Nursing Assistant Certified (NAC)

Math Module

Scheduling Patient Care, Measuring Food Quantities, and Recording Fluid Intake and Output

Nora is a Nursing Assistant Certified (NAC). She works at Harborview Adult Care Home. The Home is for elderly people who need help taking care of themselves. Nora works with many patients. She helps the patients take a shower, get dressed and undressed. She brings them their food and feeds them. She records how much they eat and drink. She also weighs the patients to measure their weight gain or loss.

A Nursing Assistant Certified works under the direct supervision of a Registered Nurse (RN). The RN assigns duties and supervises the completion of those duties. Nurse Ramona is the RN who supervises Nora. Today, Nurse Ramona tells Nora the schedule for the day.

Listen

Click on the sound icon to the right to listen to Nurse Ramona explain the day's schedule to Nora.

"There are several things that I need you to do today. First of all, you need to help your patients get dressed. Tina Alvarez and Chau Tran do not need a shower today. They showered yesterday, but you need to help Hannah Zarkovsky, Miguel Martinez and Pascal Lucas with a shower. Next you need to feed the patients their breakfast. You need to monitor the intake and output for Tina Alvarez and Chau Tran, but not the other patients. Please record the intake and output on the chart every hour."

Think About It!

How important is it to follow a schedule?

It is important to follow a schedule in order to get the work done on time. In the health care industry, schedules are also very important for the health of the patient. For example, patients need food, water, and showers on time.

Focus

The focus of this math strand is recording patient information to complete the duties of a Nursing Assistant Certified (NAC).

In this math strand you'll be learning and/or reviewing the following math skills:

1) Estimating a time schedule
2) Converting measurements
3) Reading a table
4) Writing a chart
5) Adding
6) Subtracting
7) Using Fractions
8) Simplifying a Fraction
9) Multiplying
10) Dividing
11) Calculating a ratio
12) Calculating proportion

Task One: Scheduling Time with Patients

Nora starts her shift at 7:00 in the morning. She works an 8-hour shift. Nora is responsible for taking care of 5 patients. Her first duties in the morning are to shower, dress and feed each of her 5 patients. Nora needs to estimate (guess) how much time she has to spend with each patient.

Think About It!

Why does Nora have to be careful about how much time she spends with each patient?

Nora needs to be careful about her time schedule because she needs to finish her work on time and because she needs to fully take care of each patient. She can't run out of time with the last person.

Scheduling Time with Patients

When Nora first started her job, she fell behind. To help her organize her time, she sat down with her supervisor Nurse Ramona, and Ramona told her how much time she should be spending with each patient. To help herself remember, Nora made this table.

Job Duty	Time Estimate
Give a shower	15 min.
Dress patient	10 min.
Feed patient	20 min.

Abbreviation: minute = min.

Think About It!

Look at the table again. How much time does Nora spend with each patient?

Nora spends 45 minutes with each patient: 15 min. + 10 min. + 20 min. = 45 min.

Adding and Subtracting Time

Nora adds the estimated time she can spend doing one task with one patient to determine the total time that she can spend with one patient.

15 min. shower + 10 min. dressing + 20 min. feeding = 45 min. total time with each patient

However, Nora doesn't have to give the patients a shower every day. Most patients get a shower every other day. If Nora doesn't have to give the patient a shower that day, she can subtract the time from the total.

45 min. total time – 15 min. shower = 30 min. total time with a patient without a shower

Use addition (+) to estimate the total time and use subtraction (-) to take time away from the total time.

Practice

A. Figure out how much time is needed to care for each patient. Use addition and subtraction.

1) One of Nora's patients ate breakfast in only 15 minutes instead of 20. How much time could Nora spend socializing with her patient?

5 min.

2) You help a patient get dressed. It takes 10 minutes. Then you take 20 minutes to feed the patient breakfast. How much total time do you spend with the patient?

30 min.

3) Nora usually spends 45 minutes with each patient. Today she did not need to give the patient a shower, so she saved 15 minutes. How much time did Nora spend completing her duties?

30 min.

Practice

4) Nurse Ramona asks Nora to give a patient a shower. Nora bathes the patient in 10 minutes and dresses the patient in 10 minutes. Then Nurse Ramona tells Nora to feed the patient. Nora takes 15 minutes to feed the patient. If Nora has 45 minutes in total to spend with the patient, how much extra time does she have to read to the patient?

10 min.

5) You give a patient a shower in 20 minutes. Then it takes 10 minutes to dress her and another 20 minutes to feed her. If you need 45 minutes with each patient, will you have enough time to care for the patient? How much extra time will you need?

No, you will not finish on time. You will need 5 minutes more.

Estimating Time to Work with More Than One Patient

Recall that Nora estimates that she needs 45 minutes to care for each patient. She has 5 patients. How much time will she need for all 5 patients? Nora needs to multiply (x) 45 minutes by 5 to determine how much time she needs to care for all the patients.

Multiplying is a short way of adding groups of equal numbers. For example, 5 groups of 45 minutes is adding 45 five times.

45 min. + 45 min. + 45 min. + 45 min. + 45 min. = 225 min. total time

Multiplication is written with a times sign (x). For example:

45 min. x 5 patients = 225 min. total time

Estimating Time to Work with More Than One Patient

Another way to write multiplication is with parentheses ( ). When you see parentheses, you need to multiply the number inside the parentheses by the number outside the parentheses. For example, if Nora is trying to figure out how many minutes she would need for 5 patients, she would set up this equation (math problem).

5 (45) = 225 min. total time

You read the math problem as:

45 minutes times 5 patients equals a total of 225 minutes.

The answer is called the product. In the math problem above, the product is 225 minutes.

Practice

A. Multiply these numbers.

1) 30 x 6 = 180

2) 4 (35) = 140

3) 7 x 25 = 175

4) 3 (15) = 45

5) 55 x 2 = 110

6) 1 (45) = 45

7) 10 x 5 = 50

8) 9 (40) = 360

For more practice multiplying, click here.

Practice

B. How much time is needed to care for the patients?

1) Nora has 4 patients. It takes 10 minutes to dress each patient. How much time does it take to dress all of the patients?

40 min. = 4 patients x 10 min.

2) It takes 20 minutes to feed six patients. Twenty minutes multiplied by six patients is how many minutes total?

120 min. = 20 min. x 6 patients

3) You have 5 patients in your care. You took 15 minutes to give each patient a shower. How much total time did you spend with your patients?

75 min. = 5 patients x 15 min.

Practice

4) You take 30 minutes to dress and feed each patient. If you have 3 patients, how much time do you need in all?

90 minutes = 3 patients x 30 min.

5) Nora stayed longer at work today. She spent 5 minutes too long with each of her 5 patients. How much extra time did she spend with them altogether?

25 minutes = 5 min. x 5 patients

Task Two: Measurements

Estimating Measurements Using Fractions

In addition to showering, dressing and feeding patients, Nora must estimate how much a patient drinks and how much of a meal the patient eats. The nurses and doctors want to know if the patients are eating and drinking enough to get better.

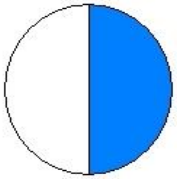
If a patient ate all the food, then that means the patient ate the whole meal, which is 1 meal. In this case, Nora writes down a whole number. Other examples of whole number are 2, as in 2 whole crackers, or 8, as in 8 whole grapes. (1, 2 and 8 are whole numbers.)

1 = a whole number

Measurements

However, sometimes a patient does not eat all of the food. The patient may drink half (½) of the broth. In this case, Nora writes down the fraction, ½. A fraction is less than a whole number. It is only part of the whole. Some fractions are ¼, ½, or ¾. (See the pictures below.)

¼ = a quarter



½ = a half

¾ = three-quarters

Practice

A. Match the whole number or the fraction with how much the patient ate and drank. Click Here to check your answers.

d	1) Half a sandwich	a.) 1
a	2) A whole banana	b.) ¼
e	3) Three quarters of a bowl of Jello	c.) 5
b	4) A quarter of a cup of water	d.) ½
c	5) Five ice cubes	e.) ¾

Practice

B. Find the fraction that shows how much a patient eats or drinks.

1) Nora feeds a patient a bowl of oatmeal for breakfast. The patient eats half of the oatmeal. What fraction of the oatmeal does the patient eat?

$^1/_2$

2) A patient would like some ice cubes to suck on. You bring the patient 8 ice cubes. The patient sucks on 6 of them. What fraction of the ice cubes does the patient consume?

$^3/_4$

Practice

3) A patient tells Nora that she is not very hungry for lunch. Nora brings her half of a sandwich, but she only eats half of the half sandwich. What fraction of the sandwich does she eat?

$1/4$

4) You feed a patient pancakes for breakfast. There are 2 pancakes on the plate; one is stacked on top of the other. The patient eats half of each pancake. How many pancakes does the patient eat?

1 whole pancake

5) Nora brings a patient a cup of tea. The patient drinks three quarters of the tea. How much tea is left in the cup?

$1/4$

Converting Measurements

Nora writes down how much the patients eat and drink. Recall that the doctors and nurses need this information. One patient drank a quarter cup of water. How much exactly is a quarter of a cup? How many ounces of water are in a quarter of a cup of water? Nora needs to know the measurements for ounces and cups. Nurse Ramona gives Nora a measurement conversion chart to help her learn about measurements. The conversion chart shows how to change the unit of liquid measurement, such as teaspoons, tablespoons, ounces, and cups.

Converting Measurements

Measurement Conversions:

3 teaspoons (tsp.) =	1 tablespoon (Tbsp.)
1 tablespoon (Tbsp.) =	15 milliliters (ml.)
8 ounces (oz.) =	1 cup (c.)
8 ounces (oz.) =	240 milliliters (ml.)

Converting Measurements

The patient drank a quarter of a cup of water, but Nora needs to know how many ounces the patient drank. The conversion chart shows that there are 8 ounces in one cup of water. To determine how many ounces are in a quarter (¼) cup of water, Nora needs to divide (÷) 8 ounces of water by 4 because there are 4 quarter cups of water in one cup. She divides and calculates that the patient drank 2 ounces of water.

8 oz. ÷ 4 = 2 oz. of water

Division is finding out how many equal parts are in a group. If 8 ounces are divided into 4 groups of equal size, the answer is 4 groups of 2 ounces each.

Converting Measurements

One way that division is written with a division sign (÷). You need to divide the first number by the second number. For example:

8 oz. ÷ 4 = 2 oz. of water

A second way to write division is with a line. This line is called a fraction bar, and it always means division. When you use a fraction bar, one number is on top of the line and the other number is under the line. You need to divide the number on top by the number under the fraction bar. For example:

$\frac{8}{4}$ oz. = 2 oz. of water

Converting Measurements

You read the math problem as:

8 ounces divided by 4 equals 2 ounces of water.

The answer is called the quotient. In the math problem above, the quotient is 2 ounces of water.

Two ounces is a whole number, but this answer can also be written as a decimal because 2 ounces is less than a whole cup of water (8 oz.). In other words, it is a fraction of a cup of water. The table below shows how a fraction can be written as a decimal.

Fraction =	Divide =	Decimal
¼ =	1 ÷ 4 =	0.25
½ =	1 ÷ 2 =	0.50
¾ =	3 ÷ 4 =	0.75

Stop!

In the field of health care, you must always write a zero (0) in front of a decimal, such as 0.75. The zero (0) is very important to introduce the decimal so that people will see that the following number is a decimal. This is important to stop mistakes in reading the number. For example, when you give a patient medicine, there is a big difference between 75 milliliters and 0.75 milliliters.

Think About It!

If there are 2 ounces in a quarter (¼) cup of water, how many ounces are in three quarters (¾) of a cup of water?

There are 6 ounces because 2 x 3 = 6.

Practice

A. Divide these numbers.

1)	30 ÷ 6 =	5
2)	1 ÷ 2 =	0.5
3)	150 ÷ 5 =	30
4)	180 ÷ 4 =	45
5)	120 ÷ 4 = Cli	30
6)	120 ÷ 2 = Cli	60
7)	100 ÷ 4 = Cli	25
8)	3 ÷ 4 =	0.75
9)	200 ÷ 2 = Cli	100
10)	1 ÷ 4 =	0.25

For more practice dividing, click here.

Practice

B. Divide the measurements to find how much the patient ate or drank.

1) Nora feeds a patient lunch. The patient drinks half of a cup of juice. How many ounces of juice does the patient drink?

8 ounces ÷ 2 = 4 ounces

2) Another patient is on a liquid diet. He is only allowed liquids, such as juice, water, or Jell-O. Nora brings him a cup of broth, but he says that he is not hungry, and he only eats 12 teaspoons of the broth. How many tablespoons of broth does he eat?

12 teaspoons ÷ 3 tablespoons = 4 tablespoons

3) You bring a patient a small glass of ginger ale. The patient drinks 2 ounces of the ginger ale. How many cups of ginger ale does the patient drink?

2 ounces ÷ 8 ounces in a cup = ¼ cup

Practice

4) A cup of water can also be measured in milliliters. One cup of water is 240 ml. If a patient drinks a quarter cup of water, how many milliliters of water does the patient drink?

240 ml. ÷ 4 = 60 ml.

5) Nora prepares coffee for 4 of her 5 patients. She makes 48 ounces of coffee. She serves the coffee to the 4 patients. Suppose that she divides the total pot of coffee evenly among the four patients. How many ounces of coffee does each patient get? How many cups of coffee does each patient get?

Each patient gets 12 ounces of coffee because 48 ounces ÷ 4 patients = 12 ounces.
Each patient drinks 1 ½ cups of coffee because12 ounces ÷ 8 ounces (1 cup) = 1 ½

Task Three: Using a Ratio to Calculate Intake and Output

Intake and Output

One of Nora's duties is to monitor the fluid (liquid) intake and output of patients. The intake is how much fluid the patient is taking in, such as how much water the patient is drinking. The output is how much fluid comes out of the patient, in terms of how much the patient urinates.

Fluid intake and output are recorded every hour of the day. The numbers are totaled at the end of the 8 hour shift and at the end of the day. (In healthcare, a day is from 7 am of one day to 7 am of the next day.) At the end of Nora's shift, it is Nora's responsibility to total all of the fluid intake and output of her patients.

Using a Ratio to Calculate Intake and Output

A doctor wants a patient's intake and output to be measured. Measuring intake and output is a special situation for patients who have digestive disorders or who are in critical condition.

Listen

Nurse Ramona tells Nora about a new patient on intake and output, and she explains how Nora needs to calculate intake and output.

A liquid is measured in cubic centimeters. A cubic centimeter is the same measurement as a milliliter (ml). If a cup is 240 cubic centimeters, then it will hold 240 milliliters of liquid.

1 cc = 1 ml

Large glass =	**240 cc**
Water glass =	180 cc
Juice glass =	100 cc
1 Cup =	240 cc
Coffee pot =	240 cc
Small bowl =	120 cc
Soup bowl =	200 cc
1 Tbsp =	15 cc
1 Ice cube =	5 cc

Abbreviation: cc = cubic centimeter

Listen


The output of urine can be determined two different ways. If the patient has a catheter, the amount of urine can be measured when the bag is emptied. If the patient does not have a catheter, the amount of urine is measured after each urination in a pan in the toilet.

You record the intake and output on a chart. This intake and output chart is divided into two parts. The intake is on the left, and the output is on the right. On the chart, the time of day is printed along the left side showing every hour. Any intake or output during each hour is written on the chart. There is also place to write any remarks, or comments. At the end of a shift, the NAC must total all the columns on the chart.

Practice

A. Tina Alvarez is one of Nora's patients. Her chart is on the next screen. Help Nora calculate Ms. Alvarez's total intake and output at the end of Nora's shift. (Use the table of measurement you saw earlier to help you calculate the total intake and output.)

Large glass = 240 cc
Water glass = 180 cc
Juice glass = 100 cc
1 cup = 240 cc

Coffee pot = 240 cc
Small bowl = 120 cc
Soup bowl = 200 cc
1 Tbsp = 15 cc

Practice

Click Here to see the answers

Time	Oral Intake	Remarks	Urine Output	Remarks
7:00 am	1 glass water 1glass juice Small bowl Jello	Ate ½ of the Jello	350 cc	7:50
8:00				
9:00				
10:00				
11:00	Large glass ginger ale		250 cc	11:45
12:00 pm	1 small bowl Jello ½ cup tea Soup bowl of broth	Drank ½ of the broth		
1:00	½ large glass of ginger ale		250 cc	1:45
2:00				
Shift Total	**980 cc**		**850cc**	

Stop!

When you calculate the total intake, you need to divide if the patient only drank ½ of the broth or if the patient only ate ½ of the Jell-O. A soup bowl of broth is 200 cc. 200 cc divided in half is 100 cc. A small bowl of Jell-O is 120 cc. 120 cc divided in half is 60 cc.

Practice

A. Chau Tran is one of your patients. Use the intake and output information below the chart to fill in the information on the chart. Then calculate the total fluid intake and output.

Large glass = 240 cc
Water glass = 180 cc
Juice glass = 100 cc
1 cup = 240 cc
1 Ice cube = 5 cc

Coffee pot = 240 cc
Small bowl = 120 cc
Soup bowl = 200 cc
1 Tbsp = 15 cc

Practice

Check your answers on the next screen

Time	Oral Intake	Remarks	Urine Output	Remarks
7:00 am				
8:00		8:45		
9:00		9:10		
10:00				10:25
11:00		11:45		
12:00 pm		12:30 Lunch		
1:00				1:30
2:00		2:00		2:30
Shift Total				

1) 8:45 patient sips 2 tablespoons of water.
2) 9:10 patient sucks on 5 ice cubes.
3) 10:25 urine output is 200 cc.
4) 11:45 patient sips ½ juice glass of juice.
5) 12:30 patient eats lunch: 1 soup bowl broth, 1 small bowl Jell-O and 1 glass water.
6) 1:30 urine output is 450 cc.
7) 2:00 patient drinks a large glass of ginger ale.
8) 2:30 urine output is 150 cc.

Practice

Time	Oral Intake	Remarks	Urine Output	Remarks
7:00 am				
8:00	**2 Tbsp. water = 30 cc water**	8:45		
9:00	**5 ice cubes = 25 cc water**	9:10		
10:00			**200 cc**	10:25
11:00	**1/2 glass juice = 50 cc**	11:45		
12:00 pm	**1 soup bowl broth = 200 cc, 1 small bowl Jello = 120 cc, 1 glass water = 180 cc**	12:30 Lunch		
1:00			**450 cc**	1:30
2:00	**1 large glass ginger ale = 240 cc**	2:00	**150 cc**	2:30
Shift Total	**845 cc**		**800 cc**	

Calculating a Ratio

When Nora calculated the intake and output for Tina Alvarez, she determined that the patient had an intake of 980 cc and an output of 850 cc. Nurse Ramona asks Nora to report the patient's intake and output. Nora reports the intake and output as a ratio. A ratio is a comparison of two numbers.

980 cc intake to 850 cc output

There are three ways to write a ratio:

First, you can separate the two numbers in the ratio with a **colon** (:). If you want to write the ratio of 980 cc intake and 850 cc output, then you can write this as:

980 cc : 850 cc

Calculating a Ratio

The second way to write a ratio is as a fraction.

980 cc / 850 cc

The third way to write a ratio is with the word "to" between the two quantities.

980 cc to 850 cc

Even though there are three ways to write a ratio, when you read the ratio, you always say the ratio as "**980 cc to 850 cc.**"

Practice

A. Write intake and output totals as ratios. Use a colon (:) in the ratio. Click Here to check your answers.

Intake	Output	Write the Ratio
845 cc	800 cc	**845 cc : 800 cc**
960 cc	890 cc	**960 cc : 890 cc**
1020 cc	985 cc	**1020 cc : 985 cc**
745 cc	700 cc	**745 cc : 700 cc**
1105 cc	1060 cc	**1105 cc : 1060 cc**

Think About It!

Look at the intake and output ratios in the previous practice activity. Why is the intake usually higher than the output?

The intake should be higher than the output because the patient should retain some water. If the patient has a higher output, then the patient is in danger of becoming dehydrated.

Comparing Ratios

Nora needs to know if her patients are taking in enough fluids. She needs to compare Tina Alvarez's intake and output ratio with the ratio for a healthy patient. Remember that Tina Alvarez's intake and output ratio was 980 cc: 850 cc. A normal intake and output ratio for a healthy patient is 960 cc: 830 cc.

Nora writes the equation to compare ratios:

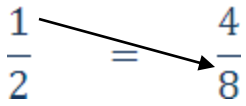
$$\underbrace{\frac{980\ cc}{850\ cc}}_{\text{Tina Alvarez's Ratio}} = \underbrace{\frac{960\ cc}{830\ cc}}_{\text{Normal Ratio}}$$

When you compare ratios, you need to write them as fractions. The ratios are equal if the fractions are equal. You can compare the fractions by multiplying for cross products.

Steps

Follow these steps to find the cross product.

Step 1: Multiply the top number of the first ratio by the bottom number of the second ratio: 1 x 8 = 8



Step 2: Multiply the bottom number of the first ratio by the top number of the second ratio: 2 x 4 = 8

Step 3: Compare the products of the two equations (8=8). If the products are the same number, then the two ratios are equal.

Stop!

Be careful! The order of the numbers is important! A ratio of 1:2 is not the same as a ratio of 2:1. The ratio 1:2 is the fraction 1/2, but the ratio 2:1 is the fraction 2/1, which is the same as the whole number, 2.

Practice

A. How does the input and output ratio for Nora's patient compare to a normal intake and output ratio? Multiply the cross products to compare the ratios.

Tina Alvarez's Ratio Normal Ratio

$$\frac{980 \text{ cc}}{850 \text{ cc}} = \frac{960 \text{ cc}}{830 \text{ cc}}$$

980 cc x 830 cc = 813,400 cc

850 cc x 960 cc = 816,000 cc

Practice

B. Compare the cross products to determine if the ratios are equal.

1) $\frac{3}{4} = \frac{12}{16}$ Yes, 3 x 16 = 48 and 4 x 12 = 48

2) $\frac{5}{15} = \frac{20}{60}$ Yes, 5 x 60 = 300 and 15 x 20 = 300

3) $\frac{110}{22} = \frac{25}{5}$ Yes, 110 x 5 = 550 and 22 x 25 = 550

4) $\frac{500}{125} = \frac{5}{1}$ No, 500 x 1 = 500 but 125 x 5 = 625

5) $\frac{120}{150} = \frac{130}{160}$ No, 120 x 160 = 19,200 but 150 x 130 = 19,500

Click here for more practice working with ratios.

Simplifying an Equation

Nora can make the cross product calculation easier if she simplifies (reduces) the equation. When she simplifies, she rewrites the equation with smaller numbers. Nora notices that the intake and output ratio numbers all end in zero (0). That means that the numbers can be divided by 10. Nora can simplify the equation by dividing all the numbers by 10.

Nora simplifies by dividing by 10:

980 cc ÷ 10 = 98 cc

850 cc ÷ 10 = 85 cc

960 cc ÷ 10 = 96 cc

830 cc ÷ 10 = 83 cc

Simplifying an Equation

The example input and output ratio was:

Tina Alvarez's Ratio Normal Ratio

$$\frac{980 \text{ cc}}{850 \text{ cc}} = \frac{960 \text{ cc}}{830 \text{ cc}}$$

The simplified input and output ratio is:

Tina Alvarez's Ratio Normal Ratio

$$\frac{98 \text{ cc}}{85 \text{ cc}} = \frac{96 \text{ cc}}{83 \text{ cc}}$$

When you simplify, calculating the answer is easier because the numbers are smaller. You can simplify a fraction by dividing the numerator (the top number) and the denominator (the bottom number) by the largest whole number that divides each easily.

Simplifying an Equation

For example:

Divide both the numerator and the denominator by 2.

$$\frac{2 \div 2}{4 \div 2} = \frac{1}{2}$$

Divide both the numerator and the denominator by 3.

$$\frac{2 \div 3}{15 \div 3} = \frac{4}{5}$$

Divide both the numerator and the denominator by 5.

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

Stop!

Be careful! You need to simplify both the numerator and the denominator by the same number.

Practice

A. Simplify (reduce) the fractions. Divide the numerator and the denominator by the whole number.

1) $\frac{10}{30}$ Reduce by 10 — 1/3

2) $\frac{8}{12}$ Reduce by 4 — 2/3

3) $\frac{9}{21}$ Reduce by 3 — 3/7

4) $\frac{16}{22}$ Reduce by 2 — 8/11

5) $\frac{20}{5}$ Reduce by 5 — 4/1 =4

Click here for more practice simplifying fractions.

Task Four: Calculating Proportion

Recall that Nora is monitoring Tina Alvarez's fluid intake. Nurse Ramona told Nora that a patient should drink about one cup of fluid (8 oz.) every hour. Nora needs to know how many ounces of fluid her patient should drink by the end of her shift (8 hours).

One way to figure this out this answer is to set up a proportion. A proportion is an equation with a ratio on each side. It is a statement that when you compare the cross products, the two ratios are equal. Remember you need to write the ratio as a fraction. For example, 8 ounces of fluid in 1 hour equals how many (?) ounces of fluid in 8 hours.

Calculating Proportion

$$\frac{8 \text{ ounces}}{1 \text{ hour}} = \frac{? \text{ ounces}}{8 \text{ hours}}$$

Proportions are helpful to calculate for an unknown number. When one of the four numbers in a proportion is unknown, cross products may be used to find the unknown number. This is called solving the proportion. Question marks or letters are often used in place of the unknown number.

Steps

Follow these steps to find the unknown number:

Step 1: Multiply the numerator (top number) of the first ratio by the denominator (bottom number) of the second ratio: 8 x 8 = 64.

$$\frac{8 \text{ ounces}}{1 \text{ hour}} = \frac{? \text{ Ounces}}{8 \text{ hours}}$$

Step 2: Divide the cross product from step 1 by the denominator of the first ratio: 64 ÷ 1 = 64 ounces. (Remember the fraction bar means to divide.)

$$\frac{64}{1} = ? \text{ Ounces}$$

Step 3: The answer is the unknown number: 64 ounces of fluid.

Think About It!

Nora's patient, Tina Alvarez, needs to have 64 ounces of fluid in 8 hours. How many cups are 64 ounces?

How many cubic centimeters (cc) are there?

There are 8 cups: 64 ounces ÷ 8 ounces in a cup = 8 cups.

There are 1920 cc: 8 cups x 240 cc in a cup = 1920 cc.

Practice

A. Simplify (reduce) the fractions. Divide the numerator and the denominator by the whole number.

1) $\frac{4}{6} = \frac{?}{12}$

? = 8. Reduce by 2 to 2/3. 2 x 12 = 24 ÷ 3 = 8

2) $\frac{15}{30} = \frac{?}{4}$

? = 2. Reduce by 15 to 1/2. 1 x 4 = 4 ÷ 2 = 2

3) $\frac{120}{150} = \frac{?}{30}$

? = 24. Reduce by 10 to 12/15. Then reduce again by 3 to 4/5. 4 x 30 = 120 ÷ 5 = 24

4) $\frac{180}{12} = \frac{?}{7}$

? = 105. Reduce by 4 to 45/3. 45 x 7 = 315 ÷ 3 = 105

5) $\frac{90}{75} = \frac{?}{45}$

? = 54. Reduce by 5 to 18/15. Then reduce again by 3 to 6/5. 6 x 45 = 270 ÷ 5 = 54

Click here for more practice solving proportions.

Practice

B. Write the proportion. Then use the proportion to solve for the unknown number. If possible, reduce the fractions before you solve the proportion.

1) Nora needs to prepare an Epson salt soak for a patient. Nora reads the directions on the Epson salt box. The directions say to use 2 cups of Epson salt in 1 gallon of water. Nora needs to prepare 3 gallons of Epson salt soak, so how many cups of Epson salt will she need for 3 gallons of water?

She will need 6 cups of Epson salt: 2/1 = ?/3

2) You are preparing Jell-O for your patients. You read the directions on the box. The directions say that 1 box of Jell-O makes 6 servings. You need to prepare servings for 18 patients. How many boxes of Jell-O do you need to prepare?

You need 3 boxes: 1/6 = ?/18

Practice

3) Nurse Ramona tells Nora that a patient needs to drink 8 ounces of fluid every 2 hours. Nora should check the intake at the end of her shift in 8 hours. How many ounces of fluid should the patient drink in 8 hours?

The patient should drink 32 ounces in 8 hours: Reduce 8/2 by 2 to 4/1. This makes the proportion: 4/1 = ?/8. When you solve the proportion, the answer is 32 ounces.

4) A patient is vomiting and cannot drink much fluid. The patient drinks 6 tablespoons of water. If 2 tablespoons of water have 30 cc, how many cubic centimeters (cc) are in 6 tablespoons?

There are 90 cc: You can reduce 30/2 by 2. The reduced fraction is 15/1. This makes the proportion 15/1 = ?/6. When you solve the proportion, the answer is 90 cc.

Congratulations!

Nora loves her job as a NAC. She has a lot of experience working with patients. She decides to continue in her career. Nora plans to go to nursing school!

Congratulations! You have finished this lesson. You have learned a lot of math! Continue to the quiz and see how much you have learned.

Quiz

Use the math that you learned in this lesson to answer the questions.

1) Nora helps her patients get ready in the morning. It takes 15 minutes to give a patient a shower, 10 minutes to dress a patient, and 20 minutes to feed a patient. Right now Nora is with Tina Alvarez. She dresses and feeds Tina, but Tina doesn't need a shower today. How much time does Nora spend with Tina?

   30 min. = 10 min. + 20 min.

2) It takes 20 minutes to feed a patient lunch. If Nora has 4 patients, how much time does Nora need to feed the patients lunch?

   80 min. = 20 min. x 4 patients

Quiz

3) Today the patients get sandwiches for lunch. The sandwiches are served cut in half. A patient eats all of one half and half of the other. What fraction of the sandwich does the patient eat?

3/4 of a sandwich

4) The patients also get a cup of soup with their sandwich for lunch. A cup is 8 ounces. If a patient eats ¼ of the soup, how many ounces does the patient eat?

2 ounces = 8 ounces ÷ 4

5) Nora needs to monitor Tina Alvarez's intake and output. At the end of her shift, Nora totals the intake and output. The intake total is 990 cc and the output is 930 cc. What is the intake and output ratio?

990 cc:930 cc

Quiz

6) Compare the cross products of these two ratios. Are the ratios equal? $\frac{35}{60} = \frac{7}{12}$

Yes, 35 x 12 = 420, and 60 x 7 = 420

7) Tina Alvarez's intake and output ratio is 990 cc/930 cc. Simplify (reduce) the fraction by the largest whole number.

Reduce by 30 to 33/31

8) Solve the proportion to find the unknown number. $\frac{3}{8} = \frac{?}{24}$

? = 9. 3 x 24 = 72 ÷ 8 = 9

Quiz

9) Nora is preparing glasses of juice for the patients. If Nora needs 960 cc of juice for 8 patients, how much juice does she need for 12 patients? Write the proportion and then solve it for the unknown number.

? = 1,440 cc of juice. The proportion is 960/8 = ?/12. You can reduce 960/8 to 120/1. 120 x 12 = 1,440 ÷ 1 = 1,440 cc.

10) One cup is 240 cc. How many cups are in 1,440 cc of juice?

6 cups = 1,440 cc ÷ 240 cc in a cup

Key Math Concepts

- Estimating Time
- Reading a Table
- Adding
- Subtracting
- Using Fractions
- Simplifying Fractions
- Multiplying
- Dividing
- Converting Measurements
- Writing a Ratio
- Calculating a Proportion
- Reading a Chart
- Writing in a Chart

Math Vocabulary

- Add
- Addition
- Calculate
- Colon
- Convert
- Decimal
- Denominator
- Divide
- Division
- Division Sign
- Equation
- Estimate
- Fraction
- Fraction Bar
- Measure
- Multiplication
- Multiply
- Numerator
- Parentheses
- Product
- Proportion
- Quotient
- Ratio
- Reduce
- Simplify
- Solve
- Subtract
- Subtraction
- Times Sign
- Total
- Unit
- Whole Number

Congratulations!

You have completed the Math Module.

The End