VetTechPrep

Medical Math for Vet Tech Students

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As a Vet Tech, you are likely to find yourself using math on a daily basis. Some of this math may be delegated to you directly by the veterinarian, while other calculations will be performed as a result of your patient care duties.

Whether or not you enjoy math, or consider yourself naturally good at it, it's important to become comfortable with performing calculations that you are likely to encounter in practice. Practicing these calculations will allow you to perform them when necessary and minimize the risk of errors that could negatively affect your patients.

Common Calculations in Veterinary Medicine

Calculate a Drug Dose

Drug dosages are typically provided in mg/kg format, stating how many milligrams of drug a patient should receive for each kg of body weight.

In order to determine a patient's dose, use the following formula:

Patient's dose (mg) = weight (kg) x dosage (mg/kg)

Example: The veterinarian diagnoses a 23 lb dog with a bacterial skin infection. She asks you to send the dog home with two weeks of cefpodoxime at a dose of 10 mg/kg once daily.

What tablet size should you send home, how many tablets should you include, and what should you print on the medication label?

First, convert the dog's weight from pounds to kg:

(23 lbs) / (2.2 lbs/kg) = 10.5 kg

Next, multiply the dog's weight (in kg) by the medication dosage:

(10.5 kg) x (10 mg/kg) = 105 mg

Cefpodoxime comes in both 100 mg and 200 mg tablets. You should send the dog home with fourteen 100 mg tablets, with a label that states "Give one tablet by mouth every 24 hours."

Calculate a Patient's Maintenance Fluid Rate

The normal maintenance fluid rate for small animal patients is 50-60 ml/kg/day. Intravenous fluid pumps, however, typically require you to enter a fluid rate in terms of milliliters per hour. In order to connect a patient to a fluid pump for the administration of maintenance fluids, you must determine how many mls of fluid the patient needs in a 24-hour period, then divide the daily fluid requirement by 24 (the number of hours in a day) to determine the hourly fluid rate.

If you wanted to create an equation to solve for ml/hr, that equation would look like this:

Maintenance fluid rate (ml/hr) = [patient's weight (in kg) x 50-60 ml/kg/day] / [24 hrs/day]

In reality, however, it's probably easier to just think through this problem, instead of writing out a full equation.

Example: A 25 kg dog requires maintenance fluid therapy. What ml/hr rate should be entered into the fluid pump?

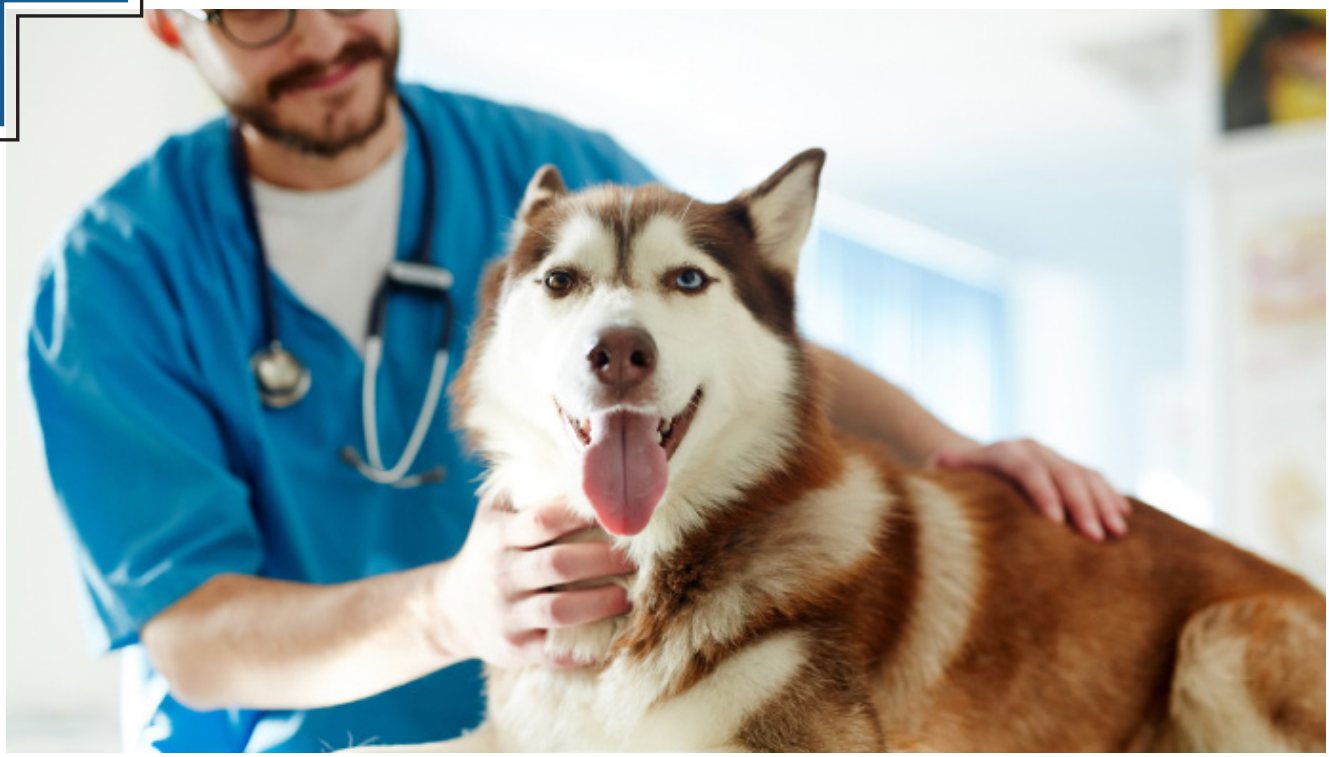
First, calculate the patient's 24-hr requirement:

(25 kg) x (55 ml/kg/day) = 1375 ml/day

There are 24 hours in a day, so use this fact to to convert ml/day to ml/hr:

(1375 ml/day) / (24 hrs/day) = 57 ml/hr

Therefore, you should enter a fluid rate of 57 ml/hr into the fluid pump.



Calculate a Patient's Replacement Fluid Rate

In a dehydrated patient, fluid therapy must take into account the patient's degree of dehydration, in addition to providing for the patient's maintenance fluid rate. Fluid deficits are typically corrected over a 24-hour period.

Example: The 25 kg dog in the example above is 8% dehydrated. What ml/hr fluid rate should be used for the first 24 hours of IV fluid therapy?

As calculated above, the dog's maintenance fluid rate is 1375 ml/day or 57 ml/hr.

Next, calculate the quantity of fluids that must be given to correct dehydration.

(25 kg) x (0.08 dehydration) = 2 kg water deficit

One kg of water is one L of water, therefore:

2k water deficit = 2L water deficit = 2000 ml water deficit

In order to obtain the fluid rate needed to correct dehydration, convert 2000 ml of water per day into ml/hr:

(2000 ml) / (24 hrs/day) = 83 ml/hr

Finally, add the maintenance fluid rate and the rate needed to correct dehydration:

83 ml/hr + 57 ml/hr = 140 ml/hr

Therefore, a fluid rate of 140 ml/hr will ensure that the dog's maintenance requirements are met and that the dog's fluid deficit is corrected within the first 24 hours.

Dilute a Substance to Achieve a Desired Concentration

In many cases, dextrose or other substances must be added to IV fluids for a particular patient. The easiest equation to use for this type of calculation is the following:

C1V1 = C2V2

In this equation, C1 and V1 represent the starting concentration and volume, while C2 and V2 represent the final concentration and volume.

Example: A 3 kg hypoglycemic puppy requires a 2.5% dextrose solution for IV fluid administration. You have a 1L bag of LRS and a bottle of 50% dextrose. How much dextrose should you add to the fluid bag?

In this example, C1 is the original dextrose concentration (50%), V1 is the dextrose volume to be added, C2 is the desired dextrose concentration (0.025%), and V2 is the total volume of fluids.

Plugging the numbers that we know into the equation gives us:

(50%) x (ml dextrose) = (2.5%) x (1000 ml)

Dividing both sides by 50% to rearrange the equation gives:

ml dextrose = (2.5%) x (1000 ml) / (50%) = 50 ml dextrose

The only tricky thing to remember in this calculation is that you want 50 ml of dextrose in a final volume of 1000 ml. Therefore, you can't add 50 ml of dextrose directly to the 1L LRS bag. First, remove 50 ml of LRS, then replace that 50 ml of LRS with dextrose. This will result in a final volume of 1L in the fluid bag.

Calculate a Constant Rate Infusion (CRI)

When calculating a CRI, it's important to think through the problem in a logical, stepwise fashion. If you know the rate at which you want the patient to receive a particular drug and you know how long the patient's fluid bag will last, you can determine how much of a particular drug should be added to the fluid bag in order to deliver the drug at your desired rate.

Example: A 10 kg dog requires a ketamine CRI at a dose of 0.5 mg/kg/hr. You would like to add the ketamine to a 1L bag of LRS, which you will administer at a maintenance rate of 23 ml/hr. How much ketamine (100 mg/ml) should you add to the fluid bag?

First, determine how much ketamine (in mg) the dog needs to receive every hour:

(0.5 mg/kg/hr) x (10 kg) = 5 mg/hr

Next, determine the volume of ketamine (in ml) the dog needs to receive every hour:

(5 mg/hr) / (100 mg/ml) = 0.05 ml/hr

Now, determine how many hours the dog's bag of IV fluids will last:

(1000 ml) / (23 ml/hr) = 43.5 hours

Finally, calculate how much ketamine needs to be added to the bag of IV fluids, in order to last the entire 43.5 hours?

(0.05 ml/hr) x (43.5 hrs) = 2.2 ml

Therefore, you should remove 2.2 ml from the bag of fluids and replace it with 2.2 ml ketamine, in order to ensure that the dog receives a 0.5 mg/kg/hr ketamine CRI.

Calculate Nutritional Requirements

Whether a pet is hospitalized or you are providing an owner with instructions for at-home feeding, there will be times that you need to calculate a pet's resting energy rate.

The first step to calculating nutritional requirements is to calculate the pet's resting energy requirement (RER), according to the following equation:

RER = 70 x (body weight in kg)0.75

The RER is then multiplied by 1.0-1.6, depending on the pet's reproductive status (altered pets < intact pets, lazy pets < active pets).

Example: A 10 kg spayed female dog presents for her annual wellness visit and you note that she has gained some weight since last year. She is not yet overweight, but you want to ensure that she does not gain additional weight. What is a good estimate of how many calories per day her owners should be feeding?

First, calculate the dog's RER:

RER = 70 x (10)0.75

= 70 x 5.6

= 394 kcal/day

Given that the dog is altered and is prone to gaining weight, the lower end of the multiplication factor range should be used. If the owner is instructed to feed RER x 1.0 to RER x 1.2, a range of 394-472 kcal should be recommended.

Tips for Medical Math

Knowing your math is essential, but it's also important to ensure that you can do these calculations quickly and accurately. Consider the following strategies to increase the speed and accuracy of your calculations.

1 *Create or Download Spreadsheets for Common Calculations*

The most common use of spreadsheets is in the calculation of emergency drugs. In many practices, a spreadsheet is used to calculate emergency drug doses for each hospitalized or anesthetized patient.

Similar spreadsheets may also be used to calculate dosages of anesthetic drugs.

2 *When in Doubt, Look it Up*

Some calculations, like resting energy requirements, can be a challenge to memorize. Enter these equations in a notebook that you keep in your pocket at work. Having easy access to medical math equations can improve your efficiency at work.

3 *Think Through What You're Doing*

For many calculations, memorizing an equation is less helpful than simply thinking through the problem. If you have any doubts about the equation, try to think through the problem in a stepwise fashion. This can help increase the chances of you arriving at the right answer.

4 Double-Check Your Calculations

A careless error, such as adding or dropping a zero, can mean the difference between dosing a pet appropriately and a significant overdose. Always double-check your calculations!

It can sometimes be helpful to work the problem two ways, ensuring that you get the same answer. In the example "*Calculate a patient's replacement fluid rate,*" for example, you could either calculate the replacement rate as an hourly rate and add the two ml/hr values together (as demonstrated in the example) or you could calculate the 24-hr replacement rate, add that to the 24-hr maintenance rate, and then divide the sum of the two numbers by 24 to get a ml/hr rate. If you calculate the problem two different ways and arrive at the same answer, you can be confident in your math.

5 Work With Your Coworkers to Catch Mistakes

When accuracy is extremely important (for example, calculating the dosage of a drug with a narrow margin of safety), ask a coworker to also do the math and ensure that you both arrive at the same answer. Even if you consider yourself to be good at math, two heads are better than one!

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About the Author

Cathy Barnette is a practicing small animal veterinarian, freelance writer, and contributor to VetPrep and VetTechPrep. She is passionate about both veterinary medicine and education, working to provide helpful information to veterinary teams and the general public. In her free time, she enjoys spending time in nature with her family and leading a Girl Scout troop.