Part One

Let's get started! In this section, we will review basic math skills and provide an introduction for you to begin working drug-math calculations.

If you feel comfortable with your basic math skills, you may wish to skip the first chapter and begin review for setting up drug problems in Chapter 2.

Chapter 1

Basic math review

It's time to get down to the basics. Let's review some basic math principles first, to get your feet wet. Before that, let's mention one thing. Are you handy with a calculator? Good. Calculators are wonderful tools and can help you work smarter, not harder. But watch out: don't trust them as if your life depended on it.

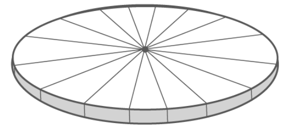
Calculators are only as good as the person who inputs the numbers—and people do make mistakes. Remember the old computer adage, "Garbage in, garbage out"? It's important that you know how to set problems up and double-check the results. And—horror of horrors! —what if you don't have a working calculator handy when you need it? What if it doesn't work because of a power outage or other disaster? What if the batteries are dead? You'd really be stuck then! So let's get to work on these problems now.

Division

Remember those multiplication tables? They really come in handy now. Most people are proficient in addition, subtraction, and multiplication. Division, however, is a trickier matter: Let's talk about division first.

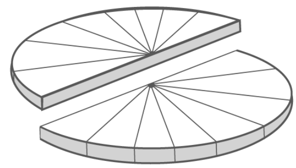
You always need two numbers to divide. First, let's use two whole numbers to make it easy. "16 divided by 2" means the first number, 16, is divided by the second number, 2. So you will write out the problem by putting 16 on top, drawing a line to separate the two numbers, and putting 2 on the bottom, thus

$$\frac{16}{2} \quad \text{or } 16 \div 2$$



This means "2" will go into "16" a number of times (we'll call this "x"), thus

$$x = \frac{16}{2} = 8$$



Easy, wasn't it? You found a whole number, 8, for your answer. But what if a number doesn't come out whole? For example, take 3 divided by 6. We set this up the same way as the problem above:

$$x = \frac{3}{6} = 0.5 \qquad \text{same as} \qquad \begin{array}{r} 0.5 \\ 6\overline{)\,3.0} \\ \underline{3.0} \\ 0 \end{array}$$

Therefore, $x = 0.5$ is our answer.

Wait! Something's different. What happened?

You ended up with a decimal point! This is not a whole number, but a part of one.

Tip: Always put a "zero" before the decimal point if there is no number there (this means the number is less than one)—it helps you avoid confusion about where the decimals should be.

Decimal points

When you are working with decimal points, make sure that you account for each decimal point. This is an easy place to make a mistake—and it can be one of the deadliest. So watch out!

Don't forget: Don't forget to account for those decimal places!

When a decimal point went very wrong

A nurse in the intensive care unit of a busy hospital was taking care of a man who had been admitted for a myocardial infarction (heart attack). The physician came in to admit the patient and to write admitting orders for him. When the nurse picked up the chart to review the orders, she saw that she was to give 1,000.0 units of heparin intravenously to the patient right away. (Heparin is an anticoagulant and makes the blood take longer than usual to clot.)

The nurse misread the order and moved the decimal point to the right by mistake. She gave the patient 10,000.0 units of heparin instead—ten times the ordered dose.

What happened to the patient? He developed bleeding into his brain and had a massive stroke. He died several days later, never regaining consciousness. The nurse was devastated. How could she have prevented herself from making this mistake in the first place?

Two things come to mind. First, if she were unsure of the physician's order, she should have asked the physician to clarify the order. Second, she should have ***double-checked*** the order and the dose with a second nurse before administering the medication. Heparin is a drug, like insulin, that must always be double-checked with another nurse—for safety's sake.

Example: 3.62 multiplied by (or "times," also represented by ×) 6.5 will give you three decimal points at the end, because you must account for each decimal place in the problem (3.62 has two decimal places, and 6.5 has one decimal place). Don't forget to count those zeroes!

$$
\begin{array}{r}
3.62 \\
\times\ \ 6.5 \\
\hline
1810 \\
2172 \\
\hline
23.530
\end{array}
$$

← three decimal places

3.62 × 6.5 = 23.530, or 23.53

You don't need to keep the zeroes if they are to the extreme right of the decimal point, as in the example above.

Those pesky fractions

Many students quake at the sight of a fraction. Oh, no! We like to work with whole numbers the best—and whole numbers with decimal points second best. Anything to avoid working with the enemy, fractions. So, many people decide to convert fractions into decimal points to make it easier for them to work with the numbers. It's more calculator friendly, too. But…

Watch out: By converting one or more fractions into decimals, you are adding one or more steps to your problem. Any time you add steps to a problem, you have increased the possibility of making a mistake. Use the fewest number of steps possible—don't make work for yourself.

You can use fractions to help you through some really rough times. Do you remember how to work with fractions? Let's review.

Just what is a fraction, anyway?

Think of a fraction as part of a number. All fractions have two parts: a top number and a bottom number. You can leave the fraction as is, if you wish to work with the fraction (try it out before you decide against it), or you can convert the fraction into a number with decimal places.

Let's jog your memory. You will be dividing the top number by the bottom number. For example

$$\frac{3}{6} = 3 \text{ divided by } 6 = \frac{1}{2} \text{ or } 0.5. \text{ That's one half!}$$

We need to do another problem. Try this one:

$$\frac{2}{6} = 2 \text{ divided by } 6 = 0.\overline{33} \quad \text{same as} \quad \begin{array}{r} 0.33 \\ 6\overline{)20} \\ \underline{18} \\ 20 \\ \underline{18} \\ 2 \end{array}$$

Notice the "3" keeps repeating itself, on and on.

Tip: Many people prefer to "cut off" a number at the hundredths place, or two decimal points.

What is this? You have a number with a decimal point! Notice, however, that your answer has a line drawn above the numbers to the right of the decimal point. Just what do these lines over the "33" mean?

Actually, $0.\overline{33}$ can also be written as $0.\overline{3}$, by rounding down. Whenever you see a line over a number or a group of numbers, it means that number or group of numbers repeats itself indefinitely. Since we can't write out the number "3" indefinitely—we would run out of space—we use that as a kind of shortcut to mean that they repeat.

But is this number an exact number? No!

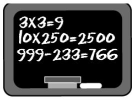
This brings up an important point. "$0.\overline{3}$" is an approximation of "one third." Even if you are using a calculator that has just calculated one third for you by figuring "one divided by three" for you to use in the problem, and the numbers to the right of the decimal point go on and on, you will not be using the exact number, and you may get an answer that is a little different from working the calculation with the fraction. Hopefully this won't be too different, but the possibility does exist.

What if you have $0.\overline{666}$? Some people, instead of writing $0.\overline{666}$, prefer to round up (because the "6" is larger than "5") and write the number as 0.67. Once again, these only approximate the real meaning of two thirds.

Tip: When do you need to "round up" or "round down" a number? Look at the number immediately to the right of the decimal place where your last number will be when you are finished. If you have four decimal places and you want to round to the hundredths, look at the third number. If the third number is five or greater, you make the second number larger by one. If the third number is four or less, you keep the second number the same. Then, you will drop the numbers to the right of the second number.

Example: You come up with "45.6832" as an answer to your calculation. You decide to "cut off" the number at the hundredths place. The third number to the right of the decimal place is "3". Since it is less than "4", you will not change the number "8"; you just drop the "3" and "2" from your answer, which leaves you with "45.68."

4	5	.	6	8	3	2
			tenths	hundreths	thousandths	ten thousandths



Example: You come up with "54.3883" as an answer to your calculation. You decide to "cut off" the number at the hundredths place. The third number to the right of the decimal place is "8". Since it is greater than "5," you will change the number "8" to "9"; you then drop the "8" and "3" from your answer, which leaves you with "54.39."

What if you come up with "54.3983" as an answer to your calculation? You decide to "cut off" the number at the hundredths place. "8" is the third number to the right of the decimal place. Since it is greater than "5", you need to change the "9" to a higher number. "10" is higher than "9", so you make the "9" a "0" and add "1" to the "3", immediately to its right, making the "3" a "4". You then drop the "8" and "3" from your answer, which leaves you with "54.40."

If you use a calculator, you will probably want to convert all your fractions into decimal points. Just keep this in mind: Sometimes it is better to work with fractions in the beginning and then convert the answer to a number with a decimal point. By reducing the number of steps in a problem (or by not adding any additional steps), you reduce your chances of making a mistake.

Adding and subtracting fractions

What if you want to add (or subtract) two fractions? This shouldn't be hard at all.

The trick to adding or subtracting fractions? *Make sure the bottom half of both fractions are the same number.* Then all you have to do is add (or subtract) the two top numbers together. The same thing goes if you want to add three or more fractions together—just make sure the bottom numbers are all the same. How do you do that? Just multiply the bottom numbers together to find your "common denominator."

Example:

The common denominator for $\frac{1}{2}$ and $\frac{1}{3}$ is 2 x 3 = 6.

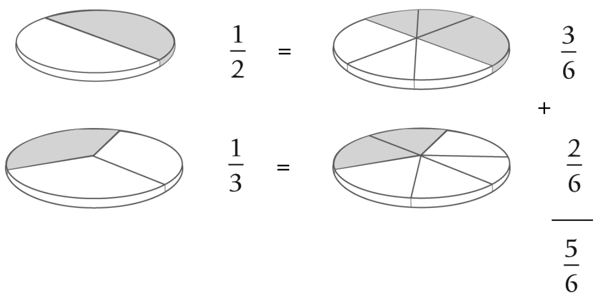
But wait! We're not through yet. Don't we have to do something to the top numbers, too? We can't add any old numbers to our problem just because we want to.

And you're right. As long as you multiply the bottom of one number by another, you'll need to multiply the top of that number by that same number. Essentially, we're just multiplying the number by "1." And that's okay.

So the first number, $\frac{1}{2}$, will be multiplied by $\frac{3}{3}$, giving us our answer of $\frac{3}{6}$.

The second number, $\frac{1}{3}$, will be multiplied by $\frac{2}{2}$, giving us our answer of $\frac{2}{6}$.

Now all we have to do is add 3 + 2 = 5 (for the top numbers) and keep 6 on the bottom, leaving us $\frac{5}{6}$. That's our answer!



Don't forget: *Whatever you do to the top number, you must do to the bottom. The proportion remains the same.*

You do the same thing for subtracting fractions. Let's borrow the numbers we just used and subtract them instead! We find our common denominator in exactly the same way.

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

Easy, huh?

Only add or subtract the top number (numerator). The bottom number (denominator) stays the same.

Multiplying fractions

Multiplication is easier. When you want to multiply fractions, you will *multiply the top numbers together and then multiply the bottom numbers together.*

Let's try a problem first.

$$\frac{16}{150} \text{ multiplied by } \frac{4}{3} = \frac{16 \times 4}{3 \times 150} = \frac{64}{450} = 0.14\overline{22}$$

Here's another group of "repeaters." We can also round down to 0.142. (And don't forget to put your "zero" before the decimal point—it helps to avoid confusion!)

Dividing fractions

Division is a little trickier than multiplication, but there is one trick to remember: *when you divide fractions, turn it into a multiplication problem.* And most people do find it much easier to multiply than to divide.

The trick? Multiply the top number by the inverse (turn the fraction upside down) of the bottom number. Let's do an example.

$\frac{1}{3}$ divided by $\frac{1}{6}$ = $\frac{1}{3}$ multiplied by $\frac{6}{1}$ (this is the inverse of $\frac{1}{6}$)

now it's a multiplication problem: $\frac{1}{3} \times \frac{6}{1} = \frac{6}{3} = 2$.

That wasn't so bad, was it? Let's try more complicated numbers to see if it works the same way.

$\frac{1}{1{,}000}$ divided by $\frac{1}{10{,}000}$ is equal to $\frac{1}{1{,}000}$ multiplied by $\frac{10{,}000}{1}$ or

$$\frac{1 \times 10{,}000}{1{,}000 \times 1} = \frac{10{,}000}{1{,}000} = \frac{10}{1} = 10.$$

Tip: Remember cancellation? You can cancel numbers out when you are dividing to simplify the problem. In the above problem, there are four zeroes on top and three zeroes on the bottom. Remember, whatever you do to the top number you must do to the bottom. Therefore, you can cancel out three zeroes (cross them out) on both the top and bottom. That leaves us with the "$\frac{10}{1}$", or "10".

$$\frac{10{,}000}{1{,}000} = \frac{10}{1} = 1$$

That was a difficult problem. If you got it, pat yourself on the back. If you didn't, you might want to review this section and try some more examples at the end of the chapter.

To summarize

Work with your fractions, not against them. Try to set up problems so you use the fewest number of steps you need to solve the problem. Remember, the more steps you add to a problem, the more of a chance you have of making a mistake! It's only logical—you've got more room for error. And practice, practice, practice!

Exercises

As you know, practice makes perfect. Let's do a few problems and see what the answers are.

1. $\frac{3}{4} + \frac{6}{9} =$

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

3. $\frac{7}{9} - \frac{1}{2} =$

4. $\frac{2}{3} - \frac{1}{6} =$

5. $\frac{4}{11} \div \frac{1}{5} =$

6. $\frac{1}{10} \div \frac{2}{3} =$

7. $\frac{1}{6} \times \frac{6}{5} =$

8. $\frac{13}{20} \times \frac{1}{3} =$

9. $3.87 \times 15.3 =$

10. $10.99 \times 62.4442 =$