Dental Technology (51.0601) T-Chart

Maintain radiology materials = Write functions or sequences that model relationships between two quantities

Program Task: Maintain the supplies needed to process radiographs.

Program Associated Vocabulary:
LATENT IMAGE, DEVELOPER, FIXER, SILVER HALIDE, RADIOLUCENT, RADIOPAQUE, FILM PROCESSING, HYDROQUINONE, ELON, ACCELERATOR, RESTRAINER, OXIDATION

Program Formulas and Procedures:
Doctors rely on radiographs to be clinically acceptable in order to treat patients. Radiographs can only be acceptable if processing solutions are maintained and changed properly. Understanding the math concept behind solution maintenance will increase the amount of clinically acceptable radiographs.

Example:
The ratio of radiology cleaning solution to water is 30 ounces of water to 15 ounces of cleaner solution. How many ounces of cleaning solution will you use if you have 48 ounces of water?

Solution:

$$\frac{30 \text{ ounces water}}{15 \text{ ounces of cleaner}} = \frac{48 \text{ ounces of water}}{x \text{ ounces of cleaner}}$$

$$30x = 48 \times 15$$

$$30x = 720$$

$$\frac{30x}{30} = \frac{720}{30}$$

$$x = 24 \text{ ounces of cleaner}$$

PA Core Standard: CC.2.2.HS.C.3

Description: Write functions or sequences that model relationships between two quantities.

Math Associated Vocabulary:
RATIO, PROPORTION, CROSS MULTIPLY, SCALE, COEFFICIENT

Formulas and Procedures:
A proportion states that two ratios are equal.

$$\frac{a}{b} = \frac{c}{d}$$

Example:

Girls outnumber boys 5 to 3. If there were 21 boys in the class, how many girls would one expect to find?

Steps:

1. Identify the proportional relationship and label the units:

   5 girls to 3 boys: $\frac{5 \text{ girls}}{3 \text{ boys}}$

2. Set up the proportional relationship, using a variable for the missing value.

   $$\frac{5 \text{ girls}}{3 \text{ boys}} = \frac{x \text{ girls}}{21 \text{ boys}}$$

3. Cross multiply.

   $(5)(21) = 3x \rightarrow 105 = 3x$

4. Divide by the coefficient.

   $\frac{105}{3} = x \qquad x = 35$

   One would expect to find 35 girls.

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Instructor's Script - Comparing and Contrasting
Rates can often be expressed as proportions. Dental hygienist often work with rates when mixing cleaning solutions and x-ray developer. In problem one, on page three, the dental assistant must perform a multi-step calculation. First, calculate 6% of one gallon and then convert the answer to ounces before continuing with the problem.

Common Mistakes Made By Students
Students do not write each ratio consistently. For example, students may write hours/minutes = minutes/hours.

Conversions of units: In many cases, the student must convert between units before setting up the proportion. For example, if one ratio is money per hour and the student must use that ratio to set up a proportion to solve for money in a given number of days, the student must convert the number of days to hours before proceeding.

CTE Instructor's Extended Discussion
The teacher should have a discussion about the importance of proper care and maintenance of radiology chemicals. Have students try creating problems based on different office types. Orthodontic, endodontic, oral surgery and general practices require different types and quantity of radiographs which affect the integrity of the chemicals. The quantity and type will dictate how much solution should be purchased and the strength of the mixture.

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Problems	Career and Technical Math Concepts Solutions
1. Your office runs a high volume of radiographs daily. In order to keep the solutions fresh, you must remove and replace 6% of the 1 gallon tank daily to maintain a fresh solution. In how many days will the entire gallon be replaced?	
2. One gallon of developer can process up to 950 single peri-apical radiographs; you have 48 ounces left, how many single periapical radiographs can be processed before you run out of solution?	
3. Your doctor would like you to buy your x-ray solution in bulk. One gallon lasts your office about 24 days. How many gallons should you buy for 1 year?	

Problems	Related, Generic Math Concepts Solutions
4. One oil change takes ¼ hr. How many changes can be done in an hour?	
5. Luke can print five posters in 15 minutes. How many can he print in one hour?	
6. Mark works 35 hours and makes $420. How much does he make if he works 25 hours at the same rate?	

Problems	PA Core Math Look Solutions
7. Vincent buys four burgers for $ 20. What is the cost of 10 burgers?	
8. There are 27 pairs of shoes in a case. How many pairs are there in 12 cases?	
9. Margie can buy seven shirts for $94.50. What would it cost if she only bought four?	

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Problems	Career and Technical Math Concepts Solutions
1. Your office runs a high volume of radiographs daily. In order to keep the solutions fresh, you must remove and replace 6% of the 1 gallon tank daily to maintain a fresh solution. In how many days will the entire gallon be replaced?	Determine how many ounces are in 1 gallon: 128 ounces. Determine operation: Multiply (128 x .06) Answer = 7.68 ounces must be removed and replenished daily. $\frac{7.68\text{ ounces}}{1\text{ day}} = \frac{128\text{ ounces}}{x} \rightarrow 128 = 7.68x \rightarrow x = 16.6$ days Rounded up to every 17 days.
2. One gallon of developer can process up to 950 single peri-apical radiographs; you have 48 ounces left, how many single periapical radiographs can be processed before you run out of solution?	Determine how many ounces are in 1 gallon: 128 ounces $\frac{128\text{ ounces}}{950} = \frac{48\text{ ounces}}{x} \rightarrow 128x = 45600$ $\frac{128x}{128} = \frac{45600}{128} \rightarrow 356.25 \rightarrow 356$ single periapical radiographs
3. Your doctor would like you to buy your x-ray solution in bulk. One gallon lasts your office about 24 days. How many gallons should you buy for 1 year?	$\frac{1\text{ gallon}}{24\text{ days}} = \frac{x\text{ gallons}}{365\text{ days}} \rightarrow 24x = 365$ $\frac{24x}{24} = \frac{365}{24} \rightarrow 15.2 \rightarrow 16$gallons
Problems	**Related, Generic Math Concepts Solutions**
4. One oil change takes ¼ hr. How many changes can be done in an hour?	$\frac{\frac{1}{4}\text{ hr.}}{1\text{ oil change}} = \frac{1\text{ hr.}}{x\text{ oil changes}} \rightarrow \frac{1}{4}x = 1$ $(4)\frac{1}{4}x = 1(4) \rightarrow x = 4$
5. Luke can print five posters in 15 minutes. How many can he print in one hour?	$\frac{5\text{ posters}}{15\text{ minutes}} = \frac{X\text{ posters}}{60\text{ minutes}}$ 15X = 5(60) 15X = 300 X = 20 posters
6. Mark works 35 hours and makes $420. How much does he make if he works 25 hours at the same rate?	$\frac{35\text{ hrs.}}{\$420} = \frac{25\text{ hrs.}}{\$X}$ 35X = 425(25) 35X = 10,500 X = $300.00
Problems	**PA Core Math Look Solutions**
7. Vincent buys four burgers for $ 20. What is the cost of 10 burgers?	$\frac{4}{\$20} = \frac{10}{\$X}$ 20(10) = 4X 200 = 4X X = $50
8. There are 27 pairs of shoes in a case. How many pairs are there in 12 cases?	$\frac{27\text{ pairs}}{1\text{case}} = \frac{X\text{ pairs}}{12\text{ cases}}$ 1X = 27(12) X = 324 pairs
9. Margie can buy seven shirts for $94.50. What would it cost if she only bought four?	$\frac{7\text{ shirts}}{\$94.50} = \frac{4\text{ shirts}}{\$X}$ 7X = 94.50(4) 7X = 378.00 X = $54