Methods and Oral Medications Workbook*
- *Health Science Math: Methods and Oral Medications Pre-Quiz* – Answer Key

Facilitation Steps:

1. Instruct participants to complete the *Health Science Math: Methods and Oral Medications Pre-Quiz*, located in the student workbook, prior to or at the start of the class.
2. Have the *Health Science Math: Methods and Oral Medications Pre-Quiz* – Answer Key available for instructor reference.
3. Have participants pair up and compare answers.

Methods and Oral Medications Pre-Quiz – Answer Key

Read each question and calculate the correct answer. Solve using any method.

1. The order reads to administer levothyroxine 125 mcg PO at 0800. The supply is levothyroxine 250 mcg tablets. How many tablets should be administered?
   a. $\frac{1}{4}$ tablet
   b. $\frac{1}{2}$ tablet
   c. 1 tablet
   d. 2 tablets

2. The order reads to administer digoxin 250 mcg PO at 0900. The pharmacy supply is digoxin 0.25 mg tablets. How many tablets should be administered?
   a. 0.1 tablet
   b. $\frac{1}{2}$ tablet
   c. 1 tablet
   d. 2 tablets

3. The order reads to administer aspirin 325 mg PO once daily. Supply is aspirin 81 mg tablets. How many tablets should be administered?
   a. 1 tablet
   b. 2 tablets
   c. 3 tablets
   d. 4 tablets

4. The order reads to administer Halcion 0.25 mg PO at bedtime prn. The supply is Halcion 0.125 mg tablets. How many tablets should be administered?
   a. 1 tablet
   b. 2 tablets
   c. 3 tablets
   d. 4 tablets

5. The order reads to administer Cipro 750 mg PO every 12 hours. The supply is Cipro 500 mg tablets. How many tablets should be administered?
   a. $\frac{1}{4}$ tablet
   b. $\frac{1}{2}$ tablet
   c. 1 tablet
   d. 1.5 tablets

6. The order reads to administer potassium chloride liquid 80 mEq PO twice a day. The supply is an oral liquid containing 40 mEq/15 mL. How many mL should be administered?
    a. 2 mL
    b. 7.5 mL
    c. 30 mL
    d. 213 mL

7. The order reads to administer Zofran 8 mg PO tid. The pharmacy sends Zofran liquid in a 100 mL bottle labeled 4 mg/5 mL. How many mL should be administered in each dose?
    a. 5 mL
    b. 10 mL
    c. 20 mL
    d. 40 mL

8. The order reads to administer cimetidine HCL 600 mg PO bid. The label on the bottle reads 300 mg/5 mL. How many teaspoons should be administered?
    a. $\frac{1}{2}$ teaspoon
    b. 1 teaspoon
    c. 2 teaspoons
    d. 2.5 teaspoons

9. The order reads to administer digoxin 60 mcg PO once daily. The label on the bottle reads digoxin 50 mcg/mL. How many mL should be administered?
    a. 0.8 mL
    b. 1 mL
    c. 1.2 mL
    d. 1.4 mL

10. The order reads to administer morphine sulfate 20 mg every 4 hours PRN for pain. The label reads morphine sulfate 4 mg/mL. How many mL should be administered?
    a. 5 mL
    b. 6 mL
    c. 10 mL
    d. 20 mL

Lesson Four – Health Science Math: Methods and Oral Medications

LEARN: Health Science Math: Methods and Oral Medications Slide Presentation

30 minutes

Purpose:

Participants will learn how to calculate oral medication math questions using different methods.

Materials:

- *Health Science Math: Methods and Oral Medications* slide presentation
- *Medical Math Student Workbook – Health Science Math: Methods and Oral Medications (*optional – participants may complete practice problems as part of lecture)
- *Health Science Math: Methods and Oral Medications* – Answer Key
- *Health Science Math: Methods and Oral Medications Online Lesson*

Facilitation Steps:

1. Share the following information with participants as you show the slide presentation. Optional: Participants may complete practice problems in the student workbook as part of lecture.
2. Note to instructor: In lieu of the slide presentation, you may assign the *Health Science Math: Methods and Oral Medications Online Lesson*. It covers all the same content but allows participants to learn at a self-paced mode.

Slide 1: Introduction slide.

Slide 2: At the end of this lecture, you should be able to:

- Explain 3 primary methods of calculations
- Use the CSC approach to calculations
- Describe the parts of a drug label
- Calculate oral medication dosages

Slide 3: For all calculations, we will be using the CSC approach. Convert if needed, solve, and check. First, complete any conversions needed. You may need to convert grams to milligrams or pounds to kilograms before you start. This depends on which method you use. In dimensional analysis, the conversion is built into the formula, but you still need to identify if a conversion is needed. Then solve the equation. We will discuss three different methods, but you do not need to know all three. Select the one you are the most comfortable with and the one that gets you the correct answer every time. Finally, check your answer. Does it make sense? For example, if you get 200 tablets as an answer, are you really going to give a patient 200 tablets? Or maybe you have your decimal places off, and it is 2 tablets? The answer should be realistic. Do you need someone to double-check? In some dosage calculations, a small error can be deadly. It is always safe to have someone else do the calculation too and verify your answer.

Slide 4: Methods title slide.

Slide 5: The ratio-proportion method is set up like a fraction and used in conversion calculations. It can also be used for medication calculations. Cross multiply to solve for x.

Realityworks Live it. Learn it.

Slide 6: The desired/have, also known as need/have or formula method, is similar to the ratio-proportion method and easy to check. Units must match in the equation, so you need to convert before setting up the equation.

Slide 7: Dimensional analysis is the algebraic way of calculating using a formula. You must use the labels to accurately set up the equation. Build the equation by placing information with the same label as the preceding denominator in the numerator so that unwanted labels will cancel out. This method is used in more complex calculations.

Slide 8: As you can see in the example, you start with what the question is asking for. In this case, it is hours per week. Since hours is the first unit, place that on top as the first numerator. Then you need to figure out how to get to the second half of the question (weeks). We know that there are 24 hours in a day and 7 days in a week. The days in the week is our conversion factor since it has part of the "supply" and part of the "order". Make sure the labels are opposite one another so they cancel out leaving what you need. Multiply across to get your answer.

Slide 9: There are some general rules for dosage calculations.

- Use leading zeroes
    - Example: 0.25 mg (correct); .25 mg (incorrect)
- No trailing zeroes
    - Example: 1.5 mg (correct); 1.50 mg (incorrect)
- Label answers
    - Example: 4.3 mg (correct); 4.3 (incorrect)
- Rounding varies; this is based on patient age (pediatrics vs. adult), type of medication (capsules vs. tablets), or delivery of medication (oral syringe vs. medication cup)

Slide 10: Reading Labels title slide.

Slide 11: Before preparing a dose of medication, it is important to read the drug label. Locate the drug name. Here the generic is listed, but there may also be a trade name. Confirm that it is in the correct drug form (liquid, pill, etc.) This one is an oral suspension. Next, what is the strength? Here you will see how many milligrams there are in every 5 milliliters. In total, this vial holds 100 milliliters. For oral medications that are tablets or capsules, you will see the milligrams per tablet/capsule and the total number of tablets/capsules in the bottle. Now locate the directions. It is vital to prepare and store the medication properly. Finally, find the lot number and expiration date. Sometimes lot numbers are part of documentation. As part of your medication checks, you will have to verify it is not expired.
**Note: Trade names are copyrighted so they will not be used in the lecture.*

Slide 12: Let's Practice!
What is the name of this medication? *Cephalexin*
What form does it come in? *Capsules*

What is the medication strength? *250 mg*
How many are in this bottle? *100 capsules*
What is the expiration date? *10/2030*
Is there anything else you should know about the medication? *Prescription only, keep away from children, light sensitive, store at 77°F*

Slide 13: Tablets and Capsules title slide.

Slide 14: When administering tablets or capsules, first look at the order and the supply. Pay attention to the supply strength. Determine what is needed and what you have. Capsules and enteric-coated tablets cannot be split so you should have a whole number answer for those calculations. Round to nearest half for scored tablets as these can be split in half. Convert, solve, and check.

Slide 15: *Participants may solve using any method.*

Slide 16: *Answer: 2 capsules*
Have the participants practice checking their answers.

Slide 17: Oral Liquid Medications title slide.

Slide 18: Just like oral tablets and capsules, you need to look at the order, determine what is needed, and what you have. Liquid medications contain a certain amount in a certain volume. You will see it written like 5mg/2mL. Use any of the methods. Round to the tenths if your answer is greater than 1mL and to the hundredths if less than 1mL.

Slide 19: *Participants may solve using any method.*

Slide 20: *Answer: 20.3mL*
Have the participants practice checking their answers.

Slide 21: Closing slide.

Lesson Four – Health Science Math: Methods and Oral Medications

REVIEW: Health Science Math: Methods and Oral Medications

20 minutes

Purpose:

Participants will practice oral medication math questions using different methods.

Materials:

- *Medical Health Student Workbook – Health Science Math: Methods and Oral Medications*
- *Health Science Math: Methods and Oral Medications* – Answer Key

Facilitation Steps (this may have been completed as part of lecture):

1. Have the participants complete the practice questions in the *Health Science Math: Methods and Oral Medications* section in the student workbook.
2. Answer any questions participants may have on the calculations.
3. Have participants self-check or peer-check their answers as you share them from the *Health Science Math: Methods and Oral Medications* – Answer Key.

Methods and Oral Medications – Answer Key

Methods

Ratio/Proportion

- Set up like a fraction
- Used in conversions
- Cross multiply to solve for x

Supply **Order**

$$\frac{100\text{ mg}}{5\text{ mL}} = \frac{300\text{ mg}}{x\text{ mL}}$$

100 x x = 100x

300 x 5 = 1500

$$\frac{100x}{100} = \frac{1500}{100} = 15\text{ mL}$$

Practice Questions

1) The order reads to administer digoxin 280 mcg PO. The pharmacy supply is digoxin 0.1875 mg per tablet. How many tablets should be administered? Solve using CSC and ratio/proportion.

Convert: 280 mcg = 0.28 mg

Solve: $\frac{0.1875\text{ mg}}{1\text{ tab}} = \frac{0.28\text{ mg}}{x\text{ mL}}$

0.1875 x x = 0.1875x

0.28 x 1 = 0.28

$$\frac{0.1875x}{0.1875} = \frac{0.28}{0.1875} = 1.49$$

1.49 = 1.5 tablets

Check!

Desired/Have

- Similar to ratio/proportion method
- Easy to check
- Unit must match so you must convert before setting up equation
- Also known as formula method

(D/H) x Q

Order: 300 mg

Supply: 100 mg/5 mL

$\left(\frac{300 \text{ mg (desired)}}{100 \text{ mg (have)}}\right)$ x 5 mL (quantity) = 3 x 5 = 15 mL

Dimensional Analysis

- Algebraic way using a formula
- Must use labels
- Start with unit of measure needed
- Build equation by placing information with the same label as the preceding denominator in the numerator so that unwanted labels will cancel out
- Used in more complex calculations

Supply **CF** **Order**

$x \text{ (label)} = \frac{\text{dosage unit}}{\text{dose supplied}} \text{ x conversion factor x } \frac{\text{order}}{1}$

2) The order reads to administer digoxin 610 mcg PO. The pharmacy supply is digoxin 0.125 mg per tablet. How many tablets should be administered? Solve using CSC and desired/have.

Convert: 610 mcg = 0.61 mg

Solve:

$\left(\frac{0.61 \text{ mg (desired)}}{0.125 \text{ mg (have)}}\right)$ x 1 tab (quantity) = 4.88 = **5 tablets**

Check!

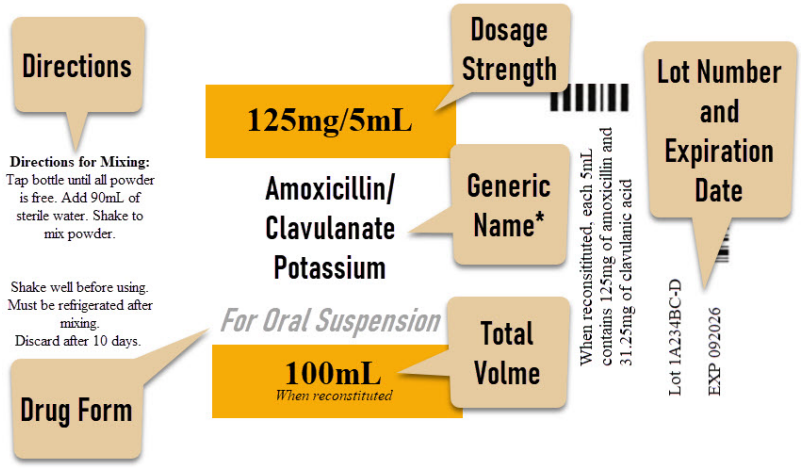
3) The order reads to administer digoxin 1365 mcg PO. The pharmacy supply is digoxin 0.25 mg per tablet. How many tablets should be administered? Solve using dimensional analysis.

Solve: $x \text{ (tablets)} = \frac{1 \text{ tablet}}{0.25 \text{ mg}} \text{ x } \frac{1 \text{ mg}}{1000 \text{ mcg}} \text{ x } \frac{1365 \text{ mcg}}{1} = 5.46 =$ **5.5 tablets**

Check!

Reading Labels

Example:



For Practice:

Practice Questions

1) What is the name of this medication?
   Solaris (eculizumab)

2) What form does it come in?
   Concentrated solution

3) What is the medication strength**?**
   10 mg/mL

4) What is the total volume?
   30 mL

5) Is there anything else you should know about the medication? **Single use vial, IV infusion only, must be diluted, Rx only**

Tablets and Capsules

Steps

- Look at the order and drug label (supply)
- Determine what is needed and what you have
- Round to whole numbers if capsules and enteric coated tablets
- Round to nearest half for scored tablets
- Convert, solve, and check

Practice Questions

1) Order: 0.045 grams orally every 8 hours
   Supply: 15 mg/capsule
   How many capsules would you administer? Solve using any method.

   3 capsules

2) Order: 12500 mcg orally twice daily.
   Supply: 5 mg/tablet
   How many tablets would you administer? Solve using any method.

   2.5 tablets

Oral Liquid Medications

Steps

- Look at the order and drug label (supply)
- Determine what is needed and what you have
- Liquid medications contain a certain amount of medication within a set volume
- Example: 5 mg / 2 mL
- May use any of the methods
    - Round to tenths if greater than 1 mL
    - Round to hundredths if less than 1 mL

Practice Questions

1) Order: 500 mg orally as needed for pain.
   Supply: 250 mg/2 mL
   How many mL would you administer? Solve using any method.

   4 mL

2) Order: 1.5 g orally as three times a day.
   Supply: 500 mg/10 mL
   How many mL would you administer? Solve using any method.

   30 mL

Lesson Five – Health Science Math: Pediatric Dosages

Lesson Overview

Participants will learn to calculate pediatric dosages. After the lesson, participants will take part in activities based on what they have learned.

Lesson Objectives

After completing this lesson, participants will be able to:

- Calculate dosages based on weight
- Calculate dosages based on body surface area
- Calculate safe dosage ranges

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• *Medical Math Student Workbook* • *Health Science Math: Pediatric Dosages Pre-Quiz* – Answer Key	• Access the *Health Science Math: Pediatric Dosages* section in the student workbook	10 minutes
LEARN	• *Health Science Math: Pediatric Dosages* slide presentation • *Medical Math Student Workbook* • *Health Science Math: Pediatric Dosages Online Lesson*	• Prepare *Health Science Math: Pediatric Dosages* slide presentation for viewing	30 minutes
REVIEW	• *Medical Math Workbook* • *Health Science Math: Pediatric Dosages* – Answer Key	• None	20 minutes (can be completed during lecture)

Lesson Five – Health Science Math: Pediatric Dosages

FOCUS: Health Science Math: Pediatric Dosages Pre-Quiz

10 minutes

Purpose:

To assess participants' current knowledge of pediatric medication calculations.

Materials:

- *Medical Math Student Workbook – Health Science Math: Pediatric Calculations*
- *Health Science Math: Pediatric Calculations Pre-Quiz* – Answer Key

Facilitation Steps:

1. Instruct participants to complete the *Health Science Math: Pediatric Calculations Pre-Quiz*, located in the student workbook, prior to or at the start of the class.
2. Have the *Health Science Math: Pediatric Calculations Pre-Quiz* – Answer Key available for instructor reference.
3. Have participants pair up and compare answers.

Pediatric Dosages Pre-Quiz – Answer Key

Read each question and calculate the correct answer. Solve using any method.

1. Administer clarithromycin 7.5 mg/kg PO every 12 hours. The child weighs 25 kg. How many milligrams should be administered?

a) 85.2 mg
b) 187.5 mg
c) 412.5 mg
d) 1875 mg

2. Administer Narcan 0.01 mg/kg stat for a neonate who weighs 3300 grams. The vial supplied is 0.4 mg/mL. How many mL should be administered?

a) 0.08 mL
b) 0.8 mL
c) 8 mL
d) 80 mL

3. Ampicillin is labeled 250 mg/5 ml and comes in a bottle containing 120 ml. A child is discharged on 250 mg q 6 hours. How many teaspoons would you instruct the mother to give every 6 hours?

a) $\frac{1}{4}$ teaspoon
b) $\frac{1}{2}$ teaspoon
c) $\frac{3}{4}$ teaspoon
d) 1 teaspoon

4. Administer acetaminophen 15 mg/kg PO every 6 hours PRN for fever. The child weighs 6.7 kg and the label on the bottle of acetaminophen reads: 100 mg/mL. How many mL should be administered?

a) 0.5 mL
b) 1 mL
c) 6 mL
d) 10 mL

5. Administer Oxacillin 50 mg/kg PO every 6 hours. The child weighs 22 lbs. and the label on the bottle reads: Oxacillin 250 mg/5 mL. How many mL should be administered?

a) 2 mL
b) mL
c) 5 mL

d) 10 mL

6. Administer aminophylline 3 mg/kg PO twice daily. The patient weighs 55 lbs. and the label reads: aminophylline 105 mg/5 mL. How many mL should be administered?

a) 0.7 mL
b) 3 mL
c) 4 mL
d) 5 mL

7. The patient weighs 56 lbs. and is 3 feet 10 inches. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(in) x wt (lb)}}{3131}}$

a) 0.6 m^2
b) 0.91 m^2
c) 1.2 m^2
d) 1.42 m^2

8. The patient weighs 39 kg and is 122 cm. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(cm) x wt (kg)}}{3600}}$.

a) 1.15 m^2
b) 1.5 m^2
c) 13.2 m^2
d) 15 m^2

9. The provider orders 150 mg of Rocephin to be taken every 8 hours by an infant weighing 10.2 lbs. The medication label shows that 75-150 mg/kg per day is the appropriate dosage range. Is this order within the desired range? Dose is 450 mg/day. Range is 348 -696 mg

a) Yes
b) No

10. For children under 12 years of age, the recommended dose of acetaminophen is 10 to 15 mg/kg every 6 hours, not to exceed 50-75 mg/kg in 24 hours. What is the safe dosage range per day for a 9-year-old weighing 28 kg?

a) 50 – 75 mg
b) 280 – 420 mg
c) 1400 – 2100 mg
d) 1680 – 2520 mg

Lesson Five – Health Science Math: Pediatric Dosages

LEARN: Health Science Math: Pediatric Dosages Slide Presentation

30 minutes

Purpose:

Participants will learn how to calculate pediatric medication dosages.

Materials:

- *Health Science Math: Pediatric Dosages* slide presentation
- *Medical Math Student Workbook – Health Science Math: Pediatric Dosages* (optional – participants may complete practice problems as part of lecture)
- *Health Science Math: Pediatric Dosages* – Answer Key
- *Health Science Math: Pediatric Dosages Online Lesson*

Facilitation Steps:

1. Share the following information with participants as you show the slide presentation. Optional: Participants may complete practice problems in the student workbook as part of lecture.
2. Note to instructor: In lieu of the slide presentation, you may assign the *Health Science Math: Pediatric Dosages Online Lesson*. It covers all the same content but allows participants to learn at a self-paced mode.

Slide 1: Introduction slide.

Slide 2: At the end of this lecture, you will be able to:

- Calculate dosages based on weight
- Calculate dosages based on body surface area
- Calculate safe dosage ranges

Please note that while these are common in pediatrics they can also be seen in adult populations.

Slide 3: Medications for pediatrics are commonly dosed according to body weight (mg/kg) or body surface area (mg/m^2).
When calculating doses in weights, medications that are less than 1 mg should be rounded two decimal places (hundredths place).
Doses that are 1 mg – 10 mg should be rounded to one decimal place (tenths place).
Doses greater than 10 mg should be rounded to the whole number.
This is a general rule, but facilities and situations could be different. Sometimes questions will specifically tell you what to round to. For the purpose of this unit, we will use the general rules.

Slide 4: Dose per Weight title slide.

Slide 5: Drugs are metabolized more quickly in children than adults. Therefore, dosages related

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to body weight may be higher. It is important to use a pediatric-specific drug reference for the calculations. You may be asked to calculate a single dose, single dose range, daily dose, or daily dose range.

Slide 6: Let's remember CSC – convert, solve, check.
First, you will need to convert. This may be pounds to kilograms, ounces to kilograms, or grams to kilograms.
Always use the most recent weight and round to hundredths.
Take a look at this question. What unit is the weight in? What unit does it need to be in?
Solve using any method.
Have participants do the conversion. *Answer: 18.18 kg*

Slide 7: *Answer: 5.7 mL*
Have the participants practice checking their answers.
Ask participants why it cannot be 5.68?
Answer: *1 – 10 = round to tenths place*

Slide 8: Participants may solve using any method.

Slide 9: *Answer: 13 mL*
Have the participants practice checking their answers.
Ask participants why it cannot be 12.8?
Answer: *Greater than 10, round to the whole number*

Slide 10: Dose per Body Surface Area title slide.

Slide 11: There are two formulas based on the type of units. One is metric and the other household.

Slide 12: Participants may solve using the formula.

Slide 13: *Answer: 0.71*
Have the participants practice checking their answers.
Ask participants why it cannot be 0.7.
Answer: *Less than 1 = round to hundredths place*
If this patient is ordered a medication dose of 15 mg/ m^2/day by mouth for 7 days, what is the daily dose of medication the patient will receive?
Solve using any method.

Slide 14: *Answer: 10.65 mg = 11 mg*
Have the participants practice checking their answers.

Slide 15: You may also figure out a child's dose based off an adult dose. The formula uses the child's body surface area. Try this problem and use the formula provided.

Slide 16: The answer is not rounded up to 171 mg since we don't want to round twice. The next step would be to find out how many tablets or mL this child would receive. That is when you would round. If we round now and round then, the ending dose would not be as accurate.

Slide 17: Dosage Ranges title slide.

Slide 18: Dosage ranges are calculated to determine if a dose is safe to give. In references, safe doses have ranges of a minimum safe dose and a maximum safe dose. When calculating, you may be asked what the safe range is per dose, per day, or per week.

Slide 19: Participants may solve using any method. Advise that weight may need converting in some questions.

Slide 20: *Answer: Min = 65; Max = 97.5*

This is not a safe dose, and the provider should be contacted. Have the participants practice checking their answers.

Slide 21: Just remember to always double-check your answer. A second person should do the calculation separately; then both results should be compared.
Select someone who is qualified to give medication or someone in the department who is delegated for this purpose.
Errors are easily made and overlooked! Over- and underdosing is a concern with pediatrics.

Slide 22: Closing slide.

Lesson Five – Health Science Math: Pediatric Dosages

REVIEW: Health Science Math: Pediatric Dosage

20 minutes

Purpose:

Participants will practice calculating pediatric medication dosages.

Materials:

- *Medical Math Student Workbook – Health Science Math: Pediatric Dosages*
- *Health Science Math: Pediatric Dosages* – Answer Key

Facilitation Steps (this may have been completed as part of lecture):

1. Have the participants complete the practice questions in the *Health Science Math: Pediatric Dosages* section in the student workbook.
2. Answer any questions participants may have on the calculations.
3. Have participants self-check or peer-check their answers as you share them from the *Health Science Math: Pediatric Dosages* – Answer Key.

Pediatric Dosages – Answer Key

Dose per Weight

- Children metabolize drugs faster than adults
- May need more medication per kilogram
- Use a pediatric-specific drug reference
- May be a single dose, single dose range, daily dose, or daily dose range
- May need to convert
    - pounds to kilograms
    - ounces to kilograms
    - grams to kilograms
- Always use the most recent weight and round to hundredths

Practice Questions

1) A 55-lb. child was ordered for acetaminophen 15 mg/kg PO every 4 hours as needed for pain. How many mg would you administer? Solve using any method.

   375 mg

2) A 25-lb. child was ordered for acetaminophen 10 mg/kg PO every 4 hours as needed for pain. Supply is 150mg/5ml. How many mL would you administer? Solve using any method.

   3.8 mL

Dose per Body Surface Area

Formulas:

Metric

$$m^2 = \sqrt{\frac{ht(cm) \times wt\ (kg)}{3600}}$$

Household

$$m^2 = \sqrt{\frac{ht(in) \times wt\ (lb)}{3131}}$$

Child's Dose

$$\frac{\text{Child's BSA}}{1.73\ m^2} \times \text{Normal Adult Dose}$$

Practice Questions

1) Calculate the body surface area for a 2 ft 5 in tall 1-year-old child who weighs 15.2 lbs.

   0.38 m²

2) Calculate the body surface area for a 123 cm tall 8-year-old child who weighs 36.5 kg.

   1.12 m²

3) For the 8-year-old child above, the provider ordered a medication that has a normal adult dose of 125 mg. The medication is supplied as 100 mg/ml. How much should you administer?

   0.9 mL

Dosage Ranges

Reason for Calculating

- To determine if a dose is safe to give
- In references, safe doses have ranges
- Need to find the minimum safe dose and the maximum safe dose
- Note time range (per dose, per day, or per week)

Practice Questions

1) A child weighing 13.2 lbs. has been prescribed acetaminophen 100 mg every 4-6 hours PO for a fever. The recommended dosage range is 10-15 mg/kg/dose. Calculate the acceptable dosage range and determine if the prescribed dose is safe. Solve using any method.

   Minimum dose: 60 mg
   Maximum dose: 90 mg
   The dose is unsafe.

Lesson Six – Health Science Math: Injection Calculations

Lesson Overview

In lesson six, participants will learn to calculate injectable dosages such as intradermal, intramuscular, IV push, and subcutaneous. After the lesson, participants will take part in activities based on what they have learned.

Lesson Objectives

After completing this lesson, participants will be able to:

- Calculate intradermal intramuscular, IV push, and subcutaneous dosages
- Calculate insulin dosages
- Calculate heparin dosages
- Calculate dosages requiring reconstitution

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• *Medical Math Student Workbook* • *Health Science Math: Injection Calculations Pre-Quiz* – Answer Key	• Access *Health Science Math: Injection Calculations* section in the student workbook	10 minutes
LEARN	• *Health Science Math: Injection Calculations* slide presentation • *Medical Math Student Workbook* • *Health Science Math: Injection Calculations Online Lesson*	• Prepare *Health Science Math: Injection Calculations* slide presentation for viewing	30 minutes
REVIEW	• *Medical Math Student Workbook* • *Health Science Math: Injection Calculations* – Answer Key	• None	20 minutes (can be completed during lecture)

Lesson Six – Health Science Math: Injection Calculations

FOCUS: Health Science Math: Injection Calculations Pre-Quiz

10 minutes

Purpose:

To assess participants' current knowledge of calculating dosages for injection.

Materials:

- *Medical Math Student Workbook*
- *Health Science Math: Injection Calculations Pre-Quiz* – Answer Key

Facilitation Steps:

1. Instruct participants to complete the *Health Science Math: Injection Calculations Workbook Pre-Quiz*, located in the student workbook, prior to or at the start of the class.
2. Have the *Health Science Math: Injection Calculations Pre-Quiz* – Answer Key available for instructor reference.
3. Have participants pair up and compare answers.

Injection Calculations Pre-Quiz – Answer Key

1. The order reads to administer dexamethasone 5 mg IM every 12 hours. The vial label reads dexamethasone 4 mg/mL. How many mL should be administered?

a) 0.8 mL
b) 0.63 mL
c) **1.3 mL**
d) mL

2. Administer metoprolol 5 mg IV every 2 minutes for 3 doses for a total of 15 mg. Give over 1 – 2 minutes. The vial supplied is 1 mg/mL. How many mL should be administered per dose?

a) 2.5 mL
b) **5 mL**
c) 7.5 mL
d) 15 mL

3. Order: Humalog KwikPen 16 units subcutaneous three times daily before meals. Each pen is 300 units. How many pens are needed for 3 weeks? (Dose cannot be split between 2 pens.)

a) 2 pens
b) 3 pens
c) **4 pens**
d) 5 pens

4. Order is for Humulin 70/30 Prefilled Pen 35 units subcutaneous twice daily before breakfast and dinner. Each pen is 300 units. How many pens are needed for 1 week? (Dose cannot be split between 2 pens.)

a) **2 pens**
b) 3 pens
c) 4 pens
d) 5 pens

5. Calculate the insulin dose for a patient who consumed 240 grams of carbohydrates and has an ordered ratio of 20 grams/unit. *Use the formula:* total carbohydrates (grams) × insulin-to-carbohydrate ratio (unit/gram) = carbohydrate insulin dose (units)

a) 0.13 units
b) 3 units
c) **12 units**
d) 3000 units

6. Calculate the insulin dose for a patient who consumed 120 grams of carbohydrates and has an ordered ratio of 15 grams/unit. *Use the formula:* total carbohydrates (grams) × insulin-to-carbohydrate ratio (unit/gram) = carbohydrate insulin dose (units)
a) 0.13 units
b) 2.7 units
c) 6.6 units
d) **8 units**

7. The order is for heparin 2,000 units every 8 hours subcutaneous. The vial reads 2,500 units/mL. How much should you administer? Solve using any method.
a) 0.8 mL
b) 1.3 mL
c) 1.4 mL
d) 1.7 mL

8. The order is for heparin 17,500 units IV push followed by a heparin infusion. The vial reads 40,000 units/2 mL. How much should you administer? Solve using any method.
a) 0.4 mL
b) 0.6 mL
c) **0.9 mL**
d) 1.2 mL

9. Administer Solu-Medrol 40 mg IV every 4 hours. The vial states to add 1.8 mL sterile water to yield a concentration of 125 mg/2 mL. How many mL should be administered?
a) 0.58 mL
b) **0.64 mL**
c) 2.2 mL
c) 5.6 mL

10. Administer ampicillin 500 mg IM every 8 hours. After adding 3.6 mL of diluent, the vial contains 250 mg/mL. How many mL should be delivered?

a) **2 mL**
b) 4 mL
c) 6 mL
d) 7 mL

Lesson Six – Health Science Math: Injection Calculations

LEARN: Health Science Math: Injection Calculations Slide Presentation

30 minutes

Purpose:

Participants will learn how to calculate dosages for injection.

Materials:

- *Health Science Math: Injection Calculations* slide presentation
- *Medical Math Student Workbook – Health Science Math: Injection Calculations* workbook pages (optional – participants may complete practice problems as part of lecture)
- *Health Science Math: Injection Calculations* – Answer Key
- *Health Science Math: Injection Calculations Online Lesson*

Facilitation Steps:

1. Share the following information with participants as you show the slide presentation. Optional: Participants may complete practice problems (*Health Science Math: Injection Calculations*) as part of lecture.
2. Note to instructor: In lieu of the slide presentation, you may assign the *Health Science Math: Injection Calculations Online Lesson*. It covers all the same content but allows participants to learn at a self-paced mode.

Slide 1: Introduction slide.

Slide 2: At the end of this lecture, you will be able to:

- Calculate intradermal, intramuscular, intravenous (IV) push, and subcutaneous dosages
- Calculate insulin dosages
- Calculate heparin dosages
- Calculate dosages requiring reconstitution

Slide 3: Injectable medications can come in many different forms. Some vials containing liquid, and some contain powder. Insulin can be in pens and measured in units. Other medications use syringes that come in milliliters. It is important to know what equipment is going to be used in order to calculate correctly.

Slide 4: Intradermal, Intramuscular, Intravenous, and Subcutaneous Dosages title slide.

Slide 5: Before calculating the dose, review the order for the correct route. Look at the vial to make sure it is for injection. If you are calculating the dose of an IV push medication, the time needed to give the dose is not needed in the calculation. Locate the dosage strength as this will be used in calculations. Calculate like oral medications.

Slide 6: Rounding is related to the volume needed, dose that is calculated and the syringe being used. If the volume calculated is less than 1 mL and does not calculate evenly to tenths,

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round to hundredths and use a 1 mL syringe or 0.5 mL syringe. If the volume is greater than or equal to 0.5 but less than 1 mL and volume calculates exactly in tenths, use a 1 mL syringe or 3 mL syringe. If the volume calculated is 1 mL to 3 mL, round to the tenths and use a 3 mL syringe.

Slide 7: *Participants may solve using any method.*

Slide 8: *Answer: 0.06 mL*

Have the participants practice checking their answers.

Ask participants why it cannot be .06?
Answer: *A preceding zero needs to be in place to prevent errors.*

Slide 9: Take a look at this problem and read the question carefully. What information do we need and not need to calculate the dose?

Slide 10: Since the question is asking about one dose, you do not need how often the dose is given and the amount of time to give the dose over. After we take those out, you can see the equation is basic.
Participants may solve using any method.

Slide 11: *Answer: 0.4 mL*
Have the participants practice checking their answers.

Slide 12: Insulin and Heparin Dosages title slide.

Slide 13: Insulin is a high alert medication by the Institute for Safe Medication Practices. It means that errors with this medication can result in harm or even death of a patient. Insulins are measured in units not milliliters. Since there are multiple types of insulins, you should confirm what type of insulin and syringe is needed. Note that U-100 insulin and syringes are not the same as U-500. U-100 insulin should be measured in U-100 syringes; U-500 insulin in U-500 syringes. Rounding units down will prevent insulin overdose. For example, if the dose is 7.7 units, administer 7 units and not 8. There are many different calculations with insulin. We will focus on calculating pens and dose based on carbohydrates.
You may practice other insulin calculations at this time.

Slide 14: Participants may solve using any method. Sometimes pens do not have enough for a full dose and there is leftover insulin. Best practice is not to inject patients multiple times to create the correct dose. One injection should have the full dose.
If needed, here is an example: There are 12 units leftover in a pen. We would not inject the patient twice (once with 12 units and one with 36) to make the 48 units needed. Also, in-use pens are to be disposed of after 10 days.

Slide 15: Answer: *10 pens*
Have the participants practice checking their answers.
If doses are not rounded to full doses, answer will be 9. Ask participants why it cannot be 9 pens?
Answer: *Best practice is to only inject patient once.*

Slide 16: Carbohydrate insulin dose is the amount of insulin needed to dispose of the carbohydrates in the meal. The insulin to carbohydrate ratio is ordered by provider and may be paired with a sliding scale. The formula is total carbohydrates (grams) × insulin-to-

carbohydrate ratio (unit/gram) = carbohydrate insulin dose (units).

Slide 17: Participants may solve using any method.

Slide 18: Answer: *5 units*
Have the participants practice by checking their answers.
Slide 19: Like insulin, heparin is another high alert medication. It comes in United States Pharmacopeia (USP) units and is administered with syringe calibrated in milliliters. Heparin is commonly found in vials.

Slide 20: *Participants may solve using any method.*

Slide 21: *Answer: 0.8 mL per dose; 2.4 mL per day*
Have the participants practice checking their answers.

Slide 22: Reconstitution Dosages title slide

Slide 23: Medications can come in powder form. To make them liquid, a diluent such as bacteriostatic water, sterile water, or sterile normal saline, are added to the powder. The powder dissolves into the diluent and then the medication can be used in an injectable form. Reconstitution can expand strength of the dose. For example, 1 gram of a powder medication can turn into 1,000 mg/10 mL after only 8 mL of diluent is added.

Slide 24: Let's take a look at this label.
What diluent will you need to add and how much? *90 mL of sterile water.*
What is the dosage strength? *125 mg/5 mL*

Slide 25: Here is a practice reconstitution calculation. Please note that you do not need the amount of the diluent to calculate dose (highlighted in red). Use the amount ordered and ending strength (highlighted in yellow). Remember to convert, solve, and check!
Participants may solve using any method.

Slide 26: *Answer: 3 mL*

Have the participants practice checking their answers.

Slide 27: Closing slide.

Lesson Six – Health Science Math: Injection Calculations

REVIEW: Health Science Math: Injection Calculations

20 minutes

Purpose:

Participants will practice calculating dosages for injection.

Materials:

- *Medical Math Student Workbook*
- *Health Science Math: Injection Calculations* – Answer Key

Facilitation Steps (this may have been completed as part of lecture):

1. Have the participants complete the practice questions in the *Medical Math Student Workbook – Health Science Math: Injection Calculations* section in the student workbook.
2. Answer any questions participants may have on the calculations.
3. Have participants self-check or peer-check their answers as you share them from the *Health Science Math: Injection Calculations* – Answer Key.

Injection Calculations - Answer Key

Intradermal, Intramuscular, IV push, and Subcutaneous Dosages

- Review order, paying attention to route
- Review supply, focusing on dosage strength
- IV push medications are given over a specific
  - Not used in calculating dose
- Calculate like oral meds

Volume	Dose	Rounding	Syringe
Less than 1 mL	Does not calculate evenly to tenths (example: 0.543)	Round to hundredths	Use 0.5 mL or 1 mL
Greater than or equal to 0.5 mL but less than 1 mL	Calculates to tenths (example: 0.5)	Do not round – leave at tenths	Use 1 mL or 3 mL
1 mL to 3 mL	Example: 1.534	Round to tenths	Use 3 mL

Practice Questions

1) The order reads: Atropine 0.3 mg IM now. The label on the vial reads: Atropine 400 mcg/mL. How many mL should be administered? Solve using any method.

   0.75 mL

2) Order reads to inject Laviv 0.1 mL ID per centimeter of facial wrinkle. The client has a 12 cm of wrinkles to be treated. The label on the vial reads: Laviv 18 million cells in 1.2 mL. How many vials would be needed? Solve using any method.

   1 vial

Insulin and Heparin Dosages

Insulin:

- Considered a "High Alert" medication
- Measured in units not milliliters
- Know what type of insulin and syringe is needed
- U-100 is not the same as U-500
- Do not round up!
- Carbohydrate insulin dose is the amount of insulin needed to dispose of the carbohydrates in the meal.
    - Insulin to carbohydrate ratio is ordered by provider

total carbohydrates (grams) × insulin-to-carbohydrate ratio (unit/gram) = carbohydrate insulin dose (units)

Heparin:

- Considered a "High Alert" medication
- Measured in units not milliliters but administered with milliliter syringe
- Comes in vials

Practice Questions

1) Order: Humalog KwikPen 8 units subcutaneous three times daily before meals. Each pen is 300 units. How many pens are needed for 2 weeks?

   2 pens

2) Calculate the insulin dose for a patient who consumed 150 grams of carbohydrates and has an ordered ratio of 20 grams/unit.

   7.5 = 7 units

3) The order is for heparin 7,500 units every 8 hours subcutaneous. The vial reads 10,000 units per 2 mL. How much should you administer? Solve using any method.

   1.5 mL

Reconstitution Dosages

Reason for Calculating

- Medications can come in powder form
- Need diluent to mix
- Label has directions for reconstituting
- Reconstitution can expand strength of dose
    - 1 gram of a powder medication can turn into 1000 mg/10 mL after only 8 mL of diluent is added.

Practice Questions

1) Administer 500 mg of Kefzol IM every 8 hours. After reconstitution with 2.5 mL diluent, the strength of the Kefzol solution is 330 mg/ mL. How many mL should be administered? Solve using any method.

   1.5 mL

Lesson Seven – Health Science Math: Infusion Calculations

Lesson Overview

In lesson seven, participants will learn to calculate infusion dosages. After the lesson, participants will take part in activities based on what they have learned.

Lesson Objectives

After completing this lesson, participants will be able to:

- Calculate dosage for IV administration via pump
- Calculate dosage for IV via gravity
- Calculate time for IV administration

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• *Medical Math Student Workbook* • *Health Science Math: Infusion Calculations Pre-Quiz* – Answer Key	• Access *Health Science Math: Infusion Calculations* section in the student workbook	10 minutes
LEARN	• *Health Science Math: Infusion Calculations* slide presentation • *Medical Math Student Workbook* • *Health Science Math: Infusion Calculations Online Lesson*	• Prepare *Health Science Math: Infusion Calculations* slide presentation for viewing	30 minutes
REVIEW	• *Medical Math Student Workbook* • *Health Science Math: Infusion Calculations* – Answer Key • *Health Science Math Summative Quizzes* • *Math Review Summative Quiz* – Answer Keys	• Print off and distribute the *Health Science Math Summative Quizzes*	20 minutes (can be completed during lecture)

Lesson Four – Health Science Math Part 4

FOCUS: Health Science Math: Infusion Calculations Pre-Quiz

10 minutes

Purpose:

To assess participants' current knowledge of calculating
dosages for infusion administration via pump and gravity.

Materials:

- *Medical Math Student Workbook – Health Science Math: Infusion Calculations*
- *Health Science Math: Infusion Calculations Pre-Quiz* – Answer Key

Facilitation Steps:

1. Instruct participants to complete the *Health Science Math: Infusion Calculations Pre-Quiz*, located in the student workbook, prior to or at the start of the class.
2. Have the *Health Science Math: Infusion Calculations Pre-Quiz* – Answer Key available for instructor reference.
3. Have pair up and compare answers.

Infusion Calculations Pre-Quiz – Answer Key

Read each question and calculate the correct answer. Solve using any method.

1. Order is for 100 mL gentamicin over 30 minutes. What is the flow rate?
   a. 50 mL
   b. 100 mL/hr
   c. 200 mL/hr
   d. 300 mL/hr

2. Order is for 100 mL gentamicin over 30 minutes. Drop factor is 20 gtts/m. What is the drip rate?
   a. 33 gtts/min
   b. 67 gtts/min
   c. 150 gtts/min
   d. 200 gtts/min

3. The provider ordered 850 mL D5/0.45% NS to infuse in 6 hours. What is the flow rate (mL/hr)?
   a. 142 mL/hr
   b. 175 mL/hr
   c. 240 mL/hr
   d. 300 mL/hr

4. The provider ordered 850 mL D5/0.45% NS to infuse in 6 hours using micro-drip tubing (60 gtts/mL). What is the drip rate?
   a. 81 gtts/min
   b. 106 gtts/min
   c. 142 gtts/min
   d. 183 gtts/min

5. 40 mEq KCL is infusing in 100 mL of Normal Saline over 45 minutes. What is the flow rate?
   a. 22 mL/hr
   b. 53 mL/hr
   c. 75 mL/hr
   d. 134 mL/hr

6. 40 mEq KCL is infusing in 100 mL of Normal Saline over 45 minutes. The drop factor is 10 gtts/mL. What is the drip rate?
   a. 22 gtts/min
   b. 53 gtts/min
   c. 45 gtts/min
   d. 75 gtts/min

7. Order is for 750 mL of Normal Saline to infuse with a flow rate of 100 mL/hr. If started at 0600, when will the infusion be complete?
   a. 1330
   b. 1350
   c. 1430
   d. 1450

8. Order is for 750 mL of Normal Saline to infuse with a flow rate of 100 mL/hr. It was started at 0600. How much will be remaining at 0900?
   a. 300 mL
   b. 450 mL
   c. 500 mL
   d. 650 mL

9. At 1730, 1000 mL of D5 1/2 NS started to infuse at 200 mL/hr. What is time will the infusion be finished?
   a. 2100
   b. 2230
   c. 2300
   d. 2430

10. At 1730, 1000 mL of D5 ½ NS started to infuse at 200 mL/hr. How much will be remaining after at 2000?
    a. 100 mL
    b. 150 mL
    c. 275 mL
    d. 300 mL

Lesson Seven – Health Science Math: Infusion Calculations

LEARN: Health Science Math: Infusion Calculations Slide Presentation

30 minutes

Purpose:

Participants will learn how to calculate dosages for IV administration via pump and gravity.

Materials:

- *Health Science Math: Infusion Calculations* slide presentation
- *Medical Math Student Workbook – Health Science Math: Infusion Calculations Workbook* (optional – participants may complete practice problems as part of lecture)
- *Health Science Math: Infusion Calculations Workbook* – Answer Key
- *Health Science Math: Infusion Calculations Online Course*

Facilitation Steps:

1. Share the following information with participants as you show the slide presentation. Optional: Participants may complete practice problems in the student workbook) as part of lecture.
2. Note to instructor: In lieu of the slide presentation, you may assign the *Health Science Math: Infusion Calculations Online Lesson*. It covers all of the same content but allows participants to learn at a self-paced mode.

Slide 1: Introduction slide.

Slide 2: At the end of this lecture, you will be able to:

- Calculate dosage for IV administration via pump
- Calculate dosage for IV via gravity
- Calculate time for IV administration

Slide 3: Intravenous (IV) solutions are supplied in plastic bags or glass bottles. Tubing then connects the bag or bottle to the patient. The solution can be regulated by gravity or a pump, and can be primary or secondary (piggyback).

Slide 4: When using an IV pump, you will need to calculate the flow rate, which is mL per hour. You will need to know the mL of fluid to be given and the time to give the solution over. For example, if 50 mL of medication is ordered to run over 30 min the flow rate would be 100 mL/hour. The easiest way to think of flow rate is if "x" amount of solution goes in over "y" minutes, then how much would go in over an hour? This amount is programmed into the pumps.

Slide 5: There are three terms you need to know in gravity calculations. Drops are expressed as gtts and can be found in the drip chamber of IV tubing (pictured). The drop factor is expressed in gtts/mL and is how many drops the tubing

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allows to drip per milliliter of fluid. The type of fluid does not matter, and this value is predetermined on tubing package. The drip (or drop) rate is expressed in gtts/min. When using gravity instead of a pump, you will need to figure this value. You will need to know mL of fluid, time, and drop factor. When you calculate it, this is how fast the IV will run. You will need to count how many drops drip in the chamber over 1 minute and adjust the flow accordingly. You will have to round to whole numbers since you cannot count less than a drop.

Slide 6: Calculating for Pumps title slide.

Slide 7: Read this problem. We are looking for mL/hr. Which number do we not need for this calculation?
500 mg
If 100 mL of solution goes in over 30 minutes, how much would go in over an hour?
Participants may solve using any method.

Slide 8: *Answer: 200 mL*
Have the participants practice checking their answers.

Slide 9: Calculating for Gravity title slide.

Slide 10: Let's look at the same problem, but now we are going to infuse it via gravity instead of a pump. We are looking for gtts/min. Which number do we not need for this calculation?
500 mg
This is a little more complex, so we cannot use the ratio-proportion method. The desired/have formula changes as well. If you use dimensional analysis, it stays the same.
Participants may solve using any method.

Slide 11: *Answer: 50 gtts/min*
Have the participants practice checking their answers.

Slide 12: Participants may solve using any method.

Slide 13: *Answer: 167 mL/hr; 28 gtts/min*
Note that some pumps may have tenths. If so, you would put in 166.7 for the flow rate.
Have the participants practice checking their answers.

Slide 14: Calculating IV Time title slide.

Slide 15: You also may need to know how long an IV infusion should last or how much volume will infuse over a certain period. To calculate this, you will need the infusion time and then add that amount to the start time.

Slide 16: Let's look at this example. If you have 1 L Normal Saline running at 100 mL/hr starting at 0930, what time will it be up?
First, convert if needed. Make sure there are mL and hours. Time should be converted to military time.
Second, calculate how many hours the IV will run. Divide the amount by the rate.
Third, add the hours to the start time.
In this example, the IV should run out at 1930.

Slide 17: Participants may solve using any method.

Slide 18: *Answer: 0700*
Have the participants practice checking their answers.

Slide 19: Let's take the same infusion and look at volume. First, figure out how much volume is infused every hour (mL/hr). Then figure out how much time has lapsed and multiply that by the rate. No particular method is used. Subtracting military time can be tricky. When subtracting

military time after midnight, add 24 to the "end time" and subtract from the start time. Lastly, subtract the amount from the initial amount.

Slide 20: *Answer: 250*
Have the participants practice checking their answers.

Slide 21: Closing slide.

Lesson Seven – Health Science Math: Infusion Calculations

REVIEW: Health Science Math: Infusion Calculations

20 minutes

Purpose:

Participants will practice calculating dosages for infusion administration via pump and gravity.

Materials:

- *Medical Math Student Workbook – Health Science Math: Infusion Calculations*
- *Health Science Math: Infusion Calculations* – Answer Key

Facilitation Steps (this may have been completed as part of lecture):

1. Have the participants complete the practice questions in the *Health Science Math: Infusion Calculations* section of the student workbook.
2. Answer any questions participants may have on the calculations.
3. Have participants self-check or peer-check their answers as you share them from the *Health Science Math: Infusion Calculations* – Answer Key.

Infusion Calculations – Answer Key

Calculating for Pumps

Flow rate:

- Expressed in mL/hour
- When using an IV pump, you will be asked for this value and will need to know mL of fluid and time
    - Example: Medication 50 mL is ordered to run over 30 min; flow rate would be 100 mL/hour

Practice Questions

1) Order is for 1 L Normal Saline over 8 hours. What is the flow rate? Solve using any method.

   125 mL/hr

2) Provider orders 2,000 mL of D5 1/2 NS over 2 days. What is the flow rate? Solve using any method.

   41.7 mL/hr

Calculating for Gravity

Drops:

- Expressed as gtts

Drop factor:

- Expressed in **gtts/mL**
- Is how many drops the tubing allows to drip per milliliter of fluid
- Type of fluid does not matter
- Predetermined - **on tubing package**

Drip (drop) rate:

- Expressed in **gtts/min**
- When using **gravity** instead of a pump, you will need to figure out this value
- Need to know mL of fluid, time, and drop factor

Practice Questions

1) The provider has ordered 500 ml of solution over 10 hours. The drop factor is 60 gtt/ml. What is the drip rate?

   50 gtts/min

2) A client is to receive 1 L of IV solution every 6 hours using an infusion set that has a drop factor of 10 gtt/mL. Calculate the rate of flow in gtts/min.

   28 gtts/min

Calculating IV time

Reason for Calculating

- How long an IV infusion should last
- How much volume will infuse over a time period
- Calculating time
  - First, convert if needed. Make sure there are mL and hours. Time should be converted to military time.
  - Second, calculate how many hours the IV will run. Divide the amount by the rate.
  - Third, add the hours to the start time.
- Calculating volume
  - First, figure out how much volume is infused every hour (mL/hr).
  - Second, figure out how much time has lapsed. No particular method is used.
  - Subtracting military time can be tricky. When subtracting military time after midnight, add 24 to the "end time" and subtract from the start time.

Practice Questions

1) The order is for 1000 mL D5 1/2 NS at 150 mL/h at 1100. When should the next liter bag be ready to hang?

   1740

2) Using the same infusion above, how much will be left at 1400?

   550 mL

Name: _____ Class: _____

Health Science Math: Methods, Oral Medications, and Pediatric Dosages Summative Quiz

Read each question and calculate the correct answer.

1) The order reads to administer digoxin 250 mcg PO at 0900. The pharmacy supply is digoxin 0.25 mg tablets. How many tablets should be administered?
   a) 0.1 tablet
   b) $\frac{1}{2}$ tablet
   c) 1 tablet
   d) 2 tablets

2) The order reads to administer aspirin 325 mg PO once daily. Supply is aspirin 81 mg tablets. How many tablets should be administered?
   a) 1 tablet
   b) 2 tablets
   c) 3 tablets
   d) 4 tablets

3) The order reads to administer Halcion 0.25 mg PO at bedtime PRN. The supply is Halcion 0.125 mg tablets. How many tablets should be administered per dose?
   a) 1 tablet
   b) 2 tablets
   c) 3 tablets
   d) 4 tablets

4) The order reads to administer potassium chloride liquid 80 mq PO twice a day. The supply is an oral liquid containing 40 mq/15 mL. How many mL should be administered daily?
   a) 2 mL
   b) 7.5 mL
   c) 30 mL
   d) 213 mL

5) The order reads to administer Zofran 8 mg PO three times daily. The pharmacy sends Zofran liquid in a 100 mL bottle labeled 4 mg/5 mL. How many mL should be administered in each dose?
   a) 5 mL
   b) 10 mL
   c) 20 mL
   d) 40 mL

6) The order reads to administer cimetidine HCL 600 mg PO bid. The label on the bottle reads 300 mg/5 mL. How many teaspoons should be administered?
   a) $\frac{1}{2}$ teaspoon
   b) 1 teaspoon
   c) 2 teaspoons
   d) 2.5 teaspoons

7) The provider writes an order for rifampin 0.6 grams PO once daily for 7 days. The supply available is in 150 mg capsules. How many capsules will the patient receive daily?
   a) 1 capsule
   b) 2 capsules
   c) 3 capsules
   d) 4 capsules

8) The order reads to administer morphine sulfate 25 mg every 4 hours PRN for pain. The label reads: morphine sulfate 50 mg/2 mL. How many mL should be administered?
   a) 0.5 mL
   b) 1 mL
   c) 2 mL
   d) 3 mL

9) Ampicillin is labeled 250 mg/5 mL and comes in a bottle containing 120 mL. A child weighing 50 kg is discharged on 5 mg/kg 6 hours. How many teaspoons would you instruct the mother to give every 6 hours?
   a) $\frac{1}{4}$ teaspoon
   b) $\frac{1}{2}$ teaspoon
   c) $\frac{3}{4}$ teaspoon
   d) 1 teaspoon

10) Administer clarithromycin 7.5 mg/kg PO every 12 hours. The child weighs 25 kg. How many milligrams should be administered?
    a) 85.2 mg
    b) 187.5 mg
    c) 412.5 mg
    d) 1875 mg

11) Administer Narcan 0.01 mg/kg stat for a neonate who weighs 3300 grams. The vial supplied is 0.4 mg/mL. How many mL should be administered?
    a) 0.08 mL
    b) 0.8 mL
    c) 8 mL
    d) 80 mL

12) A patient weighs 66 lbs. and is prescribed a medication for 3 mg/kg/dose. The vial supplied is 10 mg/0.5 mL. What volume will you give the patient?
    a) 0.5 mL
    b) 0.9 mL
    c) 4.5 mL
    d) 10 mL

13) Administer acetaminophen 15 mg/kg PO every 6 hours PRN for fever. The child weighs 6.7 kg and the label on the bottle of acetaminophen reads: 100 mg/mL. How many mL should be administered?
    a) 0.5 mL
    b) 1 mL
    c) 6 mL
    d) 10 mL

14) Administer Oxacillin 50 mg/kg PO every 6 hours. The child weighs 22 lbs. and the label on the bottle reads: Oxacillin 250 mg/5 mL. How many mL should be administered?
    a) 2 mL
    b) 4.4 mL
    c) 5 mL
    d) 10 mL

15) An infant weighing 4250 grams is ordered a medication for 0.6 mg/kg/day over 6 doses per day. How much will you give the infant per day?
    a) 2.55 mg
    b) 15.3 mg
    c) 25.5 mg
    d) 153 mg

16) A child weighs 30 kg and is prescribed a medication with a dose of 2 mg/kg/day in equal doses every 4 hours. The supply comes in 5 mg/mL. How many mg will you give per dose?
   a) 2 mL
   b) 3 mL
   c) 6 mL
   d) 12 mL

17) The patient weighs 69 lbs. and is 54 inches tall. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(in) x wt (lb)}}{3131}}$
   a) 0.7 m^2
   b) 0.9 m^2
   c) 1.2 m^2
   d) 1.5 m^2

18) The patient weighs 11.8 kg and is 72 cm tall. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(cm) x wt (kg)}}{3600}}$
   a) 0.49 m^2
   b) 0.87 m^2
   c) 1.32 m^2
   d) 1.6 m^2

19) The patient weighs 25 kg and is 4 feet 2 inches. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(in) x wt (lb)}}{3131}}$
   a) 0.7 m^2
   b) 0.9 m^2
   c) 1.1 m^2
   d) 1.5 m^2

20) The patient weighs 110 lbs. and is 1.7 m tall. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(cm) x wt (kg)}}{3600}}$
   a) 0.49 m^2
   b) 0.87 m^2
   c) 1.32 m^2
   d) 1.52 m^2

21) A patient is ordered a medication dose of 200 mg/m² a day by mouth for 5 days. The patient weighs 165 lbs. and is 5 feet 1 inches. What is the daily dose of medication the patient will receive?
   a) 222 mg
   b) 250 mg
   c) 305 mg
   d) 359 mg

22) A patient is ordered a medication dose of 25 mg/m² twice a day. The patient weighs 40 kg and is 148 cm. How many mg will the patient receive at each dose?
   a) 21 mg
   b) 32 mg
   c) 48 mg
   d) 64 mg

23) The provider orders 175 mg of Rocephin to be taken every 8 hours by an infant weighing 10.2 lbs. The medication label shows that 75-150 mg/kg per day is the appropriate dosage range. Is this dose within the desired range?
   a) Yes
   b) No, it is over the range
   c) No, it is under the range

24) For children under 12 years of age, the recommended dose of acetaminophen is 10 to 15 mg/kg every 6 hours, not to exceed 50-75 mg/kg in 24 hours. What is the safe dosage range per day for a 9-year-old weighing 28 kg?
   a) 50 – 75 mg
   b) 280 – 420 mg
   c) 1400 – 2100 mg
   d) 1680 – 2520 mg

25) A patient weighing 155 lbs. has been diagnosed with meningitis. The order is for Ampicillin 13 mg/kg/day in divided doses. According to the pharmacy, the safe dosage range for Ampicillin is 150 to 200 mg/kg/day IV in equally divided doses every 3 to 4 hours. Is this dose within the desired range?
   a) Yes
   b) No, it is over the range
   c) No, it is under the range

26) The provider has ordered Ranitidine 8 mg to be administered orally twice daily. The pharmacist informs you the acceptable range for preterm and term neonates is 4 to 8 mg/kg/day PO divided 2 to 3 times per day. The newborn weighs 4 lbs. Is this dose within the desired range?
   a) Yes
   b) No, it is over the range

c) No, it is under the range

27) Zithromax has been ordered twice daily for a patient that weighs 82 lbs. The safe dose range for this medication is 10-12 mg/kg/day. What is the maximum safe daily dose for this patient?
   a) 186 mg
   b) 224 mg
   c) 372 mg
   d) 447 mg

28) The provider orders an IV drip of Dopamine for a child weighing 9 lbs. The safe dosage range for this medication is 5-20 mcg/kg/min. What is the safe dosage range for this child?
   a) 5 - 20 mcg
   b) 19.2 – 79.9 mcg
   c) 20.45 – 81.81 mcg
   d) 45 – 180 mcg

29) Benadryl was ordered for a child that weighs 68 lbs. The safe dose range for Benadryl is 5 mg/kg/day. What is the safe dosage for this child?
   a) 25.6 mg/day
   b) 56.6 mg/day
   c) 154.5 mg/day
   d) 340 mg/day

30) The provider ordered digoxin 0.95 mg daily for a child that weighs 14 lbs. The safe dosage for this medication is 8-12 mcg/kg/day. Is this a safe dosage for this child?
   a) Yes
   b) No, it is over the range.
   c) No, it is under the range.

Health Science Math: Methods, Oral Medications, and Pediatric Dosages Summative Quiz – Answer Key

Read each question and calculate the correct answer.

1) The order reads to administer digoxin 250 mcg PO at 0900. The pharmacy supply is digoxin 0.25 mg tablets. How many tablets should be administered?
   a) 0.1 tablet
   b) $\frac{1}{2}$ tablet
   c) **1 tablet**
   d) 2 tablets

2) The order reads to administer aspirin 325 mg PO once daily. Supply is aspirin 81 mg tablets. How many tablets should be administered?
   a) 1 tablet
   b) 2 tablets
   c) 3 tablets
   d) **4 tablets**

3) The order reads to administer Halcion 0.25 mg PO at bedtime prn. The supply is Halcion 0.125 mg tablets. How many tablets should be administered per dose?
   a) 1 tablet
   b) **2 tablets**
   c) 3 tablets
   d) 4 tablets

4) The order reads to administer potassium chloride liquid 80 mq PO twice a day. The supply is an oral liquid containing 40 mq/15 mL. How many mL should be administered daily?
   a) 2 mL
   b) 7.5 mL
   c) **30 mL**
   d) 213 mL

5) The order reads to administer Zofran 8 mg PO three times daily. The pharmacy sends Zofran liquid in a 100 mL bottle labeled 4 mg/5 mL. How many mL should be administered in each dose?
   a) 5 mL
   b) **10 mL**
   c) 20 mL
   d) 40 mL

6) The order reads to administer cimetidine HCL 600 mg PO bid. The label on the bottle reads 300 mg/5 mL. How many teaspoons should be administered?
   a) $\frac{1}{2}$ teaspoon
   b) 1 teaspoon
   c) **2 teaspoons**
   d) 2.5 teaspoons

7) The provider writes an order for rifampin 0.6 grams PO once daily for 7 days. The supply available is in 150 mg capsules. How many capsules will the patient receive daily?
   a) 1 capsule
   b) 2 capsules
   c) 3 capsules
   d) **4 capsules**

8) The order reads to administer morphine sulfate 25 mg every 4 hours PRN for pain. The label reads: morphine sulfate 50 mg/2 mL. How many mL should be administered?
   a) 0.5 mL
   b) **1 mL**
   c) 2 mL
   d) 3 mL

9) Ampicillin is labeled 250 mg/5 mL and comes in a bottle containing 120 mL. A child weighing 50 kg is discharged on 5 mg/kg 6 hours. How many teaspoons would you instruct the mother to give every 6 hours?
   a) $\frac{1}{4}$ teaspoon
   b) $\frac{1}{2}$ teaspoon
   c) $\frac{3}{4}$ teaspoon
   d) **1 teaspoon**

10) Administer clarithromycin 7.5 mg/kg PO every 12 hours. The child weighs 25 kg. How many milligrams should be administered?
    a) 85.2 mg
    b) **187.5 mg**
    c) 412.5 mg
    d) 1875 mg

11) Administer Narcan 0.01 mg/kg stat for a neonate who weighs 3300 grams. The vial supplied is 0.4 mg/mL. How many mL should be administered?
    a) **0.08 mL**
    b) 0.8 mL
    c) 8 mL
    d) 80 mL

12) A patient weighs 66 lbs. and is prescribed a medication for 3 mg/kg/dose. The vial supplied is 10 mg/0.5 mL. What volume will you give the patient?
    a) 0.5 mL
    b) 0.9 mL
    c) **4.5 mL**
    d) 10 mL

13) Administer acetaminophen 15 mg/kg PO every 6 hours PRN for fever. The child weighs 6.7 kg and the label on the bottle of acetaminophen reads: 100 mg/mL. How many mL should be administered?
    a) 0.5 mL
    b) **1 mL**
    c) 6 mL
    d) 10 mL

14) Administer Oxacillin 50 mg/kg PO every 6 hours. The child weighs 22 lbs. and the label on the bottle reads: Oxacillin 250 mg/5 mL. How many mL should be administered?
    a) 2 mL
    b) 4.4 mL
    c) 5 mL
    d) **10 mL**

15) An infant weighing 4250 grams is ordered a medication for 0.6 mg/kg/day over 6 doses per day. How much will you give the infant per day?
    a) 2.55 mg
    b) **15.3 mg**
    c) 25.5 mg
    d) 153 mg

16) A child weighs 30 kg and is prescribed a medication with a dose of 2 mg/kg/day in equal doses every 4 hours. The supply comes in 5 mg/mL. How many mg will you give per dose?
   a) 2 mL
   b) 3 mL
   c) 6 mL
   d) 12 mL

17) The patient weighs 69 lbs. and is 54 inches tall. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(in) x wt (lb)}}{3131}}$
   a) 0.7 m^2
   b) 0.9 m^2
   c) **1.2** m^2
   d) 1.5 m^2

18) The patient weighs 11.8 kg and is 72 cm tall. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(cm) x wt (kg)}}{3600}}$
   a) **0.49** m^2
   b) 0.87 m^2
   c) 1.32 m^2
   d) 1.6 m^2

19) The patient weighs 25 kg and is 4 feet 2 inches. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(in) x wt (lb)}}{3131}}$
   a) 0.7 m^2
   b) **0.9** m^2
   c) 1.1 m^2
   d) 1.5 m^2

20) The patient weighs 110 lbs. and is 1.7 m tall. What is the body surface area of the patient? Use the formula $m^2 = \sqrt{\frac{\text{ht(cm) x wt (kg)}}{3600}}$
   a) 0.49 m^2
   b) 0.87 m^2
   c) 1.32 m^2
   d) **1.52 m^2**

21) A patient is ordered a medication dose of 200 mg/m² a day by mouth for 5 days. The patient weighs 165 lbs. and is 5 feet 1 inches. What is the daily dose of medication the patient will receive?
   a) 222 mg
   b) 250 mg
   c) 305 mg
   d) **359 mg**

22) A patient is ordered a medication dose of 25 mg/m² twice a day. The patient weighs 40 kg and is 148 cm. How many mg will the patient receive at each dose?
   a) **21 mg**
   b) 32 mg
   c) 48 mg
   d) 64 mg

23) The provider orders 175 mg of Rocephin to be taken every 8 hours by an infant weighing 10.2 lbs. The medication label shows that 75-150 mg/kg per day is the appropriate dosage range. Is this dose within the desired range?
   a) **Yes**
   b) No, it is over the range
   c) No, it is under the range

24) For children under 12 years of age, the recommended dose of acetaminophen is 10 to 15 mg/kg every 6 hours, not to exceed 50-75 mg/kg in 24 hours. What is the safe dosage range per day for a 9-year-old weighing 28 kg?
   a) 50 – 75 mg
   b) 280 – 420 mg
   c) **1400 – 2100 mg**
   d) 1680 – 2520 mg

25) A patient weighing 155 lbs. has been diagnosed with meningitis. The order is for Ampicillin 13 mg/kg/day in divided doses. According to the pharmacy, the safe dosage range for Ampicillin is 150 to 200 mg/kg/day in equally divided doses every 3 to 4 hours. Is this dose within the desired range?
   a) Yes
   b) No, it is over the range
   c) No, it is under the range

26) The provider has ordered Ranitidine 8 mg to be administered orally twice daily. The pharmacist informs you the acceptable range for preterm and term neonates is 4 to 8 mg/kg/day PO divided 2 to 3 times per day. The newborn weighs 4 lbs. Is this dose within the desired range?
   a) Yes
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27) Zithromax has been ordered twice daily for a patient that weighs 82 lbs. The safe dose range for this medication is 10-12 mg/kg/day. What is the maximum safe daily dose for this patient?
   a) 186 mg
   b) 224 mg
   c) 372 mg
   d) **447 mg**

28) The provider orders an IV drip of Dopamine for a child weighing 9 lbs. The safe dosage range for this medication is 5-20 mcg/kg/min. What is the safe dosage range for this child?
   a) 5 - 20 mcg
   b) 19.2 – 79.9 mcg
   c) **20.45 – 81.81 mcg**
   d) 45 – 180 mcg

29) Benadryl was ordered for a child that weighs 68 lbs. The safe dose range for Benadryl is 5 mg/kg/day. What is the safe dosage for this child?
   a) 25.6 mg/day
   b) 56.6 mg/day
   c) **154.5 mg/day**
   d) 340 mg/day

30) The provider ordered digoxin 0.95 mg daily for a child that weighs 14 lbs. The safe dosage for this medication is 8-12 mcg/kg/day. Is this a safe dosage for this child?
   a) Yes
   b) **No, it is over the range**
   c) No, it is under the range

Name: _____ Class: _____

Health Science Math Injection and Infusion Calculations Summative Quiz

Read each question and calculate the correct answer.

1) Order: Vitamin B12 0.2 mg IM every month. Available: 100 mcg/mL multi dose. How many mL would you give?
   a) 0.002 mL
   b) 0.2 mL
   c) 2 mL
   d) 20 mL

2) A provider orders morphine 0.1 mg/kg IV push every 4 hours as needed for pain management. The patient weighs 206 lbs. The vial contains 10 mg/mL. How many mL would you give?
   a) 0.6 mL
   b) 0.9 mL
   c) 1.25 mL
   d) 1.5 mL

3) A patient is ordered gentamicin 65 mg IM. The vial contains 80 mg/2 mL. How many mL would you give?
   a) 1.6 mL
   b) 2.5 mL
   c) 3.2 mL
   d) 3.8 mL

4) Flucloxacillin 250 mg was ordered IM 4 times daily for 7 days. The supply vial contains 1 g/ 10 mL. How many vials would you need for the entire order?
   a) 2.5 vials
   b) 5 vials
   c) 7 vials
   d) 8.5 vials

5) A patient was ordered ranitidine 40 mg IM every 8 hours. Stock ampoules have a strength of 50 mg/2mL. How many milliliters will the patient get per day?
   a) 1.6 mL
   b) 2.3 mL
   c) 3.7 mL
   d) 4.8 mL

6) The provider ordered penicillin 33.3 mg per kilogram for a patient weighing 24 kg. On hand is penicillin 1.2 g/6 mL. How many mL will you give?
   a) 2 mL
   b) 4 mL
   c) 6 mL
   d) 8 mL

7) Order is digoxin 0.75 mg IVP over 5 min. Vial has a concentration of 0.1 mg/mL. How many mL should be administered?
   a) 0.08 mL
   b) 0.75 mL
   c) 7.5 mL
   d) 75 mL

8) Order is for Heparin 15,000 units subcutaneous now. Supply is 20,000 units/mL. How many mL would you give?
   a) 0.2 mL
   b) 0.45 mL
   c) 0.6 mL
   d) 0.75 mL

9) Calculate the insulin dose for a patient who consumed 275,000 mg of carbohydrates and has an ordered ratio of 25 grams/unit. Use the formula: total carbohydrates (grams) × insulin-to-carbohydrate ratio (unit/gram) = carbohydrate insulin dose (units).
   a) 1 unit
   b) 11 units
   c) 21 units
   d) 110 units

10) A patient was ordered Humulin N 57 units every morning. The insulin vial is 100 units/mL. How many mL would you give?
   a) 0.57 mL
   b) 5.7 mL
   c) 7.5 mL
   d) 17. 5 mL

11) The provider ordered Heparin for a 3 mL central line flush. Supply is 100 units/mL. How many units would you give per flush?
    a) 3 units
    b) 30 units
    c) 300 units
    d) 3000 units

12) Order is for Humulin 70/30 Prefilled Pen 25 units subcutaneous twice daily before breakfast and dinner. Each pen is 300 units. How many pens are needed for 2 weeks? (Dose cannot be split between 2 pens.)
    a) 2 pens
    b) 3 pens
    c) 4 pens
    d) 5 pens

13) Order is for Heparin 17,500 units subcutaneous now. Supply is 20,000 units/mL. How many mL would you give?
    a) 0.76 mL
    b) 0.88 mL
    c) 0.91 mL
    d) 0.97 mL

14) Calculate the insulin dose for a patient who consumed 150 g of carbohydrates and has an ordered ratio of 15 grams/unit. Use the formula: total carbohydrates (grams) × insulin-to-carbohydrate ratio (unit/gram) = carbohydrate insulin dose (units)
    a) 10 units
    b) 12 units
    c) 14 units
    d) 16 units

15) Order is for Lantus Prefilled Pen 35 units subcutaneous once daily at bedtime. Each pen is 80 units. How many pens are needed for 3 weeks? (Dose cannot be split between 2 pens.)
    a) 4 pens
    b) 6 pens
    c) 9 pens
    d) 11 pens

16) The provider ordered Penicillin G 30,000 units/kg every 12 hours for a child weighing 8.8 lbs. The vial reads: Add 5.6 mL diluent to make 1,200,000 units/6 mL. How many mL would you give?
    a) 0.2 mL
    b) 0.4 mL
    c) 0.6 mL
    d) 0.8 mL

17) Order is for Rocephin 1 gram IM now. The Rocephin 1 gram vial reads: Add 2.7cc of sterile water or lidocaine to yield 3 cc of solution. How many mL of medication would you give?
   a) 0.3 mL
   b) 1.7 mL
   c) 2.7 mL
   d) 3 mL

18) Order says Cefazolin 1.5 grams IM now. Available is Cefazolin 2 gram vial and the label reads: Add 3.7cc of sterile water to yield 4 cc of solution. How many cc would you give?
   a) 3 mL
   b) 4 mL
   c) 5 mL
   d) 6 mL

19) Administer ampicillin 250 mg IM every 8 hours. After adding 3.6 mL of diluent, the vial contains 1000 mg/4 mL. How many mL should be delivered?
   a) 1 mL
   b) 2 mL
   c) 3 mL
   d) 4 mL

20) Administer 1 g of Kefzol IM every 8 hours. After reconstitution with 2.5 mL diluent, the strength of the Kefzol solution is 330 mg/ mL. How many mL should be administered?
   a) 1 mL
   b) 2 mL
   c) 3 mL
   d) 4 mL

21) The patient is to receive Ringers Lactate 500 mL IV over 12 hours. The tubing drop rate is 15 gtts/mL. Calculate the drip rate in gtts/min.
   a) 10 gtts/min
   b) 100 gtts/min
   c) 400 gtts/min
   d) 625 gtts/min

22) Order is for 100 mL gentamicin over 30 minutes. Drop factor is 20 gtts/mL. What is the drip rate in gtts/min?
   a) 33 gtts/min
   b) 67 gtts/min
   c) 150 gtts/min
   d) 200 gtts/min

23) The provider ordered 500 mL D5/0.45% NS to infuse in 6 hours using micro-drip tubing (60 gtts/mL). What is the drip rate in gtts/min?
   a) 81 gtts/min
   b) 83 gtts/min
   c) 142 gtts/min
   d) 183 gtts/min

24) The provider has ordered the patient to receive 750 mL of Normal Saline IV for 8 hours. The drop factor is 10 gtts/mL. Calculate the drip rate in gtts/min.
   a) 9 gtts/min
   b) 16 gtts/min
   c) 18 gtts/min
   d) 22 gtts/min

25) The order reads to infuse 250 mL of Lactated Ringer's over 2 hours. The IV tubing has a drop factor of 15 gtts/mL. Calculate the drip rate in gtts/min.
   a) 31 gtts/min
   b) 57 gtts/min
   c) 62 gtts/min
   d) 125 gtts/min

26) Infuse 1000 mL of D5W over 8 hours. The IV tubing drop factor is 10 gtts/mL. Calculate the drip rate in gtts/min.
   a) 10 gtts/min
   b) 18 gtts/min
   c) 21 gtts/min
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27) The order reads to infuse 1000 mL of Normal Saline over 6 hours. The IV tubing has a drop factor of 15 gtts/min. Calculate the drip rate in gtts/min.
   a) 8 gtts/min
   b) 16 gtts/min
   c) 35 gtts/min
   d) 42 gtts/min

28) Administer D5/0.45% NS 500 mL IV over 3 hours. At what flow rate will the nurse set the pump in mL/hr?
   a) 3 mL/hr
   b) 45 mL/hr
   c) 90 mL/hr
   d) 167 mL/hr

29) Administer sodium chloride 0.9% with glucose 5% 1000 mL IV from 0800 to 2000. At what flow rate would the nurse set the pump in mL/hr?
   a) 77 mL/hr
   b) 83 mL/hr
   c) 91 mL/hr
   d) 100 mL/hr

30) Administer 375 mL of Ringers Lactate IV over 30 min. At what flow rate should the nurse set the pump in mL/hr?
   a) 100 mL/hr
   b) 250 mL/hr
   c) 500 mL/hr
   d) 750 mL/hr

31) The provider has ordered 1 L of 20 mq/L Potassium Chloride in 0.9% Sodium Chloride to be administered over 8 hours. The drop factor is 15 gtts/mL. The nurse would set the pump to deliver how many mL/hr?
   a) 32 mL/hr
   b) 125 mL/hr
   c) 250 mL/hr
   d) 375 mL/hr

32) The patient has an order for 1000 mL of total parenteral nutrition (TPN) to be administered over 24 hours. At what rate in mL/hr would the pump be set?
   a) 42 mL/hr
   b) 55 mL/hr
   c) 62 mL/hr
   d) 88 mL/hr

33) The provider ordered 850 mL D5/0.45% NS to infuse in 6 hours. What is the flow rate (mL/hr)?
   a) 142 mL/hr
   b) 175 mL/hr
   c) 240 mL/hr
   d) 300 mL/hr

34) The order is for 750 mL Normal Saline IV to be administered over 8 hours. The drop factor is 20 gtt/mL. The nurse would set the pump to what flow rate in mL/hr?
   a) 31 mL/hr
   b) 66 mL/hr
   c) 94 mL/hr
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Health Science Math Injection and Infusion Calculations Summative Quiz – Answer Key

Read each question and calculate the correct answer.

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