

Distance Education Veterinary Technology Program

Technical Mathematics

Course Workbook

TECM 1303

Technical Mathematics

Course Workbook

TECM 1303

**A cooperative effort of the Liberal Arts Division and the Business Science and
Technology Division**

**at Cedar Valley College, supported by a Capstone Grant
from Cedar Valley College and the Dallas County Community College District**



EQUAL EDUCATION OPPORTUNITY

Educational opportunities are offered by the Dallas County Community College District
without regard to race, color, age, national origin, religion, sex, or handicap.

**Copyright © 2001 by the Dallas County Community College District.
Printed in the USA.**

Revised for Fall 2006

Technical Mathematics Course Workbook

Course Syllabus	iv
Accessing Blackboard (ECampus).....	vii
Important Information!	x
Introduction	1
Week One, Pretest self-assessment; Basis Math Review: Addition and Subtraction.....	2
Week Two, Basic Math Review: Multiplication and Division.....	9
Week Three, Decimal numbers; Addition and Subtraction.....	14
Week Four, Decimal Numbers; Multiplication and Division; converting Decimals to Fractions and Fractions to Decimals	20
Week Five, Scientific Notation.....	33
Week Six, Fractions: Addition and Subtraction, Multiplication and Division	40
Week Seven, Volumes and Areas; Examination One	46
Week Eight, Percentages.....	56
Week Nine, Algebra: Solving for X; Examination Two.....	63
Week Ten, Metric System: Units and Dimensional Analysis	69
Week Eleven, Dosage Calculations: Oral medications; Examination Three	78
Week Twelve, Dosage Calculations: Injectable medications	85
Week Thirteen, Dosage Calculations: Fluid Infusion.....	92
Week Fourteen, Dosage Calculations	102
Week Fifteen, <i>Final Examination</i>	112

TECHNICAL MATHEMATICS COURSE SYLLABUS

Instructors

Shellene Foster, MS
Cedar Valley College
3030 North Dallas Avenue
Lancaster, Texas 75134

Instructional Specialist

Sherry A. Hair, BS

Phone:

Toll-Free: **877-353-3482**,
or direct at: **972-860-8127**

Fax:

972-860-8057 Use this fax number! (use coversheet provided on eCampus)

Emergency use only: 972-682-7054

E-mail:

sfoster@dcccd.edu or **sah3505@dcccd.edu**

(Students with e-mail access are encouraged to contact their course instructor by e-mail with questions or concerns.)

Websites:

<http://www.dcccd.edu>

(Access this website for more information on Cedar Valley College and the Dallas County Community College District.)

<http://ollie.dcccd.edu/vettech/default.htm>

(Access this website for more information on the Veterinary Technology Program.)

II. Technical Mathematics is a veterinary technology course designed to provide a review of mathematical functions including fractions, decimals, proportions, perimeters, areas, volumes of geometric figures, and certain algebraic/trigonometric functions, as required by specific business and industries for successful on-the-job performance. Students must read the required materials, complete the CD assignments, and successfully complete the workbook and internet assignments to receive credit for the course.

III. Required Materials

A. Course Textbooks

1. *Math Master Pharmaceutical Calculations for the Allied-Health Professional*, Noah Reifman, R.Ph., MS, Ark Pharmaceutical Consultants, 2001.
2. **Course CD:** Delmar's *Veterinary Dosage Accu-Calc CD-ROM*, Demar, Thomson Learning

Course Workbook

1. Technical Mathematics for Veterinary Technology

IV. Recommended Textbooks and Materials

Medical Mathematics and Dosage Calculations for Veterinary Professionals, Robert Bill, Iowa State University Press, 2000

V. Course Objectives

This course is designed to teach basic mathematical skills required of the veterinary technician in professional practice. Students successfully completing this course will demonstrate basic mathematical skills, utilize the metric system, and solve medical problems using dimensional analysis. The course will be divided into four basic units:

1. Basic Algebraic Operations
2. Unit Conversions
3. Dosage Calculations
4. Fluid and Solution Calculations

VI. Student Credit and Grading

For students to receive a passing grade in this course, they must achieve an average grade of 70 percent. All assignments and exams will have a specific date by which the first attempt must be completed. Future attempts can be made on all assignments, and further attempts may also be made on Exams with instructor approval. All grades will be posted on the course website. All points will be added together and divided by the number of total points to determine the final course grade as a percentage. This grade will be sent to the student at the end of the course.

Students may finish assignments ahead of schedule, but **must** complete assignments by the published due date to receive credit for the course. Students are strongly encouraged to work at the pace set in the workbook to achieve the maximum benefit and learning from the course. A certificate will be mailed to the student after successful completion of the course.

If a student feels that they have received an unfair evaluation on an assignment or exam, they should contact their course instructor to resolve the situation. Email is the quickest method of communication with Ms. Foster. If the student feels that the decision of the instructor needs to be appealed, the student should contact the Veterinary Technology Program Director, Dr. Brian Heim, at 877-353-3482 (toll-free).

VII. Specific Point Values for Assignments and Examinations

Week	Type of Assignment	Point Value
1.....	Completed Checklist.....	10
2.....	Completed Checklist.....	10
3.....	Completed Checklist.....	10
4.....	Completed Checklist.....	10
5.....	Completed Checklist.....	10
	Participation Grade 1.....	10
6.....	Completed Checklist.....	10
7.....	Completed Checklist.....	10
	Examination One.....	100
8.....	Completed Checklist.....	10
9.....	Completed Checklist.....	10
	Examination Two.....	100
	Participation Grade 2.....	10
10.....	Completed Checklist.....	10
11.....	Completed Checklist.....	10
	Examination Three.....	100
	Participation Grade 3.....	10
12.....	Completed Checklist.....	10
13.....	Completed Checklist.....	10
14.....	Completed Checklist.....	10
	Participation Grade 4.....	10
15.....	Final Examination	200
Total Points		680

VII. Student Code of Conduct

Students in all distance education courses are expected to follow the same rules as set forth in the student code of conduct in the Cedar Valley College catalog. Failure to follow these rules may result in disciplinary action by the instructor or the college. Students should familiarize themselves with the code as set forth in the catalog. The Cedar Valley College catalog is available on the web at <http://www.dcccd.edu>. The student code of conduct and other catalog items can be found in the *Student Services* section of the Dallas County Community College District web page.

When are my assignments due?

FALL 2005

KEEP THIS LIST!

Ms. Shellene Foster, M.S.
Math Faculty
Cedar Valley College
3030 N. Dallas Ave.
Lancaster, TX 75134

Phone: 972-881-5973
Email: sfoster@dcccd.edu
Fax: 972-860-8057

Description	Date assignments/tests must be in	
Class starts	Monday	August 29, 2005
Week 1 assignments	Friday	September 2, 2005
Week 2 assignments	Friday	September 9, 2005
Week 3 assignments	Friday	September 16, 2005
Week 4 assignments	Friday	September 23, 2005
Week 5 assignments	Friday	September 30, 2005
Week 6 assignments	Friday	October 7, 2005
Week 7 assignments & Exam 1	Friday	October 14, 2005
	Friday	October 21, 2005
Week 8 assignments		
Week 9 assignments & Exam 2	Friday	October 28, 2005
Week 10 assignments	Friday	November 4, 2005
Week 11 assignments	Friday	November 11, 2005
Week 12 assignments & Exam 3	Friday	November 18, 2005
Week 13 assignments	Friday	November 25, 2005
Week 14 assignments	Friday	December 2, 2005
Week 15 assignments & Final Exam	Friday	December 12, 2005

***Please note that your shown work for the final exam must be in my hand by December 14th. There are no exceptions, so fax it early enough that even Snail Mail could be a backup form of delivery!

The final exam for this class will be comprehensive. It will include problems of all types covered in this course. It will NOT be multiple choice. You must show all your work and all answers must have units or they will be considered incorrect.

Accessing BlackBoard and the CourseInfo System

BlackBoard (BB), CourseInfo, and eCampus are the software systems that will be used in this course. During the length of the course, you will use several features available through this system. BB is very simple to use, and will greatly enhance your experience in this course. It will be used to help you communicate with your instructor and also with your fellow classmates.

Before using BlackBoard and the eCampus system, it is recommended that you check your computer to make sure that you have the proper Browser settings and plug-ins to run required programs. To check your systems specifications, go to the following website:

http://ollie.dcccd.edu/vettech/GeneralInfo/Specs_1.htm

This site will let you know what browser and version you are using and several other system requirements. It is recommended that you have at least NetScape Version 4.0 or higher or Internet Explorer Version 4.0 or higher. You also need Java enabled and may need certain plug-ins such as ShockWave, Flash, and Adobe Acrobat. If you need more assistance with configuring your browser, contact our technical support department. If you are experiencing technical difficulties, please send an e-mail to ecampus.support@dcccd.edu or call 972-669-6402.

Here is how you access your Blackboard site, as well as some information about the website information system.

1. To begin point your browser (Netscape or Internet Explorer) to <http://eCampus.dcccd.edu>
2. Then click on "Login"
3. Type in your **Student Identification Number** as your username and **Student Identification Number** as your password with a lower case e in front of your student id number. If you do not know your student ID number, please call or e-mail the course instructor. **Please do not ever change your password.** Doing so could affect your ability to access and utilize the system.
4. You should see a page with 4 tabs under the Dallas County Community College District Logo and a welcome announcement. If you have any difficulties accessing eCampus, please contact your course instructor by phone: 877-353-3482 (toll-free) or 972-860-8127 during business office hours of 8:00 am – 3:00 pm CST, M-Th. or by e-mail: Please remember that you must always login through the eCampus.dcccd.edu URL to access Blackboard.
5. To the far left of this screen is the tools section. Please click on "**Send email**" button and send a test email to the course instructor (Ms. Foster) at sfoster@dcccd.edu. In this test email, please type "This is a test of the BlackBoard email system. Please confirm receipt of this email." Then type your name, the class you are enrolled in, your email address, and your work phone number.. Now, click on the "**Personal Information**" button. **Remember, please do not ever change your password.** If you choose to do so, you can complete the personal information data by clicking onto the "**Edit Personal Information**" category. You can opt to limit access to your personal information as you choose by setting access limitations in the "**Privacy Options**". Once you have completed this process, go to the bottom of the page and click on the submit button. You must complete this step (clicking on the submit button) anytime you want to change any information under any category. To return to the main screen, go to the upper right area and click on the tab, "**My Institution**".

6. Now, you are ready to use Blackboard. Click on the "**Courses**" tab. It will show you a course list that contains all of the classes you are registered in. Again, if the information listed is incorrect or you are having problems, please contact your instructor. To get into the course, click on the course title.

Once in the course, please go through the web site in detail. Open each section and look at the information and features in the Blackboard site. The BlackBoard system is very forgiving, so don't worry about clicking on the wrong thing. It is almost impossible for you to mess something up (with the big exception of changing your password). The "**Announcement**" button takes you to an area where announcements are posted.. The "**Course Documents**" button is an area where additional information or relevant materials may be posted in addition to the materials and information found in the workbook. This would include such things as corrections to the workbook, additional materials, course details, or special instructions. If material is placed in this section, an announcement will be posted to your attention in the Announcements area.

In the "**Student Tools**" section, you can edit your homepage, change your personal information (**remember, please do not ever change your password**), review the course calendar, check your grades, and read the student manual. I strongly suggest you go through the manual if this is your first course. If I have assigned you any tasks or you want to list tasks for yourself, the task area is designed for that. The electronic blackboard is an area for personal notations about the course.

Speaking of checking your grades...here are the step by step instructions. Log in to Blackboard using your Student Identification Number as the user name and the password. Once you are into the website for the course, click on the "**Courses**" tab or select a class from the "**My Institution**" screen. Now, click on the "**Student Tools**" button. In this section, you will see 5 icons. Choose the "**Check Grades**" by clicking on it and all of your grades for that class will pop up. Pretty nifty, huh?!

For direct technical support, you can send an e-mail to support@ollie.dcccd.edu or call 972-669-6402.

IMPORTANT INFORMATION

All Assignments and Exams must be completed online. You do not have to fax in your work for the weekly assignments if it is your first attempt. However, if you wish to re-take a weekly assignment, please fax your original work along with your corrected work so that I can see what type of problems you have encountered (This means that all of your shown work needs to be written darkly (in ink), and very neatly, and VERY organized. Yes, number every problem and show all of your work even on your first time through an assignment). Exams have different procedures! You must submit your shown work for EVERY attempt at an exam. The questions that you receive will change each time you take an exam, so be certain to show all of your work very carefully and very darkly – IN INK. You may submit your shown work several different ways. You can print the pages out and then fax your shown work to us. You can also word process the assignments in MS Word or a similar word processing program (must be Microsoft Windows compatible, Mac documents won't be accepted), and then e-mail them to us as an attachment. You can also scan the document and send it as an attachment. Be certain not to exceed the size limits of your e-mail program if you choose this option. Faxes are fast, but can be knocked out by storms, guys on backhoes, or the lines can just be very busy, so if you have not received credit for a fax, please email Ms. Foster. Sometimes the faxes do not come through, and sometimes Ms. Foster is just so busy that she hasn't had time to check them off. Please allow up to one week for faxes to be checked off on your grade sheet.

Please remember to check the course announcements and your email at least once daily. This is how we will most commonly communicate in Blackboard and it is essential that you check these every day. I suggest you print this message and save it for future reference.

If you have problems or questions, please do not hesitate to let us know. Good luck and have fun.

Shellene Foster, MS

Professor of Mathematics
Cedar Valley College
3030 North Dallas Avenue
Lancaster, TX 75134

Phone (Sherri Hair): 877-353-3482 (toll-free) or
972-860-8127

Fax: 972-860-8057
Email: sfoster@dcccd.edu or sah3505@dcccd.edu

INTRODUCTION TO TECHNICAL MATHEMATICS

It is important to review the assignments for each week, especially for Week One. As in previous courses, schedule your time wisely and appropriately and pay special attention to the assignment schedule and the Course Task Checklist. Assignments should be completed according to the schedule listed in the syllabus to receive full credit for each class or assignment. ***All assignments more than one week (7 days) late will be assessed a 25% penalty for each week late. The course officially closes 7 days after the last assignment due date. Any assignments received after that date will NOT be accepted. Pay close attention to the “When Are My Assignments Due” page that is included in THIS WORKBOOK (see pg vii).*** Keep it in a safe place and refer to it each week to keep yourself on schedule. You are strongly encouraged to schedule an appointment with your preceptor and review the student assignments for the course. You should first review the materials and assignments for the week, and then schedule your time to accomplish the assignments.

First attempts at Examinations must be taken online by the correct date and shown work submitted to the course instructor by the stated deadline. It is your responsibility to ensure that exams are completed and submitted at the scheduled time. Late exams may not be accepted and could result in a grade of zero for that examination.

Though a preceptor is no longer required for this course, it is always a good idea to have someone who will hold you accountable each week. If you are working for a veterinarian, they will be able to answer questions that you may have about how what you are learning in this class applies to what you will be doing in their hospital. Many times, the Mathematical approach is much more rigorous than will be required by your veterinarian. Do not round a number in a math class unless you are asked to do so, even if your veterinarian requires rounding when performing calculations for them.

WEEK ONE

Pretest: A Self-Assessment Examination

Basic Math Review: Addition and Subtraction

Text Assignment

Math Master Pharmaceutical Calculations for the Allied-Health Professional, Reifman, pages 19-23.

Overview of Week One

This is the introductory week for the course. You should take extra time to familiarize yourself with the texts and assignments that are required to complete each week's work. It is essential that you stay on schedule and complete all assignments on time. Students may be entering this course with various levels of mathematical skills. The pre-test, which will NOT be graded for credit and will NOT be seen by anyone but the course instructor and the student, will allow for evaluation of both strong and weak areas for each student. It is essential that students successfully perform basic math manipulations to advance in this course. The student should work practice problems until they feel confident they have mastered the concept. Each successive skill will be built on the previous one.

Standardized National Board examinations for Veterinary Technology do not allow the use of calculators for mathematical calculations. For this reason, **students are not allowed to use calculators for the first 8 weeks of this course**. Students will be on the honor system for practice exercises and homework assignments and will only be hurting their chances for success if they do not follow these rules.

It is a well-known fact that most students (in fact, most people in general) have "math-phobia". The mere mention of mathematical calculations can cause high anxiety for many veterinary technology/assisting students. This course will attempt to decrease the student's fear of mathematics by teaching them to approach problems in a systematic, organized manner. In order for students to gain confidence in their abilities, they must start at the most basic level of calculations and work progressively toward more difficult and complex problems. Students should attempt to approach the given problems using the techniques taught in the workbook. They should avoid taking short-cuts that may provide the correct answer but may not "hold up" for more complex problems.

Week One Objectives

1. Be able to add and subtract numbers. Be able to add and subtract numbers with decimals. Understand that subtracting a negative number is the same as adding a number (two negatives make a positive!)

All Week One required submissions are due to the course instructor by the Friday following the first week of the course.

Assignment One:

Complete the pretest which is on Blackboard (E-Campus) under the Assignments section, and submit your shown work by fax or e-mail by the Friday following the first day of class. **You must show all of your work to receive credit for the problem. You may use extra paper if you need it. DO NOT USE A CALCULATOR FOR THIS EXERCISE. This assignment will not affect your grade, so do your best but do not fret about it.**

1. You should take this test with no preparation.
2. **DO NOT use a calculator for this exercise.** You are not expected to work all the problems correctly. Show all your work on each problem and include units in your answer if necessary.
3. **NO one will see this test except the course instructor.** It will be used to evaluate your current level of mathematical skill.

Assignment Two

1. Read the material in the textbook that concerns adding and subtracting decimals. This can be found on page 21 (*Math Master Pharmaceutical Calculations*).
2. Read the material in the workbook concerning addition and subtraction (you will find this on pages 4-5 in this workbook).
3. Read through the discussion on the CD under **Decimals** where it is addressing addition and subtraction.
4. Complete the Week One Assignment under the Assignments section on the course website (<http://ecampus7.dccd.edu/>). Your username and password are the same as your student ID number. Contact your instructor for this number if you don't know it. Complete the online homework for week 1 no later than the Friday following the first week of class. **DO NOT use a calculator for this exercise.** You may use extra paper if necessary.
5. You will find a picture of the online homework problems on pages 6-7 in this workbook. You do not have to use these pages unless you wish to. Some people prefer going straight to the online homework and working from there. The only real reason to use the workbook image of the problems is so that you do not have to print out the assignment.

Example: $(-3) + (+5) + (-7) = ?$

1. When presented with an equation containing both negative and positive numbers, arrange the numbers so that the positive ones occur first followed by the negative numbers. Then solve the equation.

$$(+5) + (-3) + (-7) = -5$$

In this equation, the negative numbers (-10) were greater than the positive (+5) so the answer is a negative number.

Example: $(-6) + (+5) + (-3) + (+6) = ?$
Group positives and negatives together:

$$\begin{aligned} (+5) + (+6) + (-6) + (-3) &= \\ (+11) + (-9) &= +2 \end{aligned}$$

Subtraction of Two or More Positive Numbers

If a larger positive number is subtracted from a smaller positive number the answer will be negative. If an answer remains greater than 0 then the number is positive.

Example: $15 - 30 = -15$

Subtraction of Two or More Negative Numbers

When two negative numbers are subtracted from each other and the answer is less than 0, the answer will remain negative. If a larger negative number is subtracted from a smaller negative number the answer will be positive.

Two negatives become a positive

Example: $(-3) - (-2) = ?$
 $(-3) + 2 = -1$ (two negatives become a positive)

$$(-5) - (-15) = +10$$

$$(-5) + 15 = +10$$

Assignment One: Review of Addition and Subtraction of Whole Numbers

The figure below is a number line. It demonstrates the concept of positive and negative numbers. Positive numbers are those numbers with a value greater than 0 (to the right of 0 on the number line) and negative numbers are those with a value less than 0 (to the left of 0 on the number line). A plus (+) sign may be used to identify a positive number while a (-) or minus sign is used to identify a negative number.

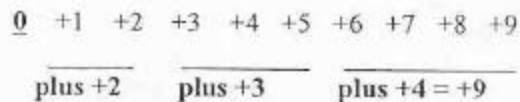
-9 -8 -7 -6 -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5 +6 +7 +8 +9

Addition of Positive Numbers

The sum of two or more positive numbers will be a positive number.

Example: $(+45) + (+24) = +69$
 $(+3) + (+2) + (+4) = +9$

looking at the number line one can see this addition process:

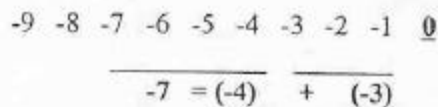


Addition of Negative Numbers

The sum of two or more negative numbers will be a negative number.

Example: $(-3) + (-4) = (-7)$

If we again look at the number line, we can see this is correct:



Addition of Both Positive and Negative Numbers

The sum of an addition of both positive and negative numbers will have the sign of the larger number involved in the calculation. If the larger number is positive, then the smaller number will be "pulled along the number line" in the positive direction. In reality, when a negative number is added to a positive one, it is *actually subtracted from the positive number*. If the larger number is negative, the sum will also be negative for the same reasons.

9. Solve the following problem:

$$(-61) + (-30) = \underline{\hspace{2cm}}$$

10. Solve the following problem:

$$(-10) + (-41) + 16 + 23 - (-15) = \underline{\hspace{2cm}}$$

Student Name (printed)

Preceptor Signature

Assignment One Work Sheet:

Without using a calculator, answer the following mathematical problems.

1. Add the following numbers:

$$-5 + 7 + (-4) + (3) = \underline{\hspace{2cm}}$$

2. Add the following columns of numbers:

$$\begin{array}{r} 23 \\ 18 \\ 17 \\ \hline 5 \end{array}$$

3. Add the following numbers

$$-23 + (-18) + 45 + (-12) + 17 = \underline{\hspace{2cm}}$$

4. $14.5 + 16.3 = \underline{\hspace{2cm}}$

5. Subtract the following numbers:

$$25 - (-16) = \underline{\hspace{2cm}}$$

6. Subtract the following numbers:

$$-45 + 21 = \underline{\hspace{2cm}}$$

7. Subtract the following numbers

$$(-73) - (-17) = \underline{\hspace{2cm}}$$

8. Add the following:

$$(+21) + (-71) + (+64) + (-14) = \underline{\hspace{2cm}}$$

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK ONE

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Online assignment:** Complete the Pretest.
2. **Online assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned online homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

WEEK TWO

Basic Mathematics Review: Multiplication and Division

Text Assignment

None

CD Assignment: None

Overview of Week Two

During Week Two, you will review multiplication and simple division. These processes will serve as the basis for mathematical manipulations required later in the course. Complete the homework problems in this workbook and have your preceptor review your work. Submit the homework answers no later than the Friday following the second week of class.

Week Two Objectives

1. Review the rules and examples for multiplication and simple division in your workbook. (See page 10)
2. Complete the online homework problems with a grade of 80% or better. You may NOT use a calculator for these problems. You will find an image of the homework problems in this workbook on page 12.

All Week Two required submissions are due to the course instructor by the Friday following the second week of the course.

Assignment One

Review the rules for multiplication and division in the workbook (this page and the next). Have your preceptor review the material with you and sign the Week Two Checklist. Submit the answers online. You may **NOT** use a calculator on this exercise. You may use extra paper if necessary. You must show **ALL** your work to receive credit if you wish to resubmit your answers. You only need to send me your shown work if you wish to take a second or third attempt at the assignment. If you make multiple attempts at the assignment, please send me an image of your first attempt and your corrections.

Review Of Multiplication And Division Of Whole Numbers

Guidelines for Multiplication and Division:

1. Multiplication and division of two or more positive numbers:

When two or more positive numbers are multiplied or divided, the result will be a positive number.

Examples: $+25 \times +5 = +125$

$$+25 \div +5 = +5 \quad \text{or} \quad \frac{25}{5} = 5$$

2. When two or more negative numbers are multiplied or divided, the result will be a positive number.

Examples: $(-3) \times (-3) = +9$

$$(-15) \div (-3) = +5$$

(Remember: two negatives become a positive)

3. When positive and negative numbers are multiplied or divided together, the result will be a negative number.

Examples: $(-15) \times (+3) = -45$

$$(-20) \div (+4) = -5$$

4. When an equation contains numbers within parentheses, that mathematical operation should be performed first.

Examples: $(5-3) \times (-4 \div 2) = (2) \times (-2) = -4$

$$(5 \times 4) \div (-10 \div 2) = (20) \div (-5) = -4$$

5. In general, the order of operations must be followed. Here is the order in which we operate:

1) Grouping Symbols such as parenthesis, and large fraction bars take first precedence.

Examples: $(5-3) \times (-4 \div 2) = (2) \times (-2) = -4$

$$\frac{5+4}{7-4} = \frac{9}{3} = 3$$

2) Exponents must be calculated next. Remember that exponents tell us how many times to multiply by a certain number: $2^4 = 2 \times 2 \times 2 \times 2 = 16$

Example: $(5-1)^2 - 3^3 = (4)^2 - 3^3$ First perform operations inside parenthesis.

$$= (4 \times 4) - (3 \times 3 \times 3)$$

$$= (16) - (27) \quad \text{Next calculate the exponents.}$$

$$= -9$$

3) Next, we perform all multiplications from the left to the right. Do not add or subtract anything in this step!

Example: $5 \div 5 \times 2 - 3 = 1 \times 2 - 3$ The left most mult. or div. is $5 \div 5$ do that first!

$$= 1 \times 2 - 3 = 2 - 3$$
 The next mult or div is 1×2 do that next.

$$= -1$$

4) Lastly, we perform all additions and subtractions left to right.

Example: $(5 \div 5 \times 2 - 3)^2 - 4 \times 3 + 5$ We must work inside the parenthesis first.

Isolating the parenthesis, we see $(5 \div 5 \times 2 - 3)$ Inside the parenthesis, we must still follow the order of operations. We must work multiplications and divisions before doing any additions or subtractions! $(5 \div 5 \times 2 - 3) = (1 \times 2 - 3) = (2 - 3) = -1$ Thus, the original problem is

$$(5 \div 5 \times 2 - 3)^2 - 4 \times 3 + 5$$

$$= (1 \times 2 - 3)^2 - 4 \times 3 + 5$$

$$= (2 - 3)^2 - 4 \times 3 + 5$$

$$= (-1)^2 - 4 \times 3 + 5$$

Next, we must calculate the exponents:

$$= (-1 \times -1) - 4 \times 3 + 5$$

$$= (1) - 4 \times 3 + 5$$

Remember, multiply 2 negatives makes a positive!

And now we perform all multiplications and divisions left to right. There is only one!

$$= (1) - 4 \times 3 + 5$$

$$= (1) - 12 + 5$$

Remember, a -4 times a $+3$ makes -12

And lastly we perform all additions and subtractions:

$$= (1) - 12 + 5$$

$$= -11 + 5$$

$$= -6$$

Worksheet Assignment: Week Two

Solve the following equations. Do not use a calculator for these problems. Show your work and use additional sheets of paper if necessary.

1. $23 \times 15 = \underline{\hspace{2cm}}$

2. $150 \times (-4) = \underline{\hspace{2cm}}$

3. $225 \div 5 = \underline{\hspace{2cm}}$

4. $(15-3) \times (12 \div 4) = \underline{\hspace{2cm}}$

5. $(12 + 5 - 3) \div (-7) = \underline{\hspace{2cm}}$

6. $(8 + 5 - 10) \times (3 + 5 - 17) = \underline{\hspace{2cm}}$

7. $\left(\frac{35}{7}\right) \times \left(\frac{15}{5}\right) = \underline{\hspace{2cm}}$

8. $12 \times (-3) \times (-4) = \underline{\hspace{2cm}}$

9. $25 \div (5) \times (3) = \underline{\hspace{2cm}}$

10. $(-40) \div (-20) \times 15 = \underline{\hspace{2cm}}$

11. $(8 - 2 \times 3) \div 2 - 3 = \underline{\hspace{2cm}}$

12. $(30 \div 5 + 1) + 2 \times 3 = \underline{\hspace{2cm}}$

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK TWO

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the workbook. Complete and submit the online homework problems

Student Name (printed)

Student or Preceptor Comments:

WEEK THREE

Basic Math Review: Decimal Numbers, Addition and Subtraction

Text Assignment

Math Master Pharmaceutical Calculations for the Allied-Health Professional, Reifman. Pages 19-23

Overview of Week Three

During Week Three, you will review the rules for addition and subtraction of decimal numbers. You must complete the required reading and the assignments listed here in the workbook and have your preceptor check your assignments and submit your homework answers online.

Week Three Objectives

1. Read the material on pages 19-23 in the textbook and complete the review problems found in #5 at the end of the chapter (pg 29)
2. Complete the online homework assignment. You can find an image of the online problems in this workbook on pages 17-18.

All Week Three required submissions are due to the course instructor by the Friday following the third week of the course.

Guidelines for Decimal Numbers

Decimal numbers are those numbers that contain a “decimal point” which orients the reader to number values. Numbers to the left of the decimal point occupy spaces whose value increases by the power of 10 as we move left:

1000 100 10 1 .

Numbers to the right of the decimal point decrease by powers of ten, beginning with 1/10:

. 1/10 1/100 1/1000

Practice reading the following decimal numbers out loud in the proper form:

55.7	Fifty-five and seven tenths
350.65	Three hundred fifty and sixty-five one hundredths
0.251	Two hundred fifty-one thousandths

Rules for Decimal Numbers

1. If there are NO numbers to the left of the decimal point (the number is less than one), ALWAYS place a zero in the ones column (to the left of the decimal point). This will prevent the number from being misread.

Example: **.25** should be written as **0.25**

2. Zeros in the farthest right hand spaces may be left off when writing the number.

Example: **3.5000** may be written as **3.5** without changing its value.

3. Zeros in between the decimal point and the spaces to the right are **always** written.

Example: **3.005** should be written as **3.005**

3. Addition and Subtraction: Three things are important when adding and subtracting decimal numbers.
 - a. Place the numbers in columns before adding or subtracting
 - b. Align the decimal points vertically
 - c. Use zeros as space keepers to keep the columns aligned.

Place the following numbers in proper columns for addition:

$$23.4 + 0.4 + 1.003 + 251.7 =$$

$$\begin{array}{r} 23.400 \\ 0.400 \\ 1.003 \\ 251.700 \\ \hline \end{array}$$

These rules also apply to subtraction. In subtraction, it is even more important to use zeros as place holders. Align the following numbers for subtraction:

$$15.55 - 1.5 =$$

$$\begin{array}{r} \hline \\ \hline \end{array}$$

Assignment One

Read pages 19-23 in the textbook. Review the rules for manipulation of decimal numbers.

1. Complete the review problems given in #5 on page 29.
2. Complete the online homework problems. You may NOT use a calculator for these problems. You can find an image of the online problems in this workbook on pages 17-18.
3. Review your checklist with your preceptor.

Worksheet Assignment: Week Three

Properly align the following numbers and either add or subtract them as the problem requires. You may not use a calculator for this exercise. You must show all your work and circle your answer. You may use extra paper if needed but be sure to send your work with this homework assignment. All work must be neat. Remember “if the instructor can’t read it, it can’t be graded”.

1. $0.0005 + 1.2 + 170.23 + 15 =$

2. $87.32 - 0.08 =$

2. $15,000 + 0.03 + 10.01 + 150.01 =$

4. $12.18 - 0.00954 =$

5. $23.751 + 0.0047561 =$

Student Name (printed)

6. $18 + 222 + 0.1 + 1.0057 =$

7. $0.000005 - 0.0005 =$

8. $22 + 16 + 3 + 0.002 =$

9. $15.05 - 00.010 =$

10. $36.84 - 3.0684 =$

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK THREE

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the workbook. Complete and submit the online homework problems.

Student Name (printed)

Student or Preceptor Comments:

WEEK FOUR

Basic Math Review: Decimal Numbers, Multiplication and Division Converting Decimals to Fractions and Fractions to Decimals

Text Assignment

Math Master Pharmaceutical Calculations for the Allied-Health Professional, Reifman. Pages 11-37. Work all problems in these pages that you have not yet completed. (You should have worked #5 last week.)

CD Assignment

Under Math review for Dosage Calculations, please complete the Diagnostic Test, then Study Roman Numerals and complete Review Set 1. Study Fractions and complete Review Set 2 – Stop before reading the section over addition and subtraction of fractions! Study Decimals and complete all of Review Sets 4, 5, and 6.

Overview of Week Four

During Week Four, you will review multiplication and division of decimal numbers. You will also review how to convert decimal numbers to fractions and how to convert fractions into decimal numbers. Complete all reading assignments listed here in the workbook and Work all problems required on the CD **BEFORE** attempting the online homework. Check in with your preceptor as to how you are progressing. This week we really begin some serious work, so do not fall behind.

Week Four Objectives

1. Read the material in the textbook and answer the review questions based on that material.
2. Complete ALL of the CD Assignment as specified above.
3. Complete the online homework problems. There is an image of the online homework problems on pages 27-31 in this workbook.

All Week Four required submissions are due to the course instructor by the Friday following the fourth week of the course.

Assignment One

Read the assigned pages in the text and in the Workbook (see below). Complete the assigned material on the course CD. Complete the self-test. Complete the review problems at the end of the assigned chapter in the text.

Complete the Online homework problems. You may NOT use a calculator for this assignment.

Guide Lines for Multiplication and Division of Two Decimal Numbers

1. When multiplying two decimal numbers, multiply the two numbers as if there were NO decimals. Then, count the number of digits to the right of the decimal point in all numbers multiplied. Move the decimal point in the answer that many spaces to the left.

Example: $25.1 \times 3.5 =$

$$\begin{array}{r} 251 \\ \times 35 \\ \hline 1255 \\ 753 \\ \hline 8785 \end{array}$$

There is one decimal place to the right of the decimal in 25.1, and one to the right of the decimal in 3.5. This makes a total of 2 decimal places. Move the decimal that many spaces to the left in the answer above, and our answer is reported to be 87.85.

Division of Decimal Numbers

If you were to buy a whole pizza and have it cut into 8 wedges, you would say that the one pizza was divided into 8 smaller pieces. Division of numbers is no different than dividing pizzas! There is the number to be divided (the dividend), the number by which we are dividing, the divisor, and the answer (how many pieces) which is the quotient.

The dividend is the number being divided or split up by the divisor. There are two ways to represent the act of division:

Method One for dividing numbers

If you are setting up a problem and are using the long division bracket, the dividend is placed under the “roof” of the division bracket and the divisor is placed in front of the bracket:

1. The dividend, or number to be divided, is placed under the “roof” of the division bracket.

$$\sqrt{\text{dividend}}$$

2. The divisor, or number of times to divide the dividend, is placed in front of the bracket (to the left)

$$\text{divisor } \sqrt{\quad}$$

Which leaves you with...

$$\text{divisor } \sqrt{\text{dividend}}$$

3. The quotient, or answer, is then placed on top of the “roof”

$$\text{divisor } \sqrt{\text{dividend}}^{\text{quotient}}$$

Method Two for dividing numbers

The second method of expressing division is to use the division sign as in the following example:

$$45 \div 5 = 9$$

In this method, the dividend is placed to the left of the division sign and the divisor is placed to the right of the division sign. The quotient is then placed to the right of the equals sign.

$$\text{dividend} \div \text{divisor} = \text{quotient}$$

Both methods of writing an equation are equivalent and will provide the same answer. For the purpose of this segment of the course, we will use the long division bracket to set up our problems.

Rules for Division of Decimal Numbers:

Consider the following example:

$$45.5 \overline{) 455.5}$$

1. When the divisor has a decimal, first move the decimal point to the right until the number becomes a whole number: 45.5 becomes 455

$$455 \overline{) 455.5}$$

2. Then, move the dividend's decimal point to the right the same number of places: 455.5 becomes 4555.

$$455 \overline{) 4555}$$

3. Now, divide the problem as you would for any division, placing the decimal point in the quotient directly over the decimal point in the dividend.

$$\begin{array}{r} 1 \\ 455 \overline{) 4555.} \\ \underline{455} \end{array}$$



$$\begin{array}{r} 10 \\ 455 \overline{) 4555.} \\ \underline{455} \\ 5 \end{array}$$



4. 0.006 _____ round to the hundredths

5. 1.77893421 _____ round to the thousandths

Answers: 1) 34.68, 2) 0.9, 3) 140, 4) 0.01, 5) 1.779

Converting Decimals to Fractions and Fractions to Decimals

Fractions are simply parts of a whole. For example, a tablet may be split into two pieces, each piece representing $\frac{1}{2}$ of the original tablet. Doses may be divided into three equal amounts, each amount representing $\frac{1}{3}$ of the total dose. The fraction itself is composed of a numerator, the top number, and the denominator, the bottom number:

$\frac{\text{Numerator}}{\text{Denominator}}$ OR Numerator / Denominator

The denominator tells the student how many pieces the whole has been split into. For example the fraction $\frac{1}{2}$ tells us that the whole has been split into 2 equal pieces. The greater the denominator, the smaller the piece and the smaller the value of the fraction.

Order the following fractions according to decreasing number value:

$\frac{1}{3}$; $\frac{1}{2}$; $\frac{1}{6}$; $\frac{1}{18}$; $\frac{1}{4}$

The numerator tells you how many of the smaller pieces you have. In the fraction $\frac{1}{2}$, we have one piece of the two total pieces. If we had the fraction $\frac{15}{16}$, we would have 15 pieces of the 16 total pieces.

Improper fractions are numbers in which the numerator is larger than the denominator. Numbers such as $\frac{3}{2}$ and $\frac{5}{3}$ are called “improper fractions”. In veterinary medicine, we rarely use “improper fractions”. Instead we convert them to “mixed numbers” which are numbers that contain a whole number and a proper fraction.

Example: $\frac{5}{3}$ can be converted to $1 \frac{2}{3}$ by dividing 5 by 3 and expressing the remainder as a proper fraction.

Express the following improper fractions as mixed numbers:

1. $\frac{14}{5}$ _____

2. $\frac{3}{2}$ _____

3. $18/9$ _____

4. $4/3$ _____

5. $142/3$ _____

Answers: 1) $2+4/5$ 2) $1+1/2$ 3) 2 4) $1+1/3$ 5) $47+1/3$

Sometimes it is necessary to convert a mixed number back into an improper fraction. To change a mixed number to an improper fraction we simply multiply the whole number by the denominator and add the numerator. We then express the number as a fraction:

Example: $12 \frac{1}{2}$ becomes $(2 \times 12) + 1$ expressed as a fraction $25/2$

Convert the following mixed numbers to improper fractions:

1. $12 \frac{2}{3}$ _____

2. $3 \frac{1}{4}$ _____

3. $15 \frac{14}{16}$ _____

4. $1 \frac{1}{8}$ _____

5. $144 \frac{2}{3}$ _____

Answers: 1) $38/3$ 2) $13/4$ 3) $254/16$ or $127/8$ reduced 4) $9/8$ 5) $434/3$

Week Four Homework Assignment

1. Multiply the following decimal numbers. Align all the numbers properly and show all your work for full credit. You may use extra paper if needed. You MAY NOT use a calculator for this exercise. Please circle your answers. **Round your answers Only if asked to do so. Otherwise, do not round.**

a. 23.46×13.16

b. 0.032×1.03

c. 10.25×0.113

d. 125.3×3.1

e. 0.004×0.002

Student Name (printed)

2. Divide the following numbers using the long division bracket method. Show all your work and circle your answers. You MAY NOT use a calculator on this exercise.

a. $15.1 \overline{)144.5}$ *Round answer to the nearest hundredths*

b. $0.008 \overline{)16.32}$ *Round answer to the nearest whole number*

c. $0.05 \overline{)0.00295}$ *Round the answer to the nearest tenths*

d. $3.6 \overline{)0.0056}$ *Round the answer to the nearest hundredths*

Student Name (printed)

e. Place these problems in long division form and round the answer to the required place.

1) $17.73 \div 4.01$ *Round answer to the nearest tenth*

2) $25.25 \div 100.2$ *Round answer to the nearest hundredth*

3) 5849.2 *Round to the tens place*

f. In the following equations, which number represents the **divisor**?
Circle the correct number.

1) $15 \div 3$

2) $0.035 \div 7$

3) $15.1 \overline{) 25}$

g. In the above equations, which number represents the **dividend**? Place your answer in the space provided.

1) _____

2) _____

3) _____

Student Name (printed)

3. Write the following decimal numbers in long hand following using the form given in the example.

Example: 0.05 is five one hundredths

a. 37.003 _____

b. 0.07 _____

c. 0.1375 _____

d. 137.069 _____

e. 1003.0101 _____

4. Express the following decimals as proper fractions. Reduce your answer to the lowest possible denominator whenever possible. Circle your answers.

a. 51.36 _____

b. 0.05 _____

c. 14.013 _____

d. 127.333 _____

e. 0.25 _____

f. 0.75 _____

g. 0.66 _____

Student Name (printed)

5. Express each of the following fractions in decimal form. Express your answers to the nearest hundredths. Circle your answer.

a. $1/4$

b. $2/3$

c. $1/2$

d. $1/3$

e. $1/10$

f. $15/16$

This assignment should be submitted to your instructor by the Friday following Week Four.

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK FOUR

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

WEEK FIVE

Scientific Notation

Text Assignment

None

CD Assignment

None

Overview Of Week Five

During Week Five, you will review how to express decimal numbers in scientific notation. Complete the reading assignments in the workbook. Complete the online homework assignment for this week.

Week Five Objectives

1. Read all the assigned material in the workbook.
2. Complete the online homework assignment for Week Five. You will find an image of the online homework problems on pages 36-38 in this workbook.

All Week Five required submissions are due to the course instructor by the Friday following the fifth week of the course.

Assignment One

Read the material provided in the Workbook. Complete the online homework assignment for Week Five. You may not use a calculator for this assignment.

Scientific Notation

Sometimes there is confusion when using very small or very large numbers. To reduce this confusion, these numbers are often expressed in “scientific notation”. Scientific notation expresses very large or very small numbers as a whole number multiplied by a power of ten. For example: 15,000 may be expressed in scientific notation as 1.5×10^4 and 0.1500 may be expressed as 1.5×10^{-1} .

Rules for converting numbers into Scientific Notation:

1. In scientific notation the number is written in such a way that it is larger than **1** but less than **10** and an integral power of 10. For example, the number 234500 can be written as **2.34500×10^5** .
2. Exponents used in scientific notation can be positive or negative numbers. Negative exponents usually indicate an original number that is less than one. Positive exponents indicate an original number greater than one.
3. To obtain the final product, simply move the decimal point to the left for a negative exponent and to the right for a positive exponent the number of times indicated by the exponent. Example: 5.6×10^2 becomes **560** and 5.6×10^{-2} becomes **0.056**.
4. In a number expressed in scientific notation, if the exponent of 10 is 0 simply multiply the number by 1 to obtain the original number. Example:
$$5 \times 10^0 = 5 \times 1 = 5$$
5. When performing addition and subtraction using scientific notation, it is best to convert all the numbers in the calculation to their original non-scientific notation form and then perform the required addition or subtraction.

Use the following guidelines when multiplying and dividing numbers in scientific notation:

1. For a number to be in proper scientific notation, the number portion must be a number less than 10. Observe the example of expressing 3450 in scientific notation:

Correct Form

$$3.45 \times 10^3$$

Incorrect Form

$$34.5 \times 10^2$$

2. When multiplying numbers in scientific notation, multiply the number portion as you would in any problem and then add the exponents of 10.

Example: $(3.0 \times 10^5) \times (2.0 \times 10^3) = 6.0 \times 10^8$

3. When dividing numbers in scientific notation, divide the whole number portion as you would in any problem and then subtract the exponents of 10.

$$\text{Examples: } \frac{6.0 \times 10^6}{2.0 \times 10^3} = \frac{6.0 \times 10^{6-3}}{2.0} = 3 \times 10^3$$

$$\frac{6.0 \times 10^{-6}}{3.0 \times 10^2} = \frac{6.0 \times 10^{-6-2}}{3.0} = 2.0 \times 10^{-8}$$

$$\frac{6.0 \times 10^{-6}}{3.0 \times 10^{-2}} = \frac{6.0 \times 10^{-6+2}}{3.0} = 2.0 \times 10^{-4}$$

Remember: *When a negative number is subtracted from a positive number, it is actually added to the number: $5 - (-1) = 6$. Two negatives become a positive.*

Week Five Homework Assignment

1. Express the following numbers in proper scientific notation. Place your answer in the space provided. Do not round anything!:

a. 35.71 _____

b. 0.0032 _____

c. 1,275.0115 _____

d. 15.3 _____

e. 0.257 _____

f. 0.00000105 _____

g. 10,000,057 _____

h. 0.5 _____

i. 66.03 _____

j. 10.03 _____

Student Name (printed)

2. Express the following numbers in scientific notation as the original decimal numbers. Place your answer in the space provided. Do not round anything!

a. 2.5×10^5 _____

b. 1.8×10^{-3} _____

c. 3.3×10^2 _____

d. 1.2×10^8 _____

e. 5.4×10^{-6} _____

f. 1.0×10^3 _____

g. 2.1×10^{-1} _____

h. 4.3×10^9 _____

i. 4.3×10^{-9} _____

Student Name (printed)

3. Multiply or divide the following numbers in scientific notation. *Show all of your work and circle your answer.* Do not round!

a. $2.3 \times 10^2 \times 1.6 \times 10^4 =$

b. $5.2 \times 10^5 \times 8.4 \times 10^{-1} =$

c. $7.1 \times 10^7 \div 3.0 \times 10^3 =$

d. $3.5 \times 10^8 \div 1.3 \times 10^3 =$

e. $9.6 \times 10^7 \times 2.5 \times 10^{-2} =$

f. $8.4 \times 10^4 \div 2.4 \times 10^{-2} =$

1. **Student Name (printed)**

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK FIVE

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

WEEK SIX

Fractions: Addition and Subtraction *Fractions: Multiplication and Division*

Text Assignment

Math master Pharmaceutical Calculations for the Allied-Health Professional, Reifman, pp. 13-15

CD Assignment

Under Math Review for Dosage Calculations, Read **all** of the Fractions section and complete review set 3.

Overview of Week Six

During Week Six, you will review the rules for addition, subtraction, multiplication and division of fractions and mixed numbers. After reviewing the material in the text, you will complete the online homework assignment.

Week Six Objectives

1. Read the material assigned in the text and complete the CD Exercise and the review problems.
2. Complete the online assignment.

All Week Six required submissions are due to the course instructor by the Friday following the sixth week of the course.

Assignment One

Read pages 13-15 in the text. Review general rules regarding fractions and the rules governing addition and subtraction of fractions. Complete Exercise on the course CD. Complete the review problems.

Complete the Online homework assignment. You will find an image of the online homework problems on pages 42-44 in this workbook.

You may not use a calculator for this exercise.

Week Six Homework Assignment

Answer the following questions concerning fractions. You may not use a calculator for this exercise. When asked to perform a mathematical calculation, you must show all your work and circle your final answer.

1. Place the following fractions in descending order of their number value (largest to smallest)

$$\frac{1}{3} ; \frac{1}{16} ; \frac{1}{2} ; \frac{1}{4} \quad \underline{\hspace{10em}}$$

2. List the fractions that are considered “improper” in descending order (largest to smallest):

$$\frac{1}{4} \quad \frac{3}{2} \quad \frac{5}{6} \quad \frac{9}{7} \quad \frac{8}{3} \quad \frac{3}{4}$$

3. Convert the following fractions so that they all have a lowest common denominator. Do not alter the order of the list:

$$\frac{1}{3} \quad \frac{4}{5} \quad \frac{2}{15} \quad \underline{\hspace{10em}}$$

$$\frac{1}{7} \quad \frac{3}{8} \quad \frac{14}{16} \quad \underline{\hspace{10em}}$$

4. Add the following fractions.

a. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \underline{\hspace{2em}}$

b. $\frac{1}{3} + \frac{2}{3} + \frac{3}{27} = \underline{\hspace{2em}}$

c. $\frac{15}{16} + \frac{1}{8} + \frac{3}{4} = \underline{\hspace{2em}}$

Student Name (printed)

5. Convert the following mixed numbers to improper fractions.

a. $1 \frac{1}{8}$ _____

d. $122 \frac{8}{16}$ _____

b. $13 \frac{17}{22}$ _____

e. $8 \frac{5}{6}$ _____

c. $5 \frac{3}{4}$ _____

6. Convert these improper fractions to mixed numbers:

a. $\frac{15}{14}$ _____

b. $\frac{4}{3}$ _____

c. $\frac{156}{4}$ _____

d. $\frac{28}{6}$ _____

e. $\frac{3}{2}$ _____

7. Express the following decimals as fractions or mixed numbers:

a. 51.36 _____

b. 0.05 _____

c. 14.013 _____

d. 127.333 _____

e. 0.25 _____

Student Name (printed)

8. Subtract the following fractions:

a. $\frac{15}{16} - \frac{4}{15}$ _____

b. $\frac{4}{17} - \frac{6}{17}$ _____

c. $\frac{2}{3} - \frac{1}{6}$ _____

d. $\frac{24}{8} - 1\frac{3}{4}$ _____

e. $1\frac{3}{5} - \frac{49}{10}$ _____

9. Multiply the following fractions:

a. $\frac{3}{4} \times \frac{2}{9}$ _____

b. $\frac{3}{8} \times \frac{5}{6}$ _____

c. $\frac{2}{5} \times \frac{16}{19}$ _____

d. $6 \times \frac{3}{8}$ _____

e. $\frac{23}{25} \times \frac{2}{3}$ _____

10. Divide the following fractions:

a. $\frac{3}{4} \div \frac{1}{2}$ _____

b. $\frac{16}{32} \div \frac{1}{8}$ _____

c. $1\frac{7}{8} \div \frac{3}{4}$ _____

d. $\frac{1}{2} \div 4$ _____

e. $\frac{2}{3} \div \frac{1}{2}$ _____

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK SIX

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

WEEK SEVEN

Areas and Volumes

Textbook Assignment

None

Overview of Week Seven

In Week Seven, the student will become familiar with calculations of area and volume. These concepts are important in veterinary medicine when building animal housing or structures for food storage. After reading the workbook (see next few pages), complete the online Homework Assignment for Week Seven.

Objectives for Week Seven

1. Read the assigned workbook chapter on areas and volumes.
2. Complete the online Homework for Week Seven. You will find an image of the online homework problems on pages 51-53 in this workbook.

All Week Seven required submissions are due to the course instructor by the Wednesday following the seventh week of the course.

Area Calculations

Scenario: Your veterinarian has \$500 to spend to re-carpet her office. She asks you to choose the best carpet but to stay within her budget. At the store you find two carpets you like: one is \$15.00 per square yard and the other is \$ 5.00 per square foot. Can you calculate which one to purchase?

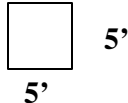
In order to solve this problem, you need to understand the term **area**. The area of any surface is the number of units of square measure contained in the surface. When computing the area of any geometric figure, **express all linear units in the same denomination**. The following are formulas that will help you calculate the area of various surfaces.

1. The area (A) of a **rectangle** is equal to the length of one side times the width of the other side:

$$A = \text{length} \times \text{width}$$


$$A = 5' \times 6' = 30 \text{ square feet}$$

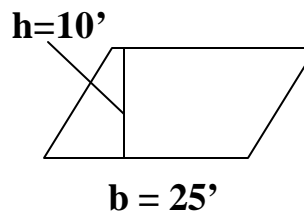
2. The area of a **square** is equal to the square of one side.

$$A = (\text{length})^2$$


$$A = (5')^2 = 5' \times 5' = 25 \text{ square feet}$$

3. The area of a **parallelogram** equals the height (h) times the base (b).

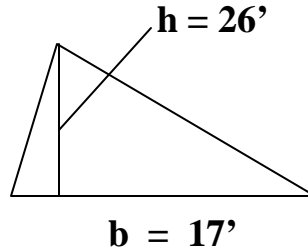
$$A = h \times b$$



$$A = 10' \times 25' = 250 \text{ square feet}$$

4. The area of a **triangle** is equal to 1/2 the height (the altitude) times the base.

$$A = \frac{1}{2} (\text{height} \times \text{base})$$



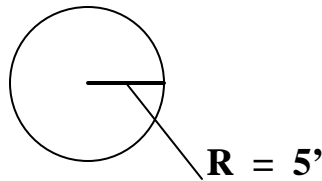
$$A = \frac{1}{2} (26' \times 17') = 221 \text{ square feet}$$

5. The area of a circle is equal to pi (π) times the radius of the circle squared (r^2). Pi is equal to approximately 3.14 and is a constant, meaning that it doesn't change.

$$A = \pi r^2$$

$$A = \pi (5')^2$$

$$= 3.14 (25) = 78.5 \text{ square feet}$$



Going back to the original scenario, you should measure the room to determine the dimensions (length and width) and calculate the total area. If the office measured 15ft. x 12 ft. the area would be calculated:

$$A = 15 \text{ ft} \times 12 \text{ ft} = 180 \text{ square feet}$$

You could then calculate the area in square yards. Since 1 yard = 3 ft, dividing the length and width of the room in feet by 3 yields the dimensions of the room in yards, resulting in dimensions of 5 yards x 4 yards. The resulting area in square yards would be:

$$A = 5 \text{ yds} \times 4 \text{ yds} = 20 \text{ square yards}$$

So, using our carpet prices, you find choice one would cost:

$$\text{Carpet 1: } \$15.00/\text{sq.yd} \times 20 \text{ square yards} = \$300.00$$

$$\text{Carpet 2: } \$5.00 / \text{sq. ft} \times 180 \text{ square feet} = \$900.00.$$

Which would you buy?

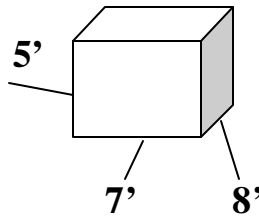
Volumes

In veterinary medicine, you may be asked to calculate the square footage of a holding pen or perhaps you need to know the floor space when constructing a dog run or a bird cage. You may also be involved in the construction of containers for holding food, water, or other products. In this case, you will need to know how to calculate volumes of solid or hollow objects.

Volume may be defined as a capacity or the cubical contents of a shape. It is the number of units of cubic measure contained in a space. The following examples will help you when calculating volumes:

1. The volume of a **rectangular solid** is equal to the *length* (l) x the *height* (h) x the *width* (w). The answer is expressed in cubic units (cu. Unit)

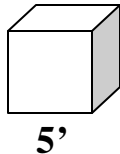
$$V = l \times h \times w$$



$$V = 8' \times 5' \times 7' = 280 \text{ cubic feet}$$

2. The volume of a **cube** is equal to the length of one side cubed. "Cubed" means multiplied by itself 3 times, so the number 2 cubed would be equal to $2 \times 2 \times 2$.

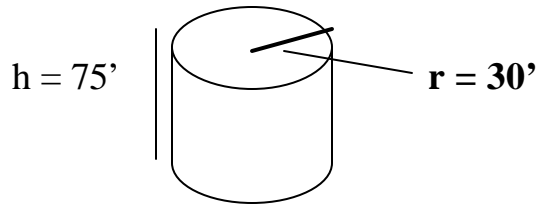
$$V = (\text{length})^3$$



$$V = (5')^3 = 5' \times 5' \times 5' = 125 \text{ cubic feet}$$

3. The volume of a cylinder is equal to pi (π) times the radius squared times the height.

$$V = \pi r^2 h$$



$$\begin{aligned} V &= \pi (30')^2 75' \\ &= \pi \times (30' \times 30') \times 75' \\ &= 3.14 \times 900 \text{ square feet.} \times 75 \text{ feet} \\ &= 211,950 \text{ cubic feet} \end{aligned}$$

**** Remember: The units of Area are square units
The units of Volume are cubic units.**

Helpful formulas, constants, abbreviations and conversion factors

$\pi = 3.14$ **diameter = 2 x radius** **1 yard = 3 feet = 36 inches**

ft. or (') is the abbreviation for feet. Do not abbreviate in the online homework this week!

in. or (") is the abbreviation for inches. Do not abbreviate in the online homework this week!

Week Seven Homework Assignment

Please show all your work for each problem. If it helps, draw a picture of the object and mark its dimensions before making your calculations. You may not use a calculator for this assignment. Please circle your answer.

You may use a calculator, record your work and save it!

To calculate formulas with pi, use either 3.14 or a calculator that has a pi button on it. Remember that 3.14 is not extremely accurate.

You must enter units on these answers. You must spell out all units fully except for money amounts. Put one space between numbers and words. Put one space between words. Do not put a space between dollar signs and numbers. Here are some examples of acceptable answers:

7 square feet 15 square inches 8 square meters

3 cubic feet 27.58 cubic inches 5 cubic meters

\$27.35 **\$35**

1. Calculate the area of a round pen having a radius of 60 feet. (*Note: a “round pen” is a circular enclosure used to train horses. The trainer stands in the middle of the circle and the horse goes around the outside.*) Round to the hundredths place if necessary.

2. Which has the greater area, a square pen that is 25 yards per side or a circular pen with a 25 yard radius? Prove your answer mathematically.

3. Calculate the area of a rectangular field that measures 180 ft. by 150 ft.

4. Determine the value of a field that is 495 ft long by 660 ft. wide if the land costs \$3.00 a square foot.

Student Name (printed)

Assignment Two

The first examination in the Technical Mathematics course is to be administered to the student by the preceptor during the seventh week of the course. This examination is **not** an open-book test. Notes or textbooks cannot be used during the examination. You may **NOT** use a calculator on this exam. You must show all of your work and circle your answer to receive credit for the problem. **Materials up to and including Week Seven will be included on this test.**

The student should schedule a time with the preceptor to take the examination if the preceptor has a computer with internet available. The average student will complete the examination in 45 to 60 minutes. The student should be under the **testing-level** supervision of the preceptor during the entire examination. The student may ask the preceptor for clarification on questions, but the preceptor should be cautious in answering these questions in order to prevent inadvertent answering of a test question.

After you have completed the examination, your preceptor should initial each page of the examination. Please fax in your shown work.

REMEMBER:

2. Do NOT use a calculator.
3. Circle your final answer.
4. Show all work.
5. There is a timer on the exam. You may go past one hour, but do not go past 2 hours. If you do go past 2 hours, you will lose 1 point for every minute that you go over. Do not open the exam unless you are absolutely prepared to sit down for 2 hours of uninterrupted work.

The exam is NOT open book.

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK SEVEN

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.
2. **Exam I**

Student Name (printed)

Student or Preceptor Comments:

WEEK EIGHT

Percentages

Text Assignment

Math Master Pharmaceutical Calculations for the Allied-Health Professional, Reiman, pp. 91-103.
Pay special attention to the vocabulary used! Work all practice problems.

CD Assignment

Under the Math review for Dosage Calculations, read all of the Ratio and Percent discussion. Work all problems under review set 7.

Workbook

Read full discussion on this and the following pages.

Overview of Week Eight

This week the student will review percentages and their use in medical calculations. Conversion of percentages to fractions or decimals will be covered. The use of percentages to express a solution concentration will also be explained.

Week Eight Objectives

1. Read and review assigned material in the text and in the workbook
2. Complete Exercise on the CD and the review problems.
3. Complete the Week Eight online homework. You will find an image of the online homework on pages 59-61 in this workbook.

Percents

Percentages are fractions with a constant denominator of 100 and are the ratio of the quantity of substance per 100 total parts. Example: if 5 animals out of 10 total are cats, then 50 out of 100 are cats and that equals 50%.

When converting decimals into percents, simply move the decimal two places to the right and add a percentage sign. Example s: $0.56 = 56%$ $2.5 = 250%$

Likewise, to convert a percent to a decimal, move the decimal point two places to the left and remove the percentage sign. Example s: $8.7\% = 0.087$ $150\% = 1.5$

All Week Eight required submissions are due to the course instructor by the Friday following the eighth week of the course.

Percentages

In addition to the uses of percentages explained in your text, they are also used when expressing the concentration of a solution. In veterinary medicine, you may be asked to prepare a 2% bleach solution or a 10% formalin solution. Would you know how?

Solutions contain a solute (the substance in the smaller amount, usually a solid) and a solvent (this is often water or normal saline in medicine, but it will always be the substance in the larger quantity). There are three types of percent solutions:

1. $\% w / w = \frac{\text{grams of solute}}{100\text{grams of solution}}$

Concentrations are often expressed in this form when both the solute and the solvent are solids, as when mixing salt and pepper.

2. $\% w / v = \frac{\text{grams of solute}}{100 \text{ milliliter (ml) of solution}}$

In medicine, concentrations are most commonly expressed in this form. Often it is a drug (the solute) and water or saline (the solvent).

3. $\% v / v = \frac{\text{milliliter(ml) of solute}}{100 \text{ ml of solution}}$

Concentrations would be expressed in this form when you are dissolving a liquid in another liquid. We do not frequently use this form in medicine.

Determine the % concentration of the following solutions? (Round to the hundredths percent if necessary)

1. 5 grams of salt in 250 ml of water _____

2. 15 grams of calcium chloride in 50 ml of saline _____

3. 20 ml of ethanol in 300 ml of water _____

Answers(2%, 30%, 6.67%)

Sometimes in the clinic we are required to dilute a more concentrated solution prior to using it. For example, we may wish to prepare a small amount of 10% formalin from a stock solution of formaldehyde whose concentration is 37%. To complete our task, we need to use the following equation:

$$C_1 \times V_1 = C_2 \times V_2 \quad \text{where}$$

- C_1 = the concentration of stock solution
- V_1 = the volume of the stock solution we must use to prepare our desired solution (also called the *aliquot*)
- C_2 = the desired concentration of the final Solution
- V_2 = the desired volume of the final Solution

Notice that one side of the equation is stock solution only, while the other side of the equation is for the final solution only. V_1 = the volume of the stock solution we must use to prepare our desired solution is what you will be finding almost all of the time! Before you begin working a dilution problem (key word – “dilute” or “stock” or “aliquote”) Identify which piece of information is the unknown first! Then identify all of the stock information and all of the information for the final solution. And finally, plug those values into the equation.

In the example given above, if we need to prepare 25 ml of a 10% formalin solution then:

$$C_1 \times V_1 = C_2 \times V_2 \quad \text{where}$$

- Stock concentration is $C_1 = 37\%$
- Stock volume is $V_1 =$ unknown amount
- Final concentration desired is $C_2 = 10\%$
- Final volume desired is $V_2 = 25 \text{ ml}$

Using the formula above and inserting the given factors results in the following: (notice that all of the stock information goes on one side of the equation while all of the final information goes on the other side of the equation.

$$(37\%)(V_1) = (10\%)(25 \text{ ml})$$

Solving the equation for V_1 results in:

$$V_1 = \frac{10\% \times 25 \text{ ml}}{37\%} =$$

$$V_1 = \frac{250 \% \text{ ml}}{37\%}$$

The % signs on the top and bottom of the equation cancel each other out, leaving only the ml designation.

$V_1 = 6.8 \text{ ml}$ of stock solution that must be diluted to 25 ml to prepare the desired solution (Rounded to the tenths place)

Therefore, to obtain your intended solution, you must remove 6.8 ml of the stock solution (37% formaldehyde) from its container, place it into another container, and add sterile water to dilute it to a total of 25 ml. In other words, you must add 18.2 ml of solvent in addition to the 6.8 ml of stock solution since the total volume is 25 ml and we must use 6.8 of stock, that leaves $25 - 6.8 = 18.2 \text{ ml}$ still needed.

Week Eight Homework

Please show all your work and circle your answer. You may not use a calculator for this exercise.

Remember to put 1 space between numbers and units. Always put your units in applied problems!

Examples of acceptable answers: 25 g or 25 grams 15 ml or 15 milliliters

Remember to not put a space between numbers and % signs: 45%

You may use the abbreviations g for grams, mg for milligrams, ml for milliliters

1. Convert the following fractions to percent. *Round to the hundredths percent if necessary:*

a. $\frac{2}{3}$ _____

b. $\frac{5}{6}$ _____

c. $\frac{1}{2}$ _____

d. $\frac{1}{4}$ _____

e. $\frac{4}{5}$ _____

2. Convert the following decimals into percent form. *Round to the hundredths if necessary:*

a. 0.75 _____

b. 0.22 _____

c. 0.10 _____

d. 0.66 _____

e. 0.50 _____

3. How many grams of solute are there in 100 ml of a 15% solution?

4. How many grams of solute are there in 250 ml of a 6% solution?

Student Name (printed)

5. The prescribed dose of a medication is 500 mg / day divided. The instructions are to give 25% in the morning and 75% in the evening. How many milligrams (mg) will you give in:

The morning _____

The evening _____

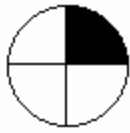
6. You are asked to prepare 500 ml of a 5% dextrose solution from a stock solution of 50% dextrose. Calculate the volume of stock solution that must be diluted to prepare the final solution. (Hint: this is a dilution problem)

7. How much solvent must you add to the above aliquot of dextrose to make the final solution?

8. Describe how you would prepare a 7% salt solution. Your total volume must be 300 ml.

Student Name (printed)

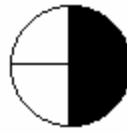
9. If you are administering only the shaded portion, what percentage of the following tablets would you be administering?



a. _____



b. _____



c. _____

10. If you had a kennel population containing 35 dogs and 17 cats, what percent of your kennel population would cats occupy? (Keep in mind that a percentage is $\frac{\text{part}}{\text{total}} = \frac{x}{100}$. The cats are the part that you are interested in, what is the total?) Round your answer to the nearest hundredth percent. **Do not round until you have your answer in percent!**

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK EIGHT

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

WEEK NINE

Algebra: Solving for X

Text Assignment

Math Master Pharmaceutical Calculations for the Allied-Health Professional, Reifman. pp.39-45.

CD Assignment

Read all of the discussion in Math Review for Dosage Calculations found in the Solving Equations for X section. This is an excellent review of items you should already know! Under Math Review for Dosage Calculations, click on practice problems, then click on start test and take the exam until you can get at least 80%.

Overview for Week Nine

In week nine the student will learn how to solve algebraic equations for the unknown X. Manipulation of algebraic equations is often necessary in medical calculations and the student should become comfortable with solving for the unknown quantity.

Week Nine Objectives

1. Demonstrate competence in manipulation of algebraic equations to solve for the unknown.
2. Review the Exercises on the CD and complete the suggested problems.
3. Read the discussion on solving equations for x in this workbook. Complete the online homework. An image of the online homework problems can be found on pages 66-67 in this workbook.

Solving for X:

When solving for X, it is best to think of it as reverse order of operations. Remember the order of operations? Grouping symbols like parenthesis and large fraction bars first, Second deal with all exponents, third deal with all multiplication and division, and lastly deal with additions and subtractions. When solving, we will reverse this order:

Example: Solve $3\left(\frac{2x+1}{2}\right) - 4 = 5$ The goal here is to get the x all by itself. Notice that we will

leave what is inside the parenthesis alone until the very last. First, we must deal with all additions and subtractions that are not inside the parenthesis. See the -4 ? We will move this to the other side by adding 4 to BOTH sides of the equation:

$$\begin{array}{r} 3\left(\frac{2x+1}{2}\right) - 4 = 5 \\ \quad \quad \quad + 4 = +4 \end{array}$$

$$3\left(\frac{2x+1}{2}\right) = 9$$

Next, we should deal with all multiplications or divisions that are not inside the parenthesis. See the 3 that is multiplied in front? We will move this 3 by dividing both sides by 3:

$$\frac{3\left(\frac{2x+1}{2}\right)}{3} = \frac{9}{3}$$

Notice that the 3's cancel!

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

Now we are ready to deal with the expression that was inside the parenthesis. However, there is another grouping symbol here since we have a large fraction bar. The fraction bar is grouping together the expression $2x+1$. Thus, we cannot touch the $2x+1$ until we get rid of the large fraction bar. The 2 in the denominator (the bottom of the fraction) is really just dividing by 2. How can we move dividing by 2 to the other side of the equation? By multiplying both sides by 2:

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

$$2 \times \left(\frac{2x+1}{2}\right) = (3) \times 2$$

Notice that the 2's cancel!

$$2x+1 = 6$$

And now we may deal with the $2x+1$. Of course, we must deal with the $+1$ first, so we will move it by subtracting 1 from both sides of the equation.

$$2x+1 = 6$$

$$\frac{-1}{-1} = \frac{-1}{-1}$$

$$2x = 5$$

Now we need to move the 2 in order to have the x all by itself. We will divide both sides by 2:

$$2x = 5$$

$$\frac{2x}{2} = \frac{5}{2}$$

Notice that the 2's cancel!

$$x = \frac{5}{2} \text{ or } 2.5$$

Sometimes an equation may have several variables. Nothing changes except that we do not have the ease of calculating all the numbers.

Example: Solve $\frac{xy+z}{a} = B$ for x . When an equation is to be solved for x , that means we want the x all by itself.

Notice the large fraction bar. We cannot touch the $xy+z$ until after we get rid of the large fraction bar. We will begin by multiplying both sides by a :

$$\frac{xy+z}{a} = B$$

$$a\left(\frac{xy+z}{a}\right) = a(B)$$

Notice that the a 's cancel!

$$xy+z = aB$$

Now we can first move the added z by subtracting z from both sides, then move the multiplied y by dividing both sides by y :

$$\begin{array}{r}
 xy + z = aB \\
 -z = -z \\
 \hline
 xy = aB - z
 \end{array}$$

$$\begin{array}{r}
 \underline{xy} = \underline{aB - z} \\
 y = y
 \end{array}$$

$$x = \frac{aB - z}{y}$$

It may not be pretty, but that is the solution. Once you have used what you know to get the x all by itself, you are done :)

If at all possible, you should do any arithmetic that is necessary to clean up the equation first.

Example: Solve $-21 + 4 \times -2 = 5x + 1$ for x. Notice that the left hand side is just arithmetic! We will use the order of operations to simplify the left hand side of the equation.

Remember, with arithmetic, multiplication comes before addition:

$$\begin{array}{r}
 -21 + (4 \times -2) = 5x + 1 \\
 -21 + (-8) = 5x + 1
 \end{array}$$

$$\begin{array}{r}
 -29 = 5x + 1 \\
 -1 = -1 \\
 \hline
 -30 = 5x
 \end{array}$$

$$\begin{array}{r}
 \underline{-30} = \underline{5x} \\
 5 \quad 5 \\
 -6 = x
 \end{array}$$

All Week Nine required submissions are due to the course instructor by the Friday following the ninth week of the course.

Week Nine Homework Assignment

Please show all your work for each problem. Circle your answer. You may use a calculator if needed when solving for x . Don't forget your units if needed in the problem.

1. Solve the following equations for x :

a. $200 \text{ ml} + 375 \text{ ml} = x \text{ ml} + 145 \text{ ml}$

b. $x \text{ g} - 25 \text{ g} = 90 \text{ g} - 37 \text{ g}$

c. $30 - x = 50$

d. $2x \text{ liters} + 3 \text{ liters} = 7 \text{ liters}$

e. $0.54 \div 17 = 3x$

2. Solve the following problems for x :

a. $x + \frac{2}{3} = \frac{5}{6}$

b. $1\frac{3}{5} + \frac{2}{5} = x + 3$

c. $\frac{4}{15} \div \frac{4}{5} = \frac{9}{10} \div x$

Student Name (printed)

d. $33.1x + 4.1 = 55.6$

e. $16 + (-12) \div 3 = 2x + 4$

3. Solve the following equation for n :

$$PV = n rT$$

4. Solve the following equation for C_2 :

$$C_1 \times V_1 = C_2 \times V_2$$

5. A veterinarian decides that the total dose of medication for a dog is a combination of 7.5 mg of Drug A and 45 mg of Drug B. If, on another patient, she decides to use a 90 mg of Drug B, how much of Drug A would she need to use to create an equivalent dose?

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK NINE

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.
2. **Written assignment:** Complete Examination Two and submit to the course instructor.

Student Name (printed)

Student or Preceptor Comments:

WEEK TEN

Metric System Units Dimensional Analysis

Text Assignment

Do not use the conversion techniques from pp 75-89 in the Text Book. Please read the workbook discussion on Dimensional Analysis before attempting any conversions. Other methods are fine, but in this course you will be required to demonstrate Dimensional Analysis on every problem for the rest of the semester. Only use Dimensional Analysis from here on! Use the tables of equivalents found in your text to familiarize yourself with basic measurements.

Math Master Pharmaceutical Calculations for the Allied-Health Professional, Reifman, pp 75-89 and pp 105-106 - converting from Centigrade to Fahrenheit and vice versa.

CD Assignment

Work through every button in Chapter 2: Systems of Measurement. This includes working the practice problems.

Read the workbook discussion on Dimensional Analysis before doing Ch 3 on the CD. Only read through the Critical Thinking Scenarios and work through the practice problems. Do not read through the other sections unless you know that you will not get confused. Remember, in this course you will be required to demonstrate Dimensional Analysis on every problem for the rest of the semester, so only use Dimensional Analysis from here on! Use Dimensional analysis when working the practice problems for Ch 3 on the CD.

Overview of Week Ten

During this week the student will concentrate on becoming familiar with the metric system. The student will be required to memorize “equivalency factors” that will allow them to convert any given units into metric units. Students will be instructed in dimensional analysis: the use of equivalency factors for step-wise conversion of units within a problem.

Objectives for Week Ten

1. First Read the discussion in this workbook on the following pages. Then complete the reading assignment in the text and work all of the problems on pp 83-89 USING DIMENSIONAL ANALYSIS (as shown in this workbook) and work problems #8-11 on pp 113-115.
2. Review the Week Ten CD assignment and the complete the practice problems USING DIMENSIONAL ANALYSIS (as shown in this workbook).
3. Complete the Online Homework Assignment for Week Ten.

All Week Ten required submissions are due to the course instructor by the Friday following the tenth week of the course.

Assignment One

Read the assigned material in the text. Memorize the list of equivalency factors **given in the workbook**. Review the CD and practice problems as specified above. Complete the online homework USING DIMENSIONAL ANALYSIS.

Equivalency Factors

First, here are some units of measurement along with their abbreviations:

Measure	Units	Symbol
Length	Kilometer	km
	Meter	m
	Centimeter	cm
	Millimeter	mm (10^{-3})
	Micrometer	μm (10^{-6})
Mass	Kilogram	kg
	Gram	g
	Milligram	mg
	Microgram	μg
Volume	Liter	L
	Milliliter	ml

Here is a complete list of abbreviations that you may use for the online homework:

centimeters cm grams g hours h inches in kilograms kg
liters L milligrams mg milliliters ml pounds lbs seconds s
deciliters dL Fahrenheit F Centigrade C minutes min
gtt for drops Kcal for Kcalories

Student should learn the following conversions. You will not be allowed to use this list for examinations, so you will need to know these. **In fact, these are the only conversions that you should use for any online homework or exams.**

1 kilometer = 1000 meters
1 deciliter = .1 liter or 1 liter = 10 deciliters
1 meter = 1000 mm or 1 millimeter = .001 meters
1 cubic centimeter (cc) = 1 milliliter
1 kilogram = 2.2 pounds
1 kilogram = 1000 grams
1 gram = 1000 milligrams
1 microgram = .000001 grams
1 teaspoon = 5 ml
1 tablespoon = 15 ml
1 tablespoon = 3 teaspoons
1 inch = 2.54 centimeters
8 furlongs = 1 mile (good for racing fans)
1 inch = 2.54 centimeters
1 ounce = 28.40909 grams
1 ounce = 29 milliliter
Formulas for conversion of Temperature

Centigrade = $(F - 32) \div 1.8$
 Fahrenheit = $1.8 (\text{centigrade}) + 32$
 1 Hand = 4 inches

Equivalency Factors

An **equivalency factor** is an expression of two numbers that are equal to each other. For example if one kilogram is equal to 2.2 pounds, then if we divide 1 kilogram by 2.2 pounds we will get 1. The equivalency factor used to express that “equalness” would be:

$$\frac{1 \text{ kilogram}}{2.2 \text{ pounds}} = 1 \quad \text{or} \quad \frac{2.2 \text{ pounds}}{1 \text{ kilogram}} = 1$$

While these factors are written like fractions, they are not. They are expressions that indicate equivalence of these two amounts and they may be written in either form depending on the unit conversion desired.

Some fun but not too useful equivalencies (you don’t have to memorize)

1×10^{12} Bulls = 1 TeraBull
 2000 Mockingbirds = Two kilo-mockingbirds
 .002 Pedes = 2 Centi-Pedes
 1×10^9 Maggies = 1 Giga-Maggies (this is a Texas thing, the Texas A&M Aggies’ slogan is Gig ‘em)
 10 Rators = 1 Deca-Rator
 2 Gorics = 1 paira-Goric
 1×10^{-18} Boys = 1 Atto-Boy
(See, math can be fun!)

Dimensional Analysis

In medicine we are not often presented with a mathematical problem that comes straight from a book. Most of our problems involve conversion of one unit to another, such as finding the number of milliliters of a drug to administer given the animals weight and the concentration of the drug we are using. If we approach these calculations in an orderly and step-wise manner each time we attempt them, we will find that even the most complicated problems are easily solved.

Dimensional analysis, often called the ‘cancel-out method’, allows us to manipulate units so that the given units may be converted to the required units through the use of **equivalency factors**. Look at the following example and see if you can determine how dimensional analysis works.

Scenario: Convert 55 pounds into kilograms:

55 pounds x the equivalency factor relating kilograms to pounds = ___ kilograms

$$55 \cancel{\text{pounds}} \times \frac{1 \text{ kilogram}}{2.2 \cancel{\text{pounds}}} = \text{___ kilograms} \quad (\text{cancel out the units you don't need})$$

$$\frac{55 \text{ kilograms}}{2.2} = 25 \text{ kilograms}$$

Notice that in order for the pounds to cancel, one of them must be on the top line and one of them MUST be in the bottom of a fraction. This is how you know whether to use (1kilogram/2.2 pounds) – which is correct in the above example, or to use (2.2 pounds/1 kilogram) – which would be incorrect in the above example because both pounds are on the top line and will not cancel.

Try the following conversion on your own:

Scenario: Convert 1 tablespoon to liters:

Use this formula and the equivalency factors above

$$1 \text{ tablespoon} \times \text{equivalency factor} \times \text{equivalency factor} = \text{liters}$$

$$1 \text{ tablespoon} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \text{liters}$$

Did you use the factor (15 milliliters/1 tablespoon)? Did you use the factor (1 liter/1000 milliliters)? By using these factors, you have tablespoons on top and bottom so that they will cancel, and you have milliliters on top and bottom so that they will cancel.

$$1 \text{ tablespoon} \times (15 \text{ milliliters}/1 \text{ tablespoon}) \times (1 \text{ liter}/1000 \text{ milliliters}) \\ = 1 \times 15 \div 1000 \text{ liters} = 0.015 \text{ liters}$$

As problems get more involved, you will find that you will require additional equivalency factors to solve the problem. Use as many as you need to convert the given units to the required units.

Dimensional Analysis: Solving word problems

Most people have had a math nightmare at one time or another. Usually this nightmare involves a word problem that starts out “*a train leaves New York at 3 pm traveling at 80 miles/hour...*” The technique of dimensional analysis allows anyone to approach these problems without fear. It provides an organized, systematic approach to the solution of any word problem, even if the student does not know “how “ to solve it. While the technique may take a little longer than other methods, you will find the extra time will pay off with the correct answer, which translates into better medicine for your patients.

When approaching a word problem, you must ask yourself several questions:

1. What is the important and useful information I have been given?
2. What am I being asked to find?
3. What equivalency factors will I need to get from what is given to what is required?
4. Does my answer make sense?

Take for example the following problem:

Bootsie is a cat with a chronic bladder infection. The veterinarian prescribes treatment with Baytril at a dose of 15 mg/kg/day divided into two doses.

Bootsie weighs 13 pounds and you have Baytril tablets containing 22.7 mg of drug per tablet. How many milligrams of drug will Bootsie require per day?

1. What important and useful information have I been given?
 - a. Bootsie weighs 13 pounds
 - b. The dose of Baytril is 15 mg / kg/day
 - c. You have 22.7 mg /tablet on hand at the clinic

2. What am I asked to find?

How many milligrams of Baytril will the cat receive per day

3. What equivalency factors will I require to solve this problem?

a. $\frac{1 \text{ kg}}{2.2 \text{ pounds}}$

This is the equivalency factor for kilograms to pounds

b. $\frac{15 \text{ milligrams}}{\text{kilogram BW}}$

This is the equivalency factor for how many milligrams should be given per kilogram of body weight

With this information, we are ready to solve the problem:

$$13 \text{ pounds} \times \frac{1 \text{ kilogram}}{2.2 \text{ pounds}} \times \frac{15 \text{ milligrams}}{1 \text{ kilogram}} = 88.6 \text{ milligrams}$$

Multiply all the numbers on top and then divide off all of the numbers on bottom: 13×15 divided by 2.2

Remember:

- One of the most important questions to ask yourself after completing a word problem is “**does my answer make sense?**” If you calculate that an animal requires 100 tablets of a drug per day, does that make sense? If you calculate that a 10-pound cat weighs 22 kilograms, does that make sense? Ask yourself this question every time you calculate an answer to a problem!
- Another reason dimensional analysis provides an excellent approach to problem solving is that it provides a self-check. If your units do not cancel to give you the correct (requested) units, then you have set the problem up incorrectly and you can locate your mistake.

Computer Instructions:

We must be able to show our dimensional analysis for the essay questions. Here is an example of how to show your dimensional analysis if the question were how many ounces are in 21 kg?

$$21\text{kg} (1000\text{g}/1\text{kg})(1\text{ounce}/28.4\text{g}) = 739.44\text{ounces}$$

This would look like $\frac{21\text{kg}}{1} \left(\frac{1000\text{g}}{1\text{kg}} \right) \left(\frac{1 \text{ ounce}}{28.4\text{g}} \right) = 739.44 \text{ ounces}$ in normal math writing, but

the computer does not allow us to type in fractions this way. Notice that the top of the fraction must be

listed first! (1000g/1kg) is the correct way to write $\left(\frac{1000\text{g}}{1\text{kg}} \right)$. The incorrect way to write $\left(\frac{1000\text{g}}{1\text{kg}} \right)$ is

(1kg/1000g) because the kgs are on top and will not cancel.

7. How many liters are there in 576 milliliters?

8. The Quarter Horse is noted for its extreme speed over the quarter mile. How many furlongs is a quarter mile?

9. Dr. Summers horse, Fax Cee, is 16 hands tall at the withers. How tall is he in inches?

10. How tall is Fax Cee in centimeters?

Word Problems:

1. You go to the bank and give the teller a \$20 bill and ask for change. She gives you back your \$20 in nickels (she is a very funny teller). How many nickels did she give you?

2. You need to weigh a bird prior to surgery but you only have a pound scale. You weigh the bird and he weighs 0.5 pounds. How many grams would the bird weigh?

Student Name (printed)

3. A dog comes into the clinic for a dental cleaning. Karen, the head technician, weighs the dog and tells you he weighs 20.9 kg. (Karen is from England) You convert that to how many pounds?

4. The label on the bottle of Drug X in the clinic states that the concentration is 4 grams per 5 milliliter. How many milligrams would be contained in 1 milliliter?

5. If you are asked to give 500 ml of IV fluids over 24 hours, how many milliliters of fluid would you need to administer each minute?

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK TEN

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

WEEK ELEVEN

Pharmacy Abbreviations and Reading Labels Dosage Calculations: Oral Medications

Text Assignment

Math Master Pharmaceutical Calculations for the Allied Health Professional, Reifman, pp.55-73, 169-170. Before working the practice problems, please read the workbook discussion for this week since you will be required to demonstrate Dimensional Analysis on every problem.

CD Assignment

This week has much work to be done on the CD: Do all of chapters 5, 6, 7, and 8, but in chapters 7 and 8, only use the Dimensional analysis method. This means that you will need to work Review sets 17, 18, 19, 20, 21, and 22. You will also need to work through all Critical thinking situations and all practice problems for each of these chapters. Hang in there – you can get this done!

Overview of Week Eleven

During Week Eleven the student will begin using the technique of dimensional analysis to solve problems associated with oral medications used in the veterinary hospital. The student will be given word problems requiring conversions of units based on the information given in the clinical situation.

Objectives of Week Eleven

1. Complete the reading assignment in the Workbook first, then Complete the CD Assignment for Week Eleven.
2. Next, work the problems out of your textbook for week Eleven.
3. Complete the online Homework for Week Eleven.
4. After completion of Week Eleven, the student should be able to correctly solve a given problem using the technique of dimensional analysis.
5. Students should be able to correctly use the pharmacy abbreviations.
6. Students should be able to correctly read the label of any given medication.

All Week Eleven required submissions are due to the course instructor by the Friday following the eleventh week of the course.

Homework Assignment Week Eleven

Solve the following problems using dimensional analysis. Answers requiring units must have them to be correct. Show all your work and circle your answer.

Computer instructions:

We must be able to show our dimensional analysis for the essay questions. Here is an example of how to show your dimensional analysis if the question were how many ounces are in 21 kg?

$$21\text{kg} (1000\text{g}/1\text{kg})(1\text{ounce}/28.4\text{g}) = 739.44\text{ounces}$$

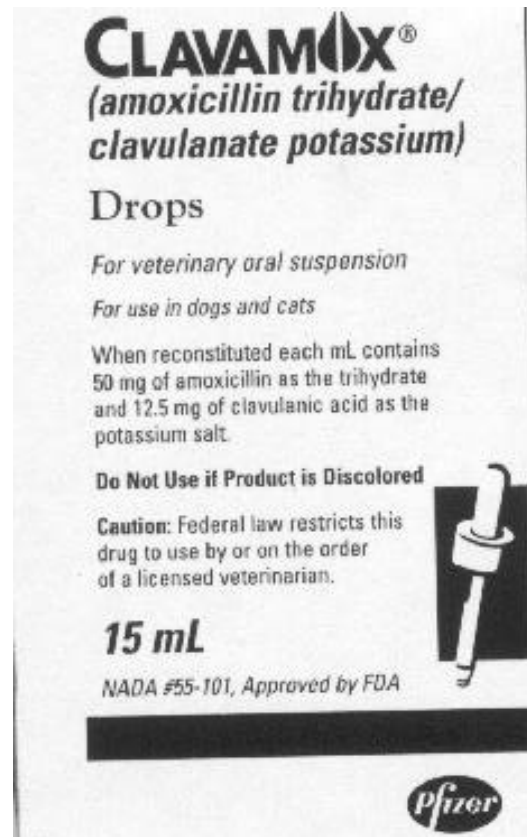
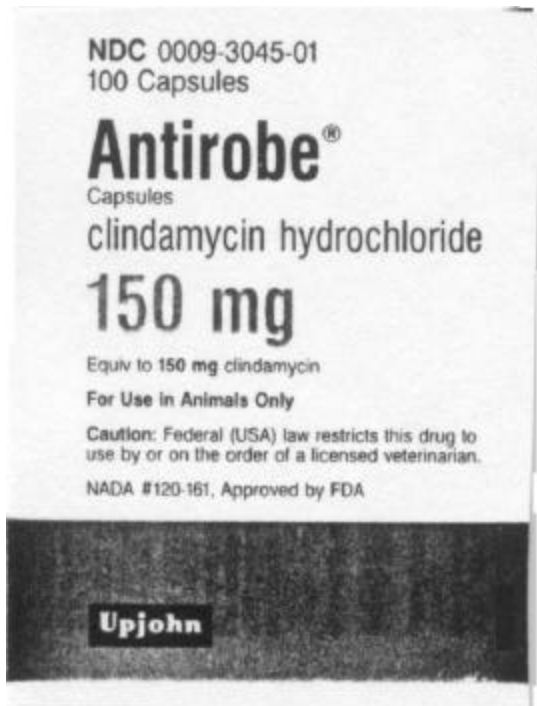
Here is the list of abbreviations that I used in the answers. Do not put periods even though they are abbreviations. Be certain to capitalize L for liters, but this is the only capital letter I used. Keep this list available while you type in your answers.

centimeters cm grams g hours h inches in kilograms kg
liters L milligrams mg milliliters ml pounds lbs seconds s

Section One:

Read the following drug labels and answer the questions provided.

1. Antirobe[®]
 - a. What is the concentration of this drug
(Remember a concentration is a ratio)
 - b. Is it a controlled substance?
 - c. Can this drug be used in humans?
2. Clavamox[®]
 - a. After mixing, when should this drug not be used?
 - b. How should this drug be given?
 - c. What is the concentration of amoxicillin in this suspension?



Student Name (printed)

3. What do the following pharmacy abbreviations stand for:

- | | |
|-----------------|---------------|
| a. s.i.d. _____ | e. q12h _____ |
| b. q.i.d. _____ | f. IM _____ |
| c. t.i.d. _____ | g. SQ _____ |
| d. p.r.n. _____ | h. PO _____ |

Section Two:

1. A cat weighs 13 pounds. The veterinarian has prescribed Amoxicillin at a dose of 15 mg/kg bid. You have 50 mg tablets on hand in the pharmacy.
- How many kilograms does this cat weigh? **Round to the nearest hundredth of a kilogram if necessary.**
 - Use your rounded answer to part a)** to calculate how many mg of Amoxicillin you will administer at each dose. **Round to the nearest hundredth of a mg if necessary.**
 - Use your rounded answer to part b)** to calculate how many tablets you will administer at each dose. **Round to the nearest half tablet. Enter only the number.**
 - Use your rounded answer to part c)** to calculate how many tablets you would need to send home for 10 days. **Enter only the number.**

Student Name (printed)

2. A 50 pound Golden Retriever was diagnosed with a flea allergy dermatitis. You are to dispense Prednisone for the dog and instruct the owner as to how to administer the drug and the possible side effects. The dose of Prednisone is 0.5 mg/lb/day. The owner is to give the dog a full dose for three days then a full dose every other day for 2 weeks.
- Calculate the dose in milligrams per day required for the dog.
 - You have 20 mg tablets on hand. How many will be required for each dose? **Round to the nearest quarter tablet if necessary. Enter only the number.**
 - Use your rounded answer to #16 to calculate the following:** How many 20 mg. tablets will you need to send home with the owner for the 17 days? **? Round to the nearest quarter tablet if necessary. Enter only the number.**
3. The dose of Amoxicillin in the cat is 22 mg/kg PO q8h. Fluffy weighs 16 pound and will require medication for 7 days. You have Amoxicillin suspension whose concentration is 125mg/ml in the pharmacy.
- How many mg will Fluffy require per dose? **Round to the nearest hundredth of a mg if necessary**
 - How many ml will you administer to Fluffy per dose? **Round to the nearest hundredth of a ml if necessary**
 - Use your rounded answer to part b)** to calculate the number of teaspoons you will administer to Fluffy per dose? **Round to the nearest hundredth of a teaspoon if necessary. Enter only the number.**

Student Name (printed)

4. A 30 pound dog is to receive a Baytril tablet twice daily. The dose of Baytril in the dog is 15 mg/kg/day divided bid.
- How many milligrams will this dog require per day? **Round to the nearest hundredth of a milligram if necessary.**
 - Use your rounded answer to part a)** to answer the following. How many milligrams will this dog require per dose? **Round to the nearest hundredth of a milligram if necessary.**
 - Use your rounded answer to part b)** to answer the following. If you have 68 mg tablets on hand, how many tablets will be required per dose? **Round to the nearest half tablet if necessary. Enter only the number.**
5. You have been asked by your veterinarian to give a 1500 pound gelding a dose of fenbendazole. The oral dose for this drug in the horse is 5 mg/kg. The concentration of the Fenbendazole you have on hand is 222mg/gram of granules.
- How many milligrams will this horse require per dose? **? Round to the nearest hundredth of a mg if necessary.**
 - Use your rounded answer to part a)** to answer the following: If you have 4 gram packets on hand, how many packets will you use? **Round to the nearest packet if necessary. Enter only the number.**
6. A dog weighs 15.5 kg. The dose of medication to be given is 25 mg/lb. How many milligrams will you need to administer for this dog?

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK ELEVEN

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

Week Twelve

Dosage Calculations: Injectable Medication

CD Assignment

Work through all of the Chapter 9 material on the CD. Work through Review sets 23, 24, and 25. Work through all Critical Thinking Scenarios and all practice problems. Remember to only use the Dimensional Analysis for this course. In addition, please engage in a discussion with your veterinarian (preceptor) to determine if the conventions presented on the CD are the same as those utilized in your clinic.

Overview of Week Twelve

The student will continue to use dimensional analysis to solve dosage problems. During this week the medications will focus on injectable drugs. Students will also practice reading measured volumes in a syringe.

Objectives of Week Twelve

1. Complete the CD Exercise and the suggested problems.
2. Become proficient in reading measured volumes in a syringe.
3. Use dimensional analysis to solve the dosage problems given in the online Homework Assignment for Week Twelve.

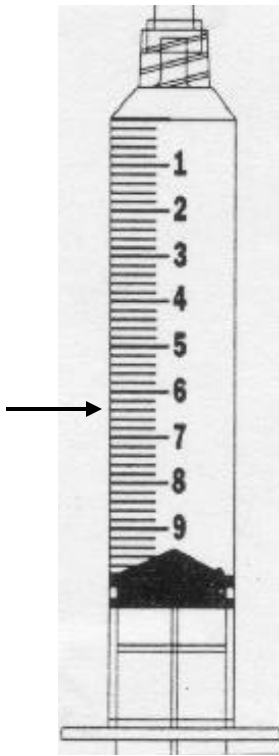
All Week Twelve required submissions are due to the course instructor by the Friday following the twelfth week of the course.

Week 12 Assignment

When asked to solve a problem, you must show all of your work to receive credit for the answer. Answers requiring units must have them. Circle your final answer.

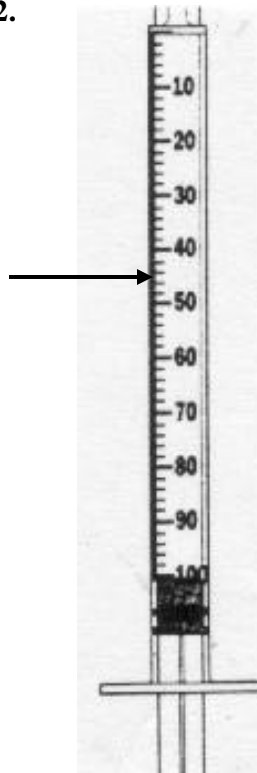
Indicate the volume of medication contained in each of the following syringes:

1.



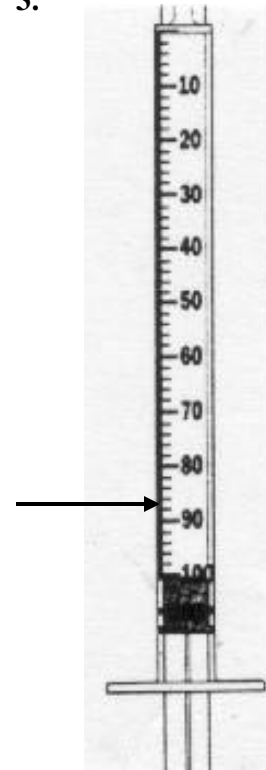
1. _____ ml

2.



2. _____ units

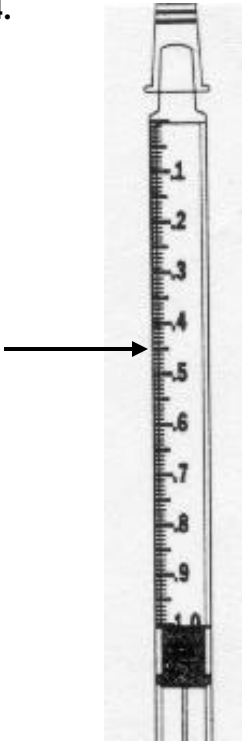
3.



3. _____ units

Student Name (printed)

4.



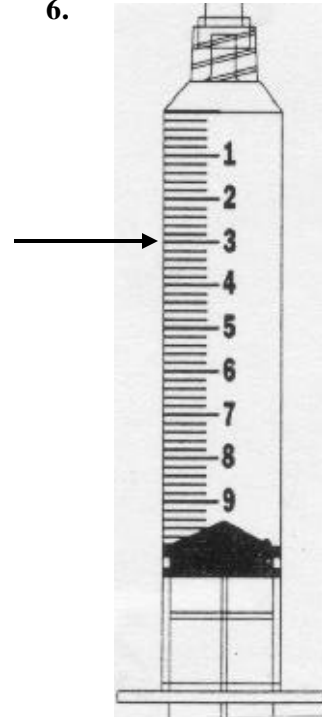
4. _____ cc

5.



5. _____ ml

6.



6. _____ ml

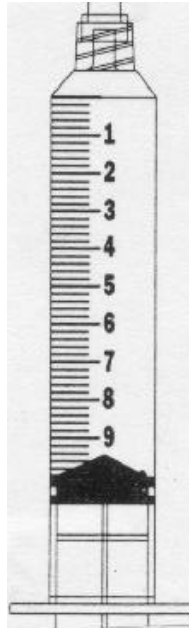
Student Name (printed)

For each of the following syringes, indicate with an arrow on the syringe where the required volume of drug would be:

1. 2.5 cc



2. 4.2 ml



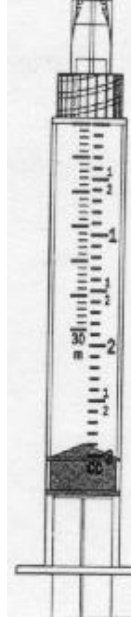
3. 0.5 cc



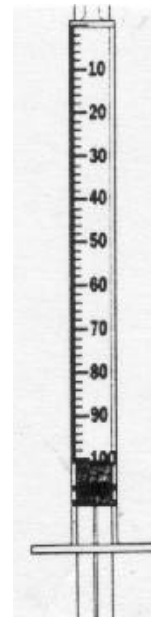
4. 30.5 units



5. 1.4 ml



6. 1 unit



Student Name (printed)

Solve the following dosage problems:

1. You are asked to give a dog his daily dose of insulin. The required dose is 0.5 U/kg every 24 hours. The dog weighs 28 lbs. The bottle of insulin you find in the refrigerator states the concentration of insulin to be 100 U/ml.
 - a. How many units will you administer to the animal? (Round to the nearest hundredth unit)

 - b. Use your rounded answer to part a) to find how many ml of the drug will you inject per dose? (Round to the nearest hundredth of a ml)

2. You are using an intravenous solution of a drug to treat a dog in shock. The concentration of the drug is 200 mEq/20 ml. How many ml of the solution will be required if the dog is to be given a dose of 45 mEq?

3. If a solution of Pentothal is a 5% solution:
 - a. How many milligrams are there in 100 ml of the solution? Begin with grams, then convert to milligrams. Use g/ml for the solution.

 - b. Use your answer to part a) to calculate the following: If we use a dose of 1 ml/5lb, how many ml would be required for a 50 kg dog?

 - c. How many mg would we be giving the 50 kg dog?

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK TWELVE

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

Week Thirteen

Fluid Therapy

Workbook Assignment

First read through the workbook discussion on Fluid Therapy calculations for week thirteen.

CD Assignment

Work through all of Ch 10 on the CD. This means that you will need to work all of the exercise sets 27, 28, 29, 30, 31, 32, 33, 34, and 35. Work through all Critical Thinking Scenarios and all practice problems. Remember to only use the Dimensional Analysis for this course, so you may skip the shortcut method presented in “Calculating Flow rates for manually regulated IV’s”.

Text Assignment

Math Master Pharmaceutical Calculations for the Allied-Health Professional, Reifman. pp.135-139. Just work the practice problems using dimensional analysis.

Overview for Week Thirteen

During Week Thirteen the student will become familiar with calculations used in intravenous fluid administration in the veterinary clinic. Students will practice the calculations for determining the amount of fluids necessary to treat an animal over a specific period of time and they will review the calculations for preparing solutions of the proper percent concentration. This chapter will also require the student to review and practice all of the previous dimensional analysis techniques covered in Chapters 10-12.

Objectives for Week Thirteen

1. Review the material provided in the workbook under Chapter 13.
2. Review the material on the CD.
3. Work the problems in the text.
4. Complete the online Homework for Week Thirteen.

All Week Thirteen required submissions are due by the Friday following the twelfth week of the course.

Fluid Therapy

In addition to the important material covered in the assigned reading in your textbook, there are other important calculations involving fluid therapy that must often be performed by the veterinary technician. Before fluids can be prescribed, the amount of fluid to be given must be calculated. This calculation involves understanding the daily fluid needs of the animal.

The daily fluid requirements for an animal can be broken down into three components:

1. The amount of fluid necessary for the body to function for 24 hours = maintenance volume
2. The amount of fluid necessary to re-hydrate the animal = dehydration fluid volume
3. The amount of fluid necessary to meet the insensible needs = insensible losses(ongoing loss)
(Insensible losses include those from urine, sweat, vomit, diarrhea etc)

Total Fluid Requirements = Maintenance + dehydration + insensible loss

Maintenance Fluid Calculations

For the purpose of this class, we will assume the following requirements for maintenance fluids:
(there are reference ranges given in the literature if the student desires a more accurate dosage rate)

Dogs : 30 ml/pound/day

Cats : 50 ml/pound/day

To calculate the 24-hour requirement for maintenance fluid, simply multiply the animals weight in pounds by 30 ml /pound using dimensional analysis:

$$\text{If the dog weighs 55 pounds: } \frac{30 \text{ ml}}{\cancel{\text{lb}}} \times 55 \cancel{\text{ lbs}} = 1650 \text{ ml}$$

This is the amount of fluid the dog will require to maintain his normal body functions for 24 hours.

Dehydration Fluid Calculations

When animals lose fluid without replacing it, they become dehydrated. Clinically, we have methods of determining the percent of dehydration. These methods include the skin turgor test and the packed cell volume (PCV). At levels of dehydration above 5-6%, we will observe a loss of skin elasticity. When the skin is elevated, there is a delay in the return to normal position. Between 6-8% there is prolonged tenting, the eyes may appear sunken in the orbits and the mucous membranes will appear dry. By 10-12% dehydration, the skin will remain tented when elevated, the eyes will be sunken in the orbits and the animal will be exhibiting signs of shock. 12-15% dehydration in most animals means that death is imminent if treatment is not instituted immediately. The veterinary technician must be able to accurately estimate the degree of dehydration and include this amount of fluid in the total daily replacement levels.

$$\text{Fluid Deficit} = \% \text{ dehydration} \times \text{body weight (lbs)} \times \frac{500 \text{ ml}}{\text{lb}}$$

Keep in mind, 500ml is approximately 1 pint, and “a pint’s a pound the world around.” In other words, a pint of water weighs approximately 1 pound.

A dog is determined to be 8% dehydrated. If he weighs 20 lb, he will require how much fluid to replace the fluid he has lost?

$$\begin{aligned} \text{Fluid deficit} &= .08 \times 20 \text{ lbs} \times \frac{500 \text{ ml}}{\text{lb}} \\ &= 800 \text{ ml of fluid} \end{aligned}$$

This may also be calculated using the weight in kilograms by converting the formula in the following manner:

$$\text{Fluid deficit} = \% \text{ dehydration} \times \text{body weight (kg)} \times \frac{1000 \text{ ml}}{\text{kg}}$$

The above problem then becomes

$$\begin{aligned} \text{Fluid deficit} &= .08 \times 9.1 \text{ kg} \times \frac{1000 \text{ ml}}{\text{kg}} \\ &= 728 \text{ ml of fluid} \end{aligned}$$

**Even though the answers are not “exactly” the same, they are close enough that the animal will receive adequate fluid amounts. The second method is actually more precise mathematically, but fluid therapy is an art as well as a science. Since there is no way to exactly measure the percent dehydration of a patient (short of knowing its weight before it became dehydrated and subtracting its present weight), you are estimating the deficit regardless of which method you use. Success in fluid therapy rests with calculating an initial dose and then modifying it if needed as you monitor the patient.

Insensible Losses (also called ongoing losses)

It is often difficult to determine these fluid volumes. The technician must either measure the urine, vomitus, or diarrhea produced (a time consuming job) or make an educated estimate of the volumes.

When calculating the total amount of fluids required for the entire 24-hour period, the technician should combine the maintenance volumes, the fluid deficit and the insensible losses to arrive at the total.

In the above problem, if we estimate the insensible (ongoing) losses to be 700 ml /day, then the total fluids required for the first 24 hours would be

$$\begin{aligned}\text{Total Fluid Requirements} &= 1650 \text{ ml} + 800 \text{ ml} + 700 \text{ ml} \\ &= 3150 \text{ ml}\end{aligned}$$

Flow Rate Calculations

We will of course be using Dimensional analysis to calculate our Flow Rates:

Example 1: Determine the flow rate to be used to infuse 2 liters of D5W over 12 hours if the set delivers 10 drops per ml. Your answer should be in drops per minute.

Our equivalencies are:

- 2 liters = 12 hours
- 10 drops = 1 ml
- 1 hour = 60 minutes
- 1 liter = 1000 ml

So our Dimensional analysis will look like:

$$\left(\frac{10\text{drops}}{1\text{ml}}\right)\left(\frac{1000\text{ml}}{1\text{liter}}\right)\left(\frac{2\text{liters}}{12\text{hours}}\right)\left(\frac{1\text{hour}}{60\text{min}}\right) = 27.7778\frac{\text{drops}}{\text{min}} = 28\frac{\text{gtt}}{\text{min}}$$

Of course, we could have put our equivalency factors in any order that we wanted, but it is usually considered polite to order them so that canceling units are immediately right or left of each other.

Example 2: Determine the infusion time (in hours) of 1 liter of NS if an infusion set delivering 20 drops/ml is set at 40 drops/min

Our equivalencies are:

- 40 drops = 1 min
- 20 drops = 1 ml
- 1 hour = 60 minutes
- 1 liter = 1000 ml

So our Dimensional analysis will look like:

$$\left(\frac{1\text{liter}}{1}\right)\left(\frac{1000\text{ml}}{1\text{liter}}\right)\left(\frac{20\text{drops}}{1\text{ml}}\right)\left(\frac{1\text{min}}{40\text{drops}}\right)\left(\frac{1\text{hr}}{60\text{min}}\right) = 8.3333\text{hr}$$

Example 3: An infant is to receive 50 mls of an IV solution at 25 gtt/min. If the set is calibrated to deliver 60 gtt/ml, how long (in hours) will it take to infuse this IV solution?

Our equivalencies are:

- 60 drops = 1 ml
- 25 drops = 1 min
- 1 hour = 60 minutes

So our Dimensional analysis will look like:

$$\left(\frac{50\text{ml}}{1}\right)\left(\frac{60\text{drops}}{1\text{ml}}\right)\left(\frac{1\text{min}}{25\text{drops}}\right)\left(\frac{1\text{hour}}{60\text{min}}\right) = 2\text{hours}$$

Homework Assignment for Week Thirteen

In this exercise, you will be given actual clinical situations in which you must calculate the fluid requirements and the infusion rates. Please show all your calculations and use dimensional analysis when performing your calculations. Circle your answers.

** gtt = drops

Computer instructions: Here is the list of abbreviations that I used in the answers. Do not put periods even though they are abbreviations. Be certain to capitalize L for liters, but this is the only capital letter I used. Keep this list available while you type in your answers.

hours h kilograms kg seconds s minutes min
liters L milligrams mg milliliters ml

1. A little kitty is presented to your clinic. He has been trapped in a Coleman cooler for 4 days (he went in for the lunch meat and got trapped). He is estimated to be 7% dehydrated and he weighs 5 lbs.
 - a. How many milliliters of fluid will be required to correct his dehydration? Round to the nearest ml if necessary.

 - b. What would be his maintenance requirement for 24 hours? Round to the nearest ml if necessary.

 - c. What would be his total fluid requirements over the next 24 hours if he has about 100 ml of ongoing loss in the form of urine? Round to the nearest ml if necessary.

2. A horse is presented to your clinic with colic. The mare is sweating profusely and is very painful. You need to start IV fluids immediately as you wait for the veterinarian to arrive. The animal weighs 1267 lbs. and you determine that she is about 8% dehydrated. How many liters of fluid will you need to give to correct the dehydration? Round to the nearest L if necessary.

Student Name (printed)

7. During surgery, our student technicians must maintain IV fluids for our patients. If the feline patient weighs 8 pounds:
- Calculate the maintenance requirements for this patient for a 24 hour period.
 - If the cat is not dehydrated and there will be minimal ongoing losses, calculate the drip rate needed in gtt/min if you are using a microdrip set calibrated to 60 gtt/ml.
8. A parvo patient is 9% dehydrated. The dog weighs 24 kg. You are directed to correct the dehydration over the first 12 hours and to provide the entire day's maintenance fluid volume over the next 12 hours.
- Calculate the dehydration replacement volume for this animal in ml.
 - Calculate the maintenance volume required by this dog for 24 hours.

Student Name (printed)

- c. Using a macrodrip set calibrated at 15 gtt/ml, calculate the drip rate in gtt/min for the first 12 hours. Round to the nearest drop if necessary. Do not use any spaces in your answer.
- d. Calculate the drip rate for the second 12 hours. Round to the nearest drop if necessary. Do not use any spaces in your answer.
9. You have calculated that your patient needs a total of 3 liters of fluids over the next 24 hours. Your drip set is calibrated to deliver 20 gtt/ml. What would be your drip rate in gtt/seconds to deliver the volume of fluid required by this patient? Round to the nearest tenth of a drop if necessary. Do not use any spaces in your answer.

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK THIRTEEN

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete the assigned reading in the textbook and the workbook. Review the CD and the suggested review problems. Complete and submit the assigned homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

Week Fourteen

Problem Review

Text Assignment

None

Overview of Week Fourteen

Problems for Week Fourteen will stress all aspects of medical mathematical calculations covered in this course. Students should be able to confront any given problem and solve that problem in a systematic method using dimensional analysis. Week Fourteen will also serve as a review for the final examination.

Objectives for Week Fourteen

1. Review the chapters on basic mathematical calculations.
2. Demonstrate the ability to convert units using the dimensional analysis technique.
3. Demonstrate the ability to solve complex clinical medication problems using dimensional analysis.
4. Review the entire course in preparation for the final examination.

All Week Fourteen required submissions are due to the course instructor by the Friday following the twelfth week of the course.

- B. The owner calls you the following day and says the dog is worse and she wants to bring her back to the clinic. On arrival you note that the dog is now 8% dehydrated.
- 1) Calculate the total amount of fluid volume that needs to be replaced in this animal in the next 24 hour period if the ongoing losses total approximately 700 ml. Your answer should be in ml

 - 2) Using an infusion set calibrated for 15 gtt/ml, calculate the drip rate in gtt/min for this patient. Round to the nearest drop per minute.
- C. Radiographs reveal that the dog has swallowed a rubber pig and it is lodged in the stomach. The veterinarian will use an endoscope to remove the pig while the animal is under anesthesia. She requests you calculate how many milliliters of Propofol will be used IV in this patient. Your clinic routinely uses a dose of 5 mg/kg IV for anesthesia. The Propofol concentration is 10mg/ml. (Do not round).
- D. After surgery, the dog is placed on maintenance levels of IV fluids. Calculate the drip rate in gtt/10 seconds if you are still using a macrodrip set calibrated to deliver 15 gtt/ml. (Include maintenance only.) Round to the nearest tenth of a drop if necessary. Use gtt/10s as your units.

Student Name (printed)

4. You are looking for a pasture for your horses. You have 6 brood mares that you feed well but you would like to have some pasture for exercise. If each horse requires 1 acre of land and 1 acre is equal to 43,560 sq. ft., will you have enough room for the horses if you purchase a pasture that measures 600 ft. x 275 ft. Show your calculations of the area of the pasture and confirm your answer using mathematics!

How much land will you require? Do not abbreviate:

How much land will you have if you purchase a pasture that measures 600 ft. x 275 ft. Do not abbreviate:

5. A 7 year old male orange tabby cat is presented to your clinic collapsed. The owner states that he has not seen the cat in the litter box for three days. You examine the cat and find the following:

Weight = 9 pounds

Dehydration = 9%

Capillary refill = 4 seconds

Body temperature = 99°F

- A. You feel a firm, enlarged bladder in the caudal abdomen. The veterinarian confirms your belief that the cat has a urinary obstruction and asks that you start fluids on the cat to replace the fluid deficit and maintenance requirements over the next 24 hours. She also wants you to give the cat dexamethasone at a dose of 5 mg/lb IV. You have on hand dexamethasone whose concentration is 4 mg/ml.

- 1) Calculate the total fluid requirement for the entire 24 hour period (assume no ongoing loss). Round to the nearest ml if necessary.

- 2) Calculate the number of ml of dexamethasone required IV for the cat. Do not round.

Student Name (printed)

B. The veterinarian passes a catheter on the cat and relieves the bladder obstruction. During the next 24 hours the cat begins to pass urine in large amounts. His insensible loss over the second 24-hour period is now about 2000 ml.

- 2) Calculate the total requirement for fluids in this cat for just the second 24 hour period assuming that you have corrected his dehydration during the first 24 hours. Your answer should be in ml.

C. The cat is sent home after three days in the clinic with a prescription for Clavamox liquid whose concentration is 50 mg/ml. The dose prescribed for the cat is 63 mg/lb bid.

- 1) Calculate the number of mg the cat will require for each dose.

- 2) Calculate the number of ml the cat will receive at each dose. Do not round.

Student Name (printed)

6. You have been asked to prepare a 2.5% dextrose solution in a liter bag of Lactated Ringers solution. You have on hand a 250 ml bottle of 50% dextrose. Calculate the amount of the stock solution you would need to prepare the required solution. Your answer should be in ml

Briefly describe HOW you would prepare the final solution.

7. You have been asked to prepare a 7% saline solution for use in the emergency clinic. You have on hand a box of salt, a beaker, and a bottle of sterile water. How many mg of salt are you going need to prepare 250 ml of the 7% solution? ? Do not round. Use g/ml for your ratio.

Student Name (printed)

8. A dog has been hospitalized in your clinic for renal failure. His kidneys are not working well but the veterinarian has prescribed Gentamicin IV twice daily at a dose of 4 mg/kg every 8 hours. At the time of admissions, the dog's creatinine levels are moderately elevated. (Creatinine provides a measure of kidney function). You weigh the dog daily and today he weighs 48 pounds.
- A. Calculate the number of milliliters you will need to inject this dog per dose if you have Gentamicin whose concentration is 50mg/ml. Round to the nearest hundredth of a ml.
- B. By the second day in the hospital the creatinine levels in this dog have become markedly increased. The veterinarian asks you to decrease the dose of Gentamicin by 40%. Use your rounded answer to part A to calculate how many milliliters will you now be giving this dog per dose? Round to the nearest hundredth if necessary.
9. Poopsie is a very fat cat that is presented to your clinic for weight reduction. The veterinarian decides that Poopsie needs to lose 12% of her current weight in the next year. She currently weighs 26 pounds!
- A. How many pounds must Poopsie lose in the next year? Do not round.
- B. How many grams would that amount to? Round to the nearest gram.
- C. If Poopsie was to require 20 Kcal./lb/day, how many Kcal. would she need to consume daily?

Student Name (printed)

10. A dog is presented to your clinic with a skin infection. The veterinarian prescribes Cephalexin at a dose of 33 mg/kg q 8h for 10 days. The weight of the dog is 15 pounds. The pharmacy has on hand capsules with a concentration of 250 mg/capsule.
- A. How many mg will the dog require per dose?

 - B. How many mg will be required for the entire day?

 - C. How many capsules will you send home with the owner for the ten day period? Round to the nearest number of capsules per dose, then calculate the Total number of capsules. Enter only the number.

 - D. The capsules are \$1.25 each and there is a \$3.00 prescription fee. Since the owner is a very good client, she receives a 5% discount in pharmacy charges. How much will you charge her for this prescription? Do not round until the final answer!

Student Name (printed)

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK FOURTEEN

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. **Written assignment:** Complete and submit the assigned homework problems from the workbook.

Student Name (printed)

Student or Preceptor Comments:

WEEK FIFTEEN

Final Examination

Week Twelve Assignments

1. **Final written examination is to be taken online** . You may have more than one attempt as time permits. All attempts after the first must be cleared – by e-mail with the instructor.

This examination is **not** an open-book test. Notes or textbooks cannot be used during the examination. You must show your work on the exam to receive credit. **This examination is comprehensive.**

The average student will complete the examination in 60 to 90 minutes.

After you have completed the examination, you must submit your shown work to the course instructor by fax or as an attachment in e-mail.

All Week Fifteen required submissions are due to the course instructor by the Friday following the twelfth week of the course.

*This page is to help you stay accountable. If your veterinarian is willing, you should have them check that you have completed every thing on this checklist **each** week. Seek out their comments and their expertise!*

PRECEPTOR CHECKLIST • WEEK FIFTEEN

Preceptor note: On written assignments, the preceptor is asked to verify that the questions were answered. The preceptor should aid the student in difficulties where possible, as well as engage in discussion with the student about clinic practices and how they may differ from the pure mathematical approach. All professional evaluation that a preceptor can provide will help the student.

Task or Assignment

1. Complete the final examination in Technical Mathematics.

Student Name (printed)

Student or Preceptor Comments: