Nurses are often intimidated by the math that occurs in everyday practice. Patient safety depends on the practitioner’s ability to calculate medications correctly and in a timely manner. This article will provide a simple and concise method for accurate computation using basic calculations (see Quick reference: Universal formulas).

Doing the math
Even with the programmable I.V. pumps used in many clinical settings, it’s advisable for the nurse to verify the correct dosage by calculation once during the shift; more often if a medication is being titrated or changed. Verification of correct dosages with another RN is also a widespread practice among many professionals and sometimes mandatory in institutions.

Another resource that’s present in many practice settings is the pharmacy. Pharmacists have an abundance of knowledge about medications, as well as an unparalleled proficiency with drug calculations; utilize their expertise if you’re unsure of your computation.

Knowing the therapeutic dosage for the desired effect is as important as knowing the correct calculations for the drug. For example, dopamine at doses of 3 to 5 mcg/kg/minute provides a gentle dilatation of the renal arteries, increasing urine output with no effect on BP. At higher doses (up to 20 mcg/kg/minute), dopamine is used for BP support. Know the medication and what effect you’re attempting to achieve, as well as the maximum recommended safe infusion dosage.

Next time you have a patient on I.V. medication, try the following simple methods for calculating in a systematic way. Patient medication safety is a goal that all practitioners have in common—it starts with doing the math!

Basic calculations
The universal formula is:

\[
\frac{D \text{ (desired amount)}}{H \text{ (amount on hand)}} \times V \text{ (volume)} = \text{Dose}
\]

Example:
Administer heparin 5,000 units I.V. push. Available is heparin 10,000 units/mL. How many mL will you need to administer to achieve a 5,000 unit dose?

\[
\frac{5,000 \text{ units (D)}}{10,000 \text{ units (H)}} \times 1 \text{ mL (V)} = X
\]

Answer: \(X = 0.5\) mL

Calculations in mcg/minute
Follow these four steps to easily calculate your patient’s accurate drug dosage.
1. Find out what’s in your I.V. bottle (drug concentration or number of mL of fluid).
2. Determine in which units your drug is measured (units/hour, mg/hour, or mcg/kg/minute).
3. Know the patient’s weight in kg if your calculation is weight based.

Quick reference: Universal formulas

<table>
<thead>
<tr>
<th>Basic dosage calculation</th>
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<tbody>
<tr>
<td>(\frac{D \text{ (desired dose)}}{H \text{ (amount on hand)}} \times V \text{ (volume)} = \text{Dose})</td>
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<table>
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<tr>
<th>I.V. drips in mcg/minute</th>
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<tbody>
<tr>
<td>mg x 1,000 mcg mL x 1 hour = mcg/minute</td>
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<tr>
<td>mL x 1 mL 1 hour 60 minute (= by kg to get mcg/kg/minute)</td>
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<table>
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<tr>
<td>(\frac{D \text{ (desired)}}{H \text{ (on hand)}} \times V \text{ (volume)} = \text{units/hour (}#\text{ mL x units/mL = dose)})</td>
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</tbody>
</table>
Use the universal formula below and then divide your final answer by the patient’s weight in kg to arrive at mcg/kg/minute.

\[
\frac{\text{mg}}{\text{mL}} \times \frac{1,000 \text{ mcg}}{1 \text{ mg}} \times \frac{\text{mL}}{\text{hour}} \times \frac{1 \text{ hour}}{60 \text{ minute}} = \text{mcg/minute}
\]

**Example:**
Dopamine is infusing. The bottle states dopamine 800 mg, and it’s mixed in 500 mL of D5W. The I.V. pump in your patient’s room is set at 15 mL, and the patient weighs 60 kg (60,000 g). At how many mcg/kg/minute is the patient’s dopamine infusing?

\[
\frac{800 \text{ mg}}{500 \text{ mL}} \times \frac{1,000 \text{ mcg}}{1 \text{ mg}} \times \frac{15 \text{ mL}}{1 \text{ hour}} \times \frac{1 \text{ hour}}{60 \text{ minute}} = \text{X}
\]

Answer: \(X = 6.7 \text{ mcg/kg/minute}\)

**Example:**
Dobutamine 200 mg in 250 mL of D5W is ordered to run at 5 mcg/kg/minute. At how many mL/hour will you set the pump?

\[
\frac{200 \text{ mg}}{250 \text{ mL}} \times \frac{1,000 \text{ mcg}}{1 \text{ mg}} \times \frac{X}{1 \text{ hour}} \times \frac{1 \text{ hour}}{60 \text{ minute}} = \frac{5 \text{ mcg/kg/minute}}{60 \text{ kg}}
\]

Answer: \(X = 22.5 \text{ mL/hour}\)

**Calculations in units/hour**
To arrive at units/hour, the universal formula is:

\[
\frac{D \text{ (desired)}}{H \text{ (on hand)}} \times \frac{V \text{ (volume)}}{\text{units/hour (# of mL \times units/mL = dose)}} = \text{units/hour}
\]

**Example:**
Heparin 20,000 units in 500 mL D,W is ordered to run at 1,000 units/hour. How will the I.V. pump be set?

\[
\frac{20,000 \text{ units}}{500 \text{ mL}} = 40 \text{ units/mL}
\]

\[
1,000 \text{ units (D)} \times \frac{1 \text{ mL (V)}}{40 \text{ units (H)}} = X
\]

Answer: \(X = 25 \text{ mL/hour}\)

**Example:**
Heparin 20,000 units in 500 mL D,W is infusing at 20 mL/hour. At how many units/hour is the heparin infusing?

\[
\frac{20,000 \text{ units}}{500 \text{ mL}} = 40 \text{ units/mL}
\]

\[
\frac{40 \text{ units}}{1 \text{ mL}} \times \frac{20 \text{ mL}}{1 \text{ hour}} = X
\]

Answer: \(X = 800 \text{ units/hour}\)

**Precisely!**
Patient safety depends on accurate I.V. drug dosing; precise calculations are essential to this process. Nurses shouldn’t be apprehensive when I.V. drug dosages are presented in practice. Use the simple calculations conveyed in this article as a first step! ■

The author has disclosed that she has no financial relationships related to this article.