Unit 2 Practice Problems

Lesson 1

Problem 1

In a fruit basket there are 9 bananas, 4 apples, and 3 plums.

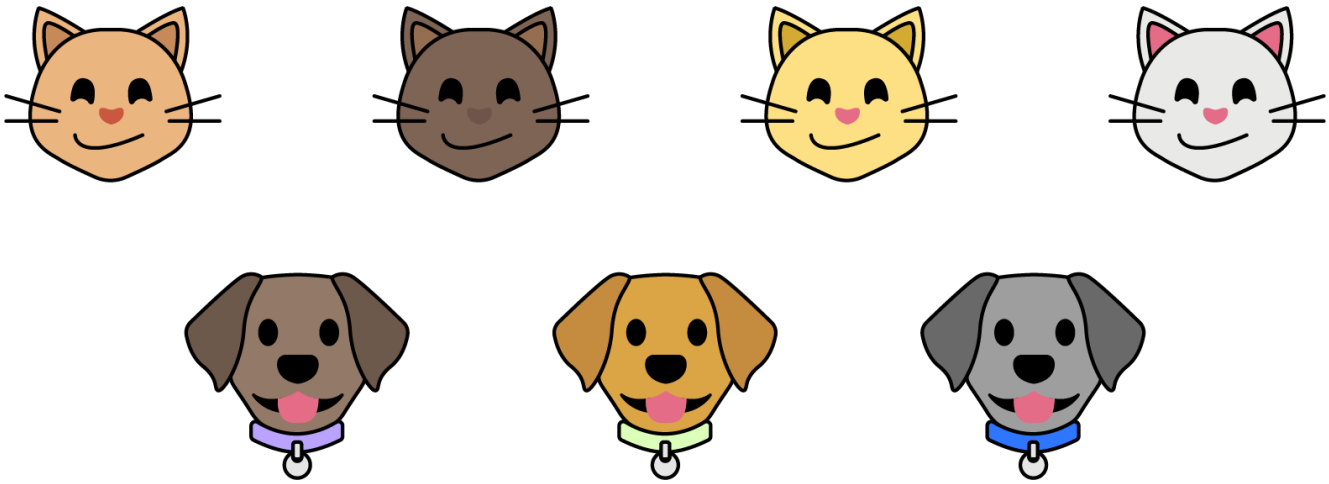
1. The ratio of bananas to apples is _____ : _____.
2. The ratio of plums to apples is _____ to _____.
3. For every _____ apples, there are _____ plums.
4. For every 3 bananas there is one _____.

Solution

1. 9, 4
2. 3, 4
3. 4, 3
4. plum

Problem 2

Complete the sentences to describe this picture.



1. The ratio of dogs to cats is _____.

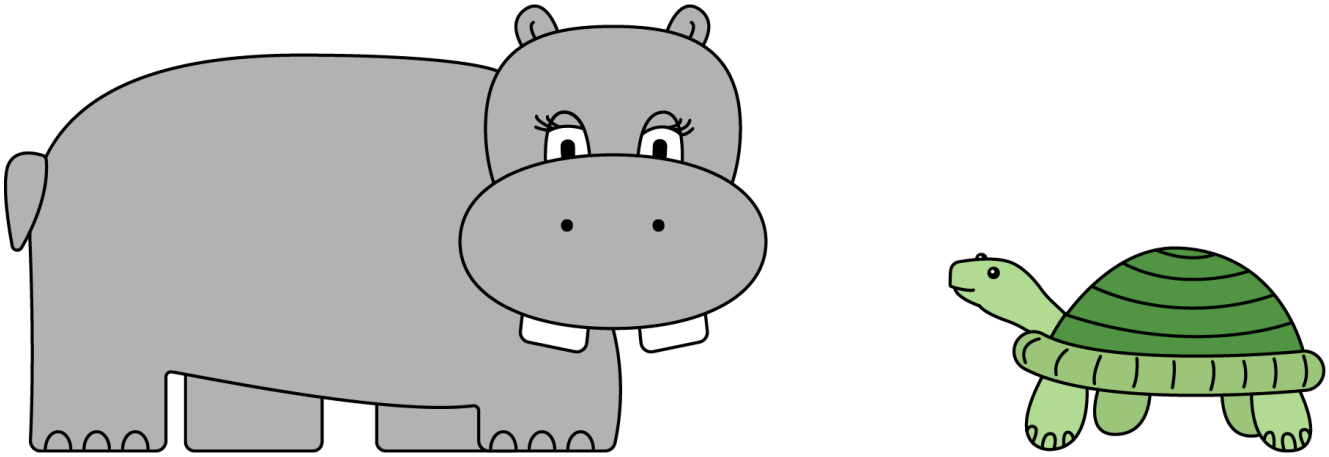
2. For every _____ dogs, there are _____ cats.

Solution

1. 3 to 4
2. 3, 4

Problem 3

Write two different sentences that use ratios to describe the number of eyes and legs in this picture.



Solution

Answers vary. Sample responses:

- The ratio of legs to eyes is 8 to 4.
- The ratio of eyes to legs is $4:8$.
- There are 2 legs for every eye.
- There are 4 legs for every 2 eyes.

Problem 4

(from Unit 1, Lesson 17)
Choose an appropriate unit of measurement for each quantity.

1. area of a rectangle
2. volume of a prism
3. side of a square
4. area of a square
5. volume of a cube

- cm
- cm^3
- cm^2

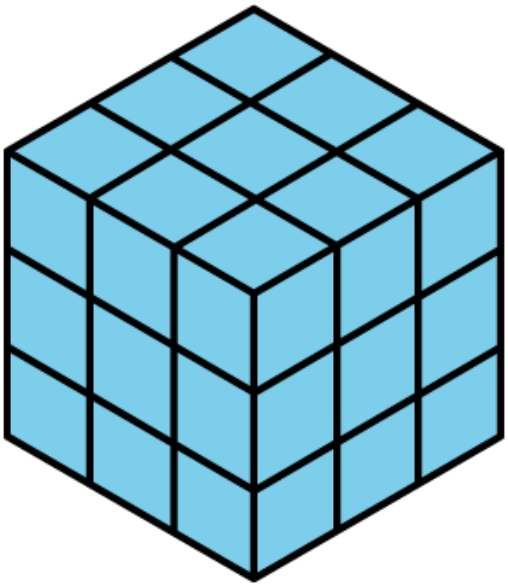
Solution

1. cm^2
2. cm^3
3. cm
4. cm^2
5. cm^3

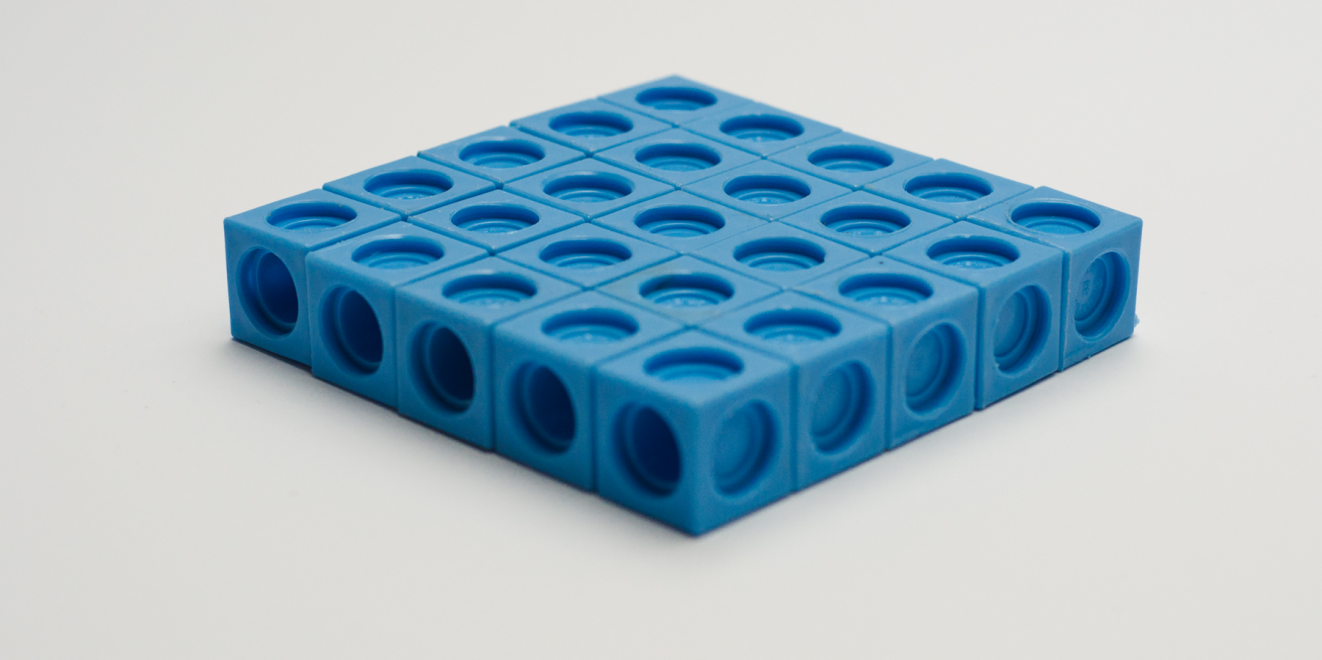
Problem 5

(from Unit 1, Lesson 16)
Find the volume and surface area of each prism.

1. Prism A: 3 cm by 3 cm by 3 cm



2. Prism B: 5 cm by 5 cm by 1 cm



3. Compare the volumes of the prisms and then their surface areas. Does the prism with the greater volume also have the greater surface area?

Solution

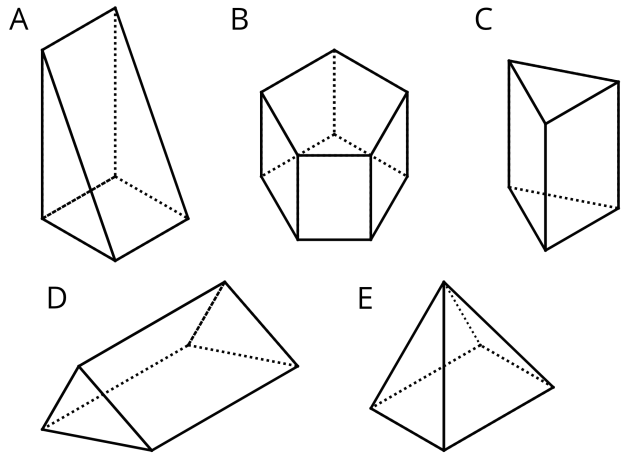
1. Volume: 27 cubic inches, surface area: 54 square inches

2. Volume: 25 cubic inches, surface area: 70 square inches

3. Prism A has a greater volume, but Prism B has a greater surface area.

Problem 6

(from Unit 1, Lesson 13)
Which figure is a triangular prism? Select **all** that apply.



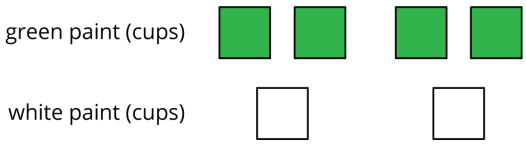
Solution

A, C, D

Lesson 2

Problem 1

Here is a diagram that describes the cups of green and white paint in a mixture.



Select **all** the statements that accurately describe this diagram.

1. The ratio of cups of white paint to cups of green paint is 2 to 4.
2. For every cup of green paint, there are two cups of white paint.
3. The ratio of cups of green paint to cups of white paint is $4 : 2$.
4. For every cup of white paint, there are two cups of green paint.
5. The ratio of cups of green paint to cups of white paint is $2 : 4$.

Solution

A,C,D

Problem 2

To make a snack mix, combine 2 cups of raisins with 4 cups of pretzels and 6 cups of almonds.

1. Create a diagram to represent the quantities of each ingredient in this recipe.

2. Use your diagram to complete each sentence.

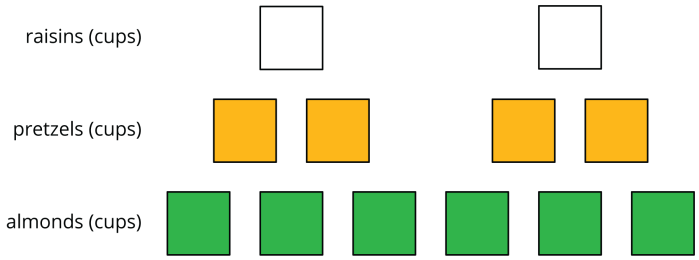
   - The ratio of _____ to _____ to _____ is _____ : _____ : _____.

   - There are _____ cups of pretzels for every cup of raisins.

   - There are _____ cups of almonds for every cup of raisins.

Solution

1. Answers vary. Sample response:



2. Statements:
   a. Answers vary. Sample response: cups of raisins, cups of pretzels, cups of almonds, 2, 4, 6

   b. 2

   c. 3

Problem 3

(from Unit 1, Lesson 17)

1. A square is 3 inches by 3 inches. What is its area?

2. A square has a side length of 5 feet. What is its area?

3. The area of a square is 36 square centimeters. What is the length of each side of the square?

Solution

1. 9 square inches ($3 \cdot 3 = 9$)

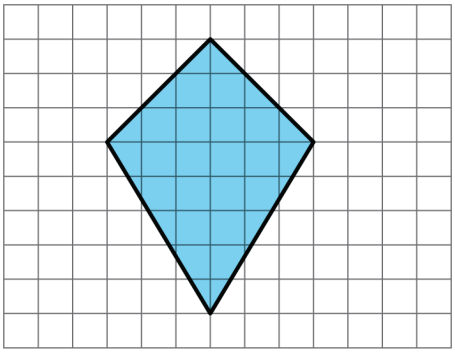
2. 25 square feet ($5 \cdot 5 = 25$)

3. 6 centimeters ($6 \cdot 6 = 36$)

Problem 4

(from Unit 1, Lesson 11)

Find the area of this quadrilateral. Explain or show your strategy.



Solution

24 square units. Possible strategy: Decompose the quadrilateral into two triangles with a horizontal cut. The top triangle has a base of 6 units and a height of 3 units. Its area is 9 square units, as $(6 \cdot 3) \div 2 = 9$. The bottom triangle has a base of 6 units and a height of 5 units. Its area is 15 square units, as $(6 \cdot 5) \div 2 = 15$. $9 + 15 = 24$. The area of the quadrilateral is then 24 square units.

Problem 5

(from Unit 2, Lesson 1)
Complete each equation with a number that makes it true.

1. $\frac{1}{8} \cdot 8 =$ _____
2. $\frac{3}{8} \cdot 8 =$ _____
3. $\frac{1}{8} \cdot 7 =$ _____
4. $\frac{3}{8} \cdot 7 =$ _____

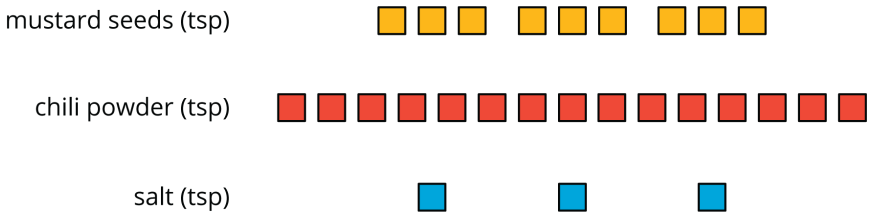
Solution

1. 1 (or equivalent)
2. 3 (or equivalent)
3. $\frac{7}{8}$ (or equivalent)
4. $\frac{21}{8}$ (or equivalent, $2\frac{5}{8}$ for example)

Lesson 3

Problem 1

A recipe for 1 batch of spice mix says, “Combine 3 teaspoons of mustard seeds, 5 teaspoons of chili powder, and 1 teaspoon of salt.” How many batches are represented by the diagram? Explain or show your reasoning.



Solution

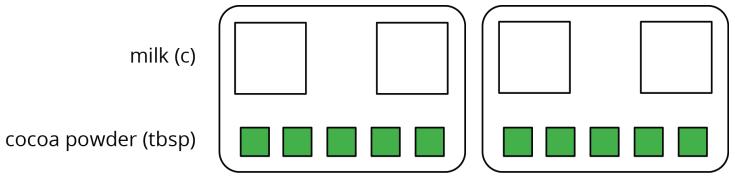
The diagram represents 3 batches of spice mix. It shows 3 times the amount of each ingredient in the recipe: 9 teaspoons of mustard $(3 \cdot 3)$, 15 teaspoons of chili powder $(3 \cdot 5)$, and 3 teaspoons of salt $(3 \cdot 1)$.

Problem 2

Priya makes chocolate milk by mixing 2 cups of milk and 5 tablespoons of cocoa powder. Draw a diagram that clearly represents two batches of her chocolate milk.

Solution

Answers vary. Sample response:



Problem 3

In a recipe for fizzy grape juice, the ratio of cups of sparkling water to cups of grape juice concentrate is 3 to 1.

1. Find two more ratios of cups of sparkling water to cups of juice concentrate that would make a mixture that tastes the same as this recipe.

2. Describe another mixture of sparkling water and grape juice that would taste different than this recipe.

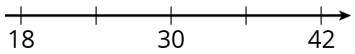
Solution

Answers vary. Sample responses:

1. 6 to 2
2. 6 to 3

Problem 4

(from Unit 2, Lesson 1)
Write the missing number under each tick mark on the number line.



Solution

24, 36 (intervals of 6)

Problem 5

(from Unit 2, Lesson 1)
At the kennel, there are 6 dogs for every 5 cats.

1. The ratio of dogs to cats is _____ to _____.

2. The ratio of cats to dogs is _____ to _____.

3. For every _____ dogs there are _____ cats.

4. The ratio of cats to dogs is _____ : _____.

Solution

1. 6 to 5
2. 5 to 6
3. 6, 5
4. $5 : 6$

Problem 6

(from Unit 1, Lesson 17)
Elena has 80 unit cubes. What is the volume of the largest cube she can build with them?

Solution

64 cubic units (from a 4 by 4 by 4 cube)

Problem 7

(from Unit 2, Lesson 1)
Fill in the blanks to make each equation true.

1. $3 \cdot \frac{1}{3} =$ _____
2. $10 \cdot \frac{1}{10} =$ _____
3. $19 \cdot \frac{1}{19} =$ _____
4. $a \cdot \frac{1}{a} =$ _____
   (As long as a does not equal 0.)
5. $5 \cdot$ _____ $= 1$
6. $17 \cdot$ _____ $= 1$
7. $b \cdot$ _____ $= 1$

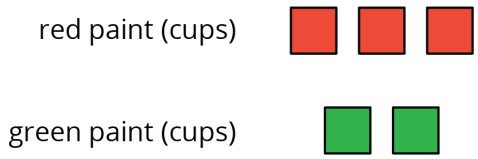
Solution

1. 1 (or equivalent)
2. 1 (or equivalent)
3. 1 (or equivalent)
4. 1 (or equivalent)
5. $\frac{1}{5}$ (or equivalent)
6. $\frac{1}{17}$ (or equivalent)
7. $\frac{1}{b}$ (or equivalent)

Lesson 4

Problem 1

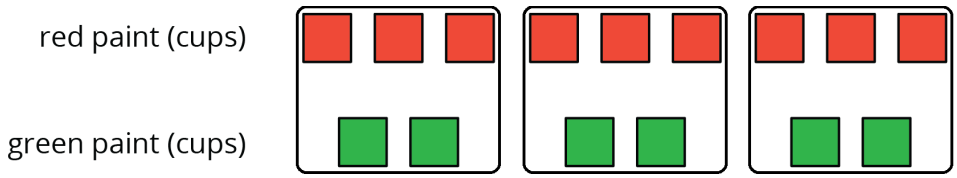
Here is a diagram showing a mixture of red paint and green paint needed for 1 batch of a particular shade of brown.



Add to the diagram so that it shows 3 batches of the same shade of brown paint.

Solution

Answers vary. Sample response:



Problem 2

Diego makes green paint by mixing 10 tablespoons of yellow paint and 2 tablespoons of blue paint. Which of these mixtures produce the same shade of green paint as Diego's mixture? Select **all** that apply.

1. For every 5 tablespoons of blue paint, mix in 1 tablespoon of yellow paint.
2. Mix tablespoons of blue paint and yellow paint in the ratio $1:5$.
3. Mix tablespoons of yellow paint and blue paint in the ratio 15 to 3.
4. Mix 11 tablespoons of yellow paint and 3 tablespoons of blue paint.

Solution

B and C

Problem 3

To make 1 batch of sky blue paint, Clare mixes 2 cups of blue paint with 1 gallon of white paint.

1. Explain how Clare can make 2 batches of sky blue paint.

2. Explain how to make a mixture that is a darker shade of blue than the sky blue.

3. Explain how to make a mixture that is a lighter shade of blue than the sky blue.

Solution

1. Mix 4 cups of blue paint and 2 gallons of white paint.

2. Answers vary. Sample response: 3 cups of blue paint and 1 gallon of white paint. Mixing the same amount of white paint with *more* blue paint will make a darker shade of blue.

3. Answers vary. Sample response: 2 cups of blue paint and 2 gallons of white paint. Mixing the same amount of blue paint with *more* white paint will make a lighter shade of blue.

Problem 4

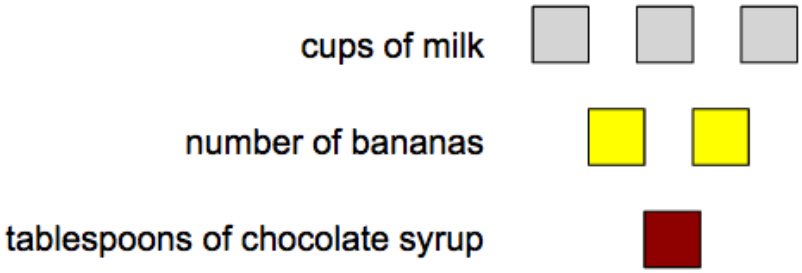
(from Unit 2, Lesson 2)
A smoothie recipe calls for 3 cups of milk, 2 frozen bananas and 1 tablespoon of chocolate syrup.

1. Create a diagram to represent the quantities of each ingredient in the recipe.

2. Write 3 different sentences that use a ratio to describe the recipe.

Solution

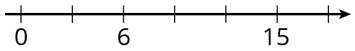
1. Answers vary. Sample response:



2. Answers vary. Sample response: The ratio of cups of milk to number of bananas is $3:2$, the ratio of bananas to tablespoons of chocolate syrup is 2 to 1, for every tablespoon of chocolate syrup, there are 3 cups of milk.

Problem 5

(from Unit 2, Lesson 1)
Write the missing number under each tick mark on the number line.

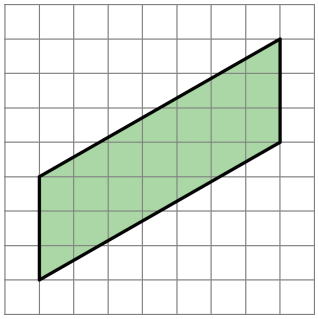


Solution

0, 3, 6, 9, 12, 15, 18 (intervals of 3)

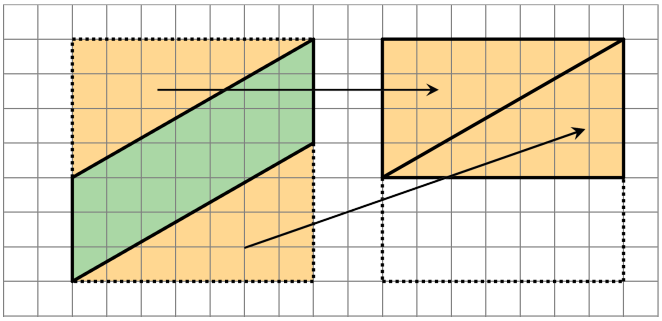
Problem 6

(from Unit 1, Lesson 4)
Find the area of the parallelogram. Show your reasoning.



Solution

21 square units. Reasoning varies. Sample reasoning: Draw a square around the parallelogram; its area is 49 square units, because $7 \cdot 7 = 49$. Rearrange the triangles above and below the parallelogram to form a rectangle; the area of this rectangle is 28 square units, because $4 \cdot 7 = 28$. Subtracting the area of the triangles from the area of the square, we have 21 square units. $49 - 28 = 21$.



Problem 7

(from Unit 2, Lesson 1)
Complete each equation with a number that makes it true.

1. $11 \cdot \frac{1}{4} =$ _____
2. $7 \cdot \frac{1}{4} =$ _____
3. $13 \cdot \frac{1}{27} =$ _____
4. $13 \cdot \frac{1}{99} =$ _____
5. $x \cdot \frac{1}{y} =$ _____
   (As long as y does not equal 0.)

Solution

1. $\frac{11}{4}$ (or equivalent)
2. $\frac{7}{4}$ (or equivalent)
3. $\frac{13}{27}$ (or equivalent)
4. $\frac{13}{99}$ (or equivalent)
5. $\frac{x}{y}$ (or equivalent)

Lesson 5

Problem 1

Each of these is a pair of equivalent ratios. For each pair, explain why they are equivalent ratios or draw a diagram that shows why they are equivalent ratios.

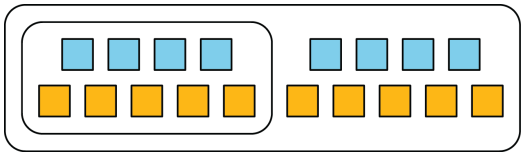
1. $4 : 5$ and $8 : 10$

2. $18 : 3$ and $6 : 1$

3. $2 : 7$ and $10{,}000 : 35{,}000$

Solution

Answers vary. Sample response:



1. The diagram shows that 8 to 10 is the same as 2 groups of 4 to 5 so these are equivalent ratios.
2. $18 \cdot \frac{1}{3} = 6$ and $3 \cdot \frac{1}{3} = 1$.
3. $2 \cdot (5,000) = 10,000$ and $7 \cdot (5,000) = 35,000$.

Problem 2

Explain why $6 : 4$ and $18 : 8$ are not equivalent ratios.

Solution

Answers vary. Sample response: $6 : 4$ is not equivalent to $18 : 8$ because 18 is $6 \cdot 3$, but 8 is not $4 \cdot 3$.

Problem 3

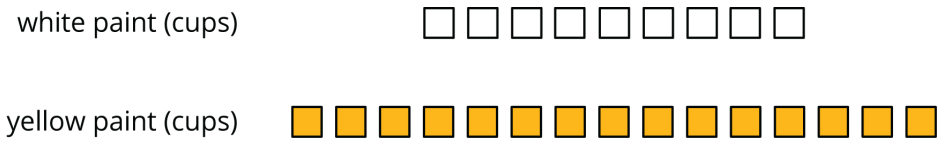
Are the ratios $3 : 6$ and $6 : 3$ equivalent? Why or why not?

Solution

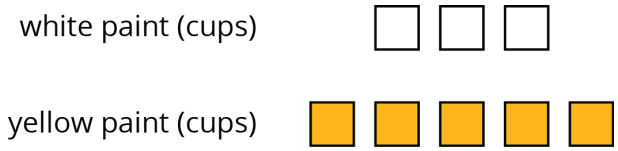
Answers vary. Sample response: No, the ratio $3 : 6$ is not equivalent to $6 : 3$. The ratio $3 : 6$ represents 3 of one type of object for every 6 of another type of object while the ratio $6 : 3$ represents 6 of the first type of object for every 3 of the second type of object.

Problem 4

(from Unit 2, Lesson 4)
This diagram represents 3 batches of light yellow paint. Draw a diagram that represents 1 batch of the same shade of light yellow paint.



Solution



Problem 5

(from Unit 2, Lesson 1)
In the fruit bowl there are 6 bananas, 4 apples, and 3 oranges.

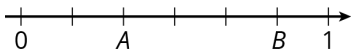
1. For every 4 _____, there are 3 _____.
2. The ratio of _____ to _____ is $6 : 3$.
3. The ratio of _____ to _____ is 4 to 6.
4. For every 1 orange, there are _____ bananas.

Solution

1. apples, oranges
2. bananas, oranges
3. apples, bananas
4. 2

Problem 6

(from Unit 2, Lesson 1)
Write fractions for points A and B on the number line.



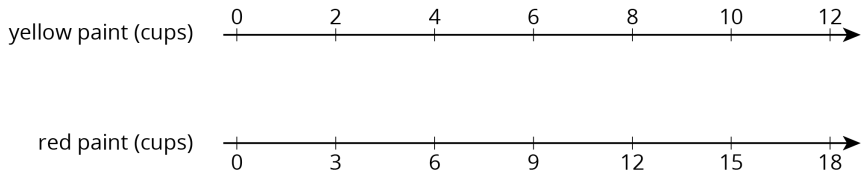
Solution

$A = \frac{2}{6}$ or $\frac{1}{3}$ $B = \frac{5}{6}$

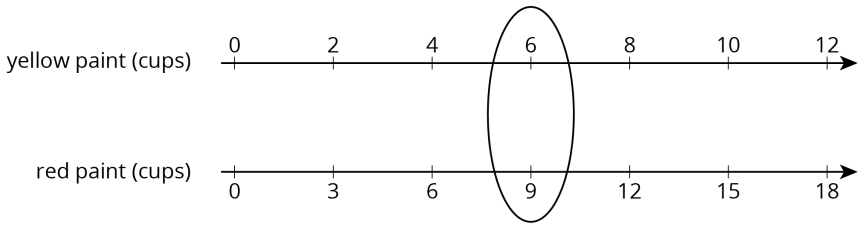
Lesson 6

Problem 1

A particular shade of orange paint has 2 cups of yellow paint for every 3 cups of red paint. On the double number line, circle the numbers of cups of yellow and red paint needed for 3 batches of orange paint.

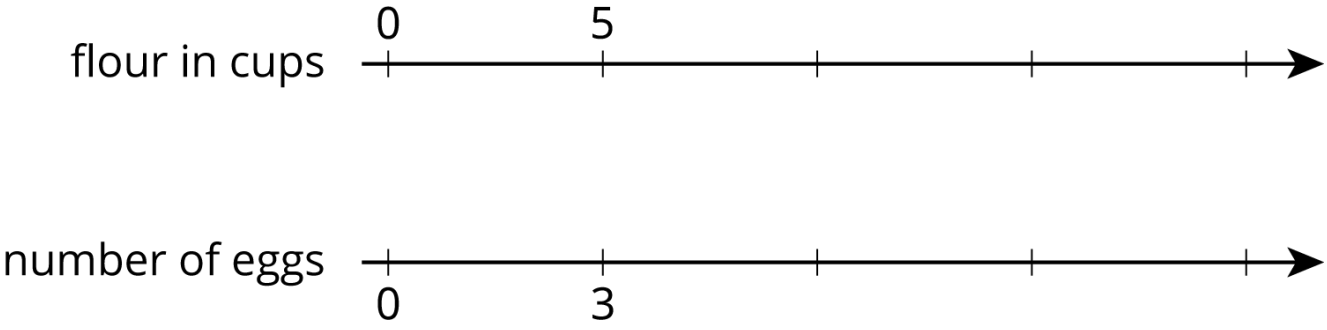


Solution



Problem 2

This double number line diagram shows the amount of flour and eggs needed for 1 batch of cookies.



1. Complete the diagram to show the amount of flour and eggs needed for 2, 3, and 4 batches of cookies.
2. What is the ratio of cups of flour to eggs?
3. How much flour and how many eggs are used in 4 batches of cookies?
4. How much flour is used with 6 eggs?
5. How many eggs are used with 15 cups of flour?

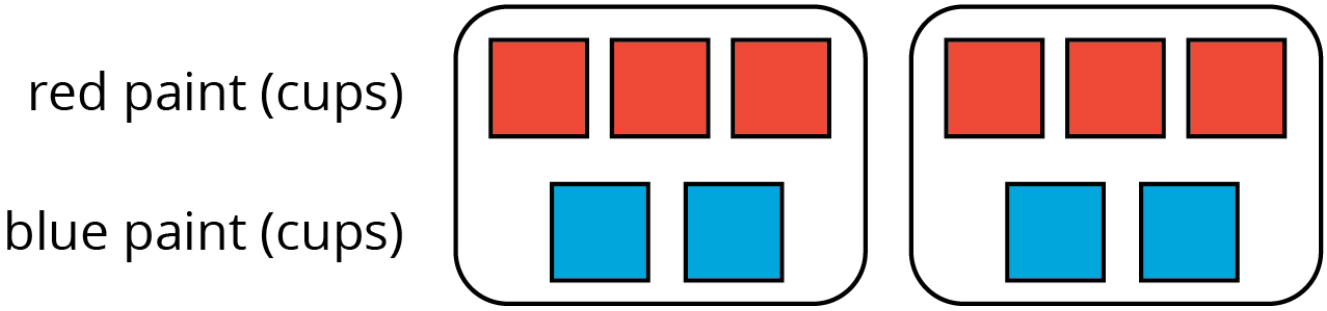
Solution

1. Flour in cups: 5, 10, 15, 20. Number of eggs: 3, 6, 9, 12.
2. $5 : 3$ or equivalent
3. 20 cups of flour and 12 eggs
4. 10 cups
5. 9 eggs

Problem 3

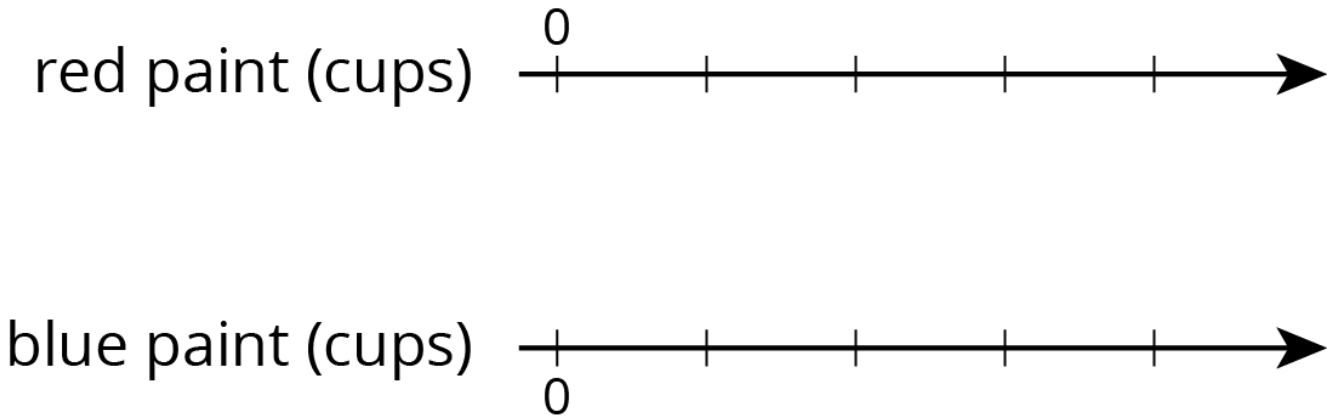
Here is a representation showing the amount of red and blue paint that make 2 batches of purple paint.

1. On the double number line, label the tick marks to represent amounts of red and blue paint used to make batches of this shade of purple paint.



2. How many batches are made with 12 cups of red paint?

3. How many batches are made with 6 cups of blue paint?



Solution

1. Red (cups): 0, 3, 6, 9, 12; Blue (cups): 0, 2, 4, 6, 8

2. 4 batches

3. 3 batches

Problem 4

(from Unit 2, Lesson 1)
Diego estimates that there will need to be 3 pizzas for every 7 kids at his party. Select **all** the statements that express this ratio.

1. The ratio of kids to pizzas is $7:3$.
2. The ratio of pizzas to kids is 3 to 7.
3. The ratio of kids to pizzas is $3:7$.
4. The ratio of pizzas to kids is 7 to 3.
5. For every 7 kids there need to be 3 pizzas.

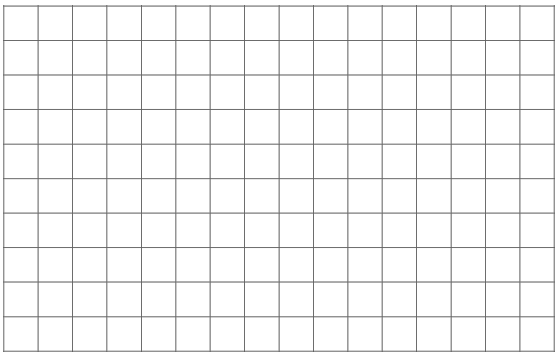
Solution

A, B, E

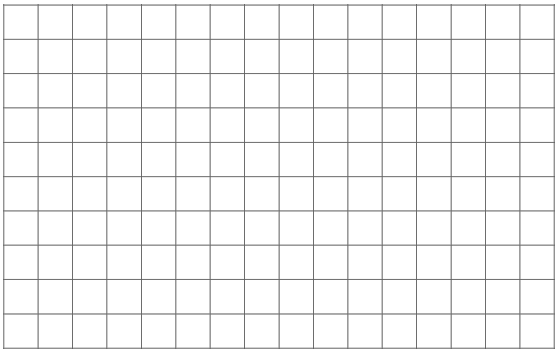
Problem 5

(from Unit 1, Lesson 6)

1. Draw a parallelogram that is not a rectangle that has an area of 24 square units. Explain or show how you know the area is 24 square units.



2. Draw a triangle that has an area of 24 square units. Explain or show how you know the area is 24 square units.



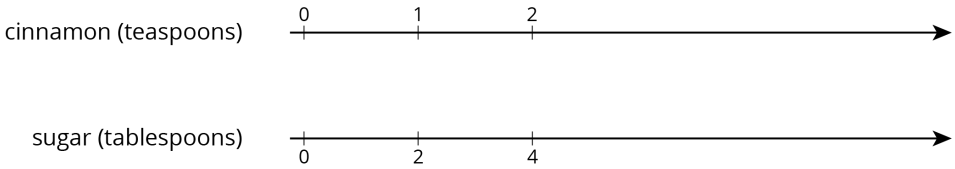
Solution

Answers vary. There are many possible pairs of base and height lengths to make an area of 24 square units.

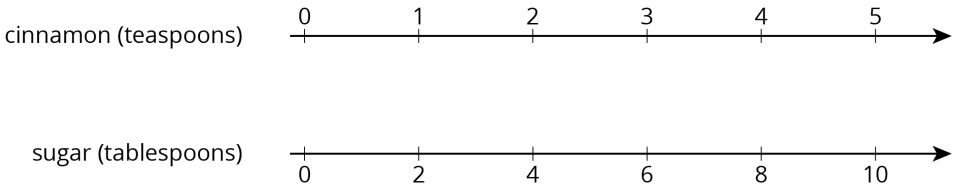
Lesson 7

Problem 1

A recipe for cinnamon rolls uses 2 tablespoons of sugar per teaspoon of cinnamon for the filling. Complete the double number line diagram to show the amount of cinnamon and sugar in 3, 4, and 5 batches.

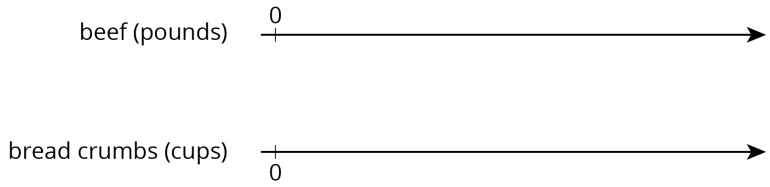


Solution



Problem 2

One batch of meatloaf contains 2 pounds of beef and $\frac{1}{2}$ cup of bread crumbs. Complete the double number line diagram to show the amounts of beef and bread crumbs needed for 1, 2, 3, and 4 batches of meatloaf.



Solution

1 batch: 2 pounds of beef, $\frac{1}{2}$ cup of bread crumbs. 2 batches: 4 pounds of beef, 1 cup of bread crumbs. 3 batches: 6 pounds of beef, $1\frac{1}{2}$ cups of bread crumbs. On a double number line, the top line is labeled 2, 4, 6, 8 and the bottom line is labeled $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2.

Problem 3

A recipe for tropical fruit punch says, “Combine 4 cups of pineapple juice with 5 cups of orange juice.”

1. Create a double number showing the amount of each type of juice in 1, 2, 3, 4, and 5 batches of the recipe.

2. If 12 cups of pineapple juice are used with 20 cups of orange juice, will the recipe taste the same? Explain your reasoning.

3. The recipe also calls for $\frac{1}{3}$ cup of lime juice for every 5 cups of orange juice. Add a line to your diagram to represent the amount of lime juice in different batches of tropical fruit punch.

Solution

1. Answers vary. A correct double number line will have equally spaced tick marks. A line labeled “cups of pineapple juice” is labeled 0, 4, 8, 12, 16, 20 and a line labeled “cups of orange juice” is labeled 0, 5, 10, 15, 20, 25.
2. No, it will not taste the same. 12 cups of pineapple juice should be mixed with 15 cups of orange juice.
3. A line labeled “cups of lime juice” is labeled $\frac{1}{3}, \frac{2}{3}, 1, 1\frac{1}{3}, 1\frac{2}{3}$.

Problem 4

(from Unit 2, Lesson 4)
One batch of pink paint uses 2 cups of red paint and 7 cups of white paint. Mai made a large amount of pink paint using 14 cups of red paint.

1. How many batches of pink paint did she make?

2. How many cups of white paint did she use?

Solution

1. 7 batches (because 14 is $7 \cdot 2$)
2. 49 cups (because $7 \cdot 7 = 49$)

Problem 5

(from Unit 2, Lesson 5)
1. Find three different ratios that are equivalent to the ratio $3 : 11$.

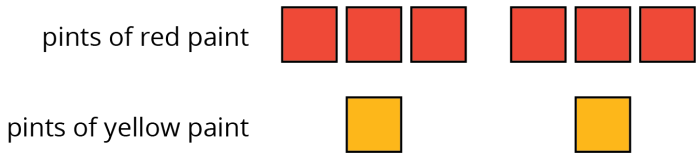
2. Explain why your ratios are equivalent.

Solution

1. Answers vary. Sample response: $6:22$, $9:33$, $12:44$.
2. Answers vary. Sample response: These ratios come from $3:11$ by multiplying both numbers in the ratio by 2, 3, and 4 respectively.

Problem 6

(from Unit 2, Lesson 2)
Here is a diagram that represents the pints of red and yellow paint in a mixture.



Select **all** statements that accurately describe the diagram.

1. The ratio of yellow paint to red paint is 2 to 6.
2. For every 3 pints of red paint, there is 1 pint of yellow paint.
3. For every pint of yellow paint, there are 3 pints of red paint.
4. For every pint of yellow paint there are 6 pints of red paint.
5. The ratio of red paint to yellow paint is $6:2$.

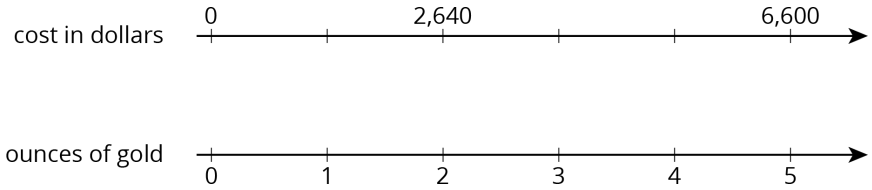
Solution

A, B, C, E

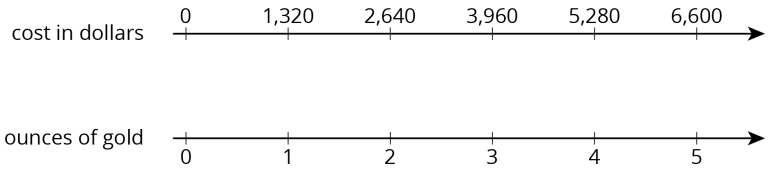
Lesson 8

Problem 1

In 2016, the cost of 2 ounces of pure gold was $2,640. Complete the double number line to show the cost for 1, 3, and 4 ounces of gold.

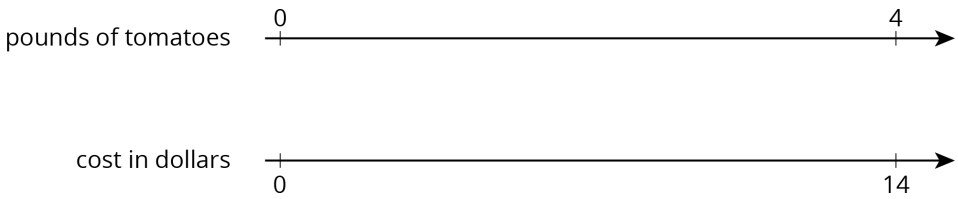


Solution

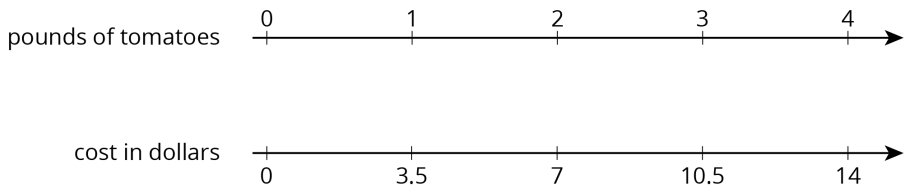


Problem 2

The double number line shows that 4 pounds of tomatoes cost $14. Draw tick marks and write labels to show the prices of 1, 2, and 3 pounds of tomatoes.



Solution



Problem 3

4 movie tickets cost $48. At this rate, what is the cost of:

1. 5 movie tickets?
2. 11 movie tickets?

Solution

1. $60 (1 ticket costs $12 because $48 \div 4 = 12$. 5 tickets cost $60 because $5 \cdot 12 = 60$.)
2. $132 (because $11 \cdot 12 = 132$)

Problem 4

Priya bought these items at the grocery store. Find each unit price.

1. 12 eggs for $3. How much is the cost per egg?
2. 3 pounds of peanuts for $7.50. How much is the cost per pound?
3. 4 rolls of toilet paper for $2. How much is the cost per roll?
4. 10 apples for $3.50. How much is the cost per apple?

Solution

1. 25 cents or $0.25
2. $2.50
3. 50 cents or $0.50
4. 35 cents or $0.35

Problem 5

(from Unit 2, Lesson 3)
Clare made a smoothie with 1 cup of yogurt, 3 tablespoons of peanut butter, 2 teaspoons of chocolate syrup, and 2 cups of crushed ice.

1. Kiran tried to double this recipe. He used 2 cups of yogurt, 6 tablespoons of peanut butter, 5 teaspoons of chocolate syrup, and 4 cups of crushed ice. He didn't think it tasted right. Describe how the flavor of Kiran's recipe compares to Clare's recipe.

2. How should Kiran change the quantities that he used so that his smoothie tastes just like Clare's?

Solution

1. Kiran's smoothie would be more chocolatey than Clare's. All ingredients are doubled, but there is an extra teaspoon of chocolate syrup in his smoothie.

2. Answers vary. Sample response: he should use 4 teaspoons of chocolate syrup instead of 5.

Problem 6

(from Unit 1, Lesson 15)
A drama club is building a wooden stage in the shape of a trapezoidal prism. The height of the stage is 2 feet. Some measurements of the stage are shown here.

What is the area of all the faces of the stage, excluding the bottom? Show your reasoning. If you get stuck, consider drawing a net of the prism.

Solution

292 square feet. Sample reasoning: The trapezoidal face is 180 square feet since $(12 \cdot 10) + 2(\frac{1}{2} \cdot 12 \cdot 5) = 120 + 60 = 180$. The side faces are $2(13 \cdot 2) + (10 \cdot 2) + (20 \cdot 2)$ or 112 square feet.

Lesson 9

Problem 1

Han ran 10 meters in 2.7 seconds. Priya ran 10 meters in 2.4 seconds.

1. Who ran faster? Explain how you know.

2. At this rate, how long would it take each person to run 50 meters? Explain or show your reasoning.

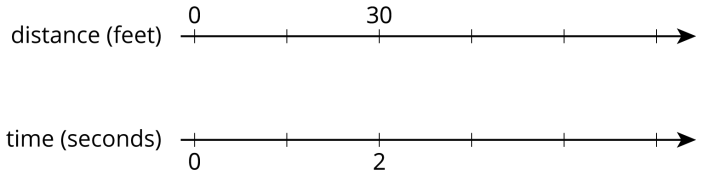
Solution

1. Priya ran faster. Sample explanation: Priya ran the same distance (10 meters) in *less* time than Han. This means she was running faster.

2. At this rate, it would take Han13.5 seconds to run 50 meters. Since 50 meters is 5 times 10 meters, the time it would take is 5 times 2.7 seconds. It would take Priya 12 seconds, which is 5 times 2.4 seconds, to run 50 meters.

Problem 2

A scooter travels 30 feet in 2 seconds at a constant speed.



1. What is the speed of the scooter in feet per second?

2. Complete the double number line to show the distance the scooter travels after 1, 3, 4, and 5 seconds.

3. A skateboard travels 55 feet in 4 seconds. Is the skateboard going faster, slower, or the same speed as the scooter?

Solution

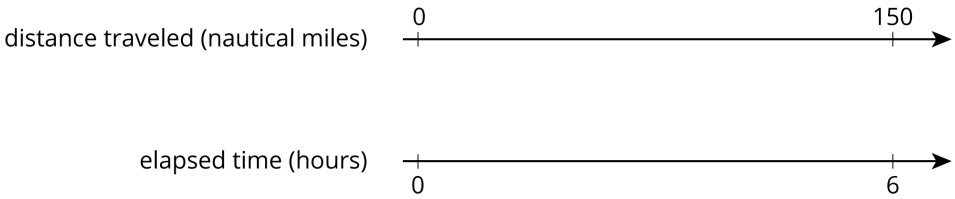
1. 15 feet per second

2. Distance: 0, 15, 30, 45, 60, 75. Time: 0, 1, 2, 3, 4, 5.

3. Slower. The scooter travels 60 feet in 4 seconds, so it is going faster than the skateboard, which travels 55 feet in 4 seconds.

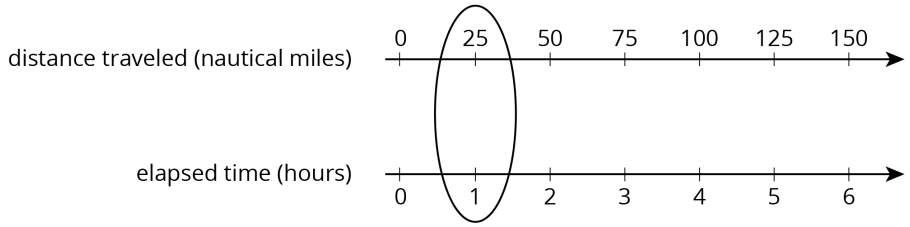
Problem 3

A cargo ship traveled 150 nautical miles in 6 hours at a constant speed. How far did the cargo ship travel in one hour?



Solution

The ship travels 25 nautical miles in 1 hour. Possible strategy:



Problem 4

(from Unit 2, Lesson 3)
A recipe for pasta dough says, “Use 150 grams of flour per large egg.”

1. How much flour is needed if 6 large eggs are used?

2. How many eggs are needed if 450 grams of flour are used?

Solution

1. 900 grams

2. 3 eggs

Problem 5

(from Unit 2, Lesson 8)
The grocery store is having a sale on frozen vegetables. 4 bags are being sold for $11.96. At this rate, what is the cost of:

1. 1 bag

2. 9 bags

Solution

1. $2.99

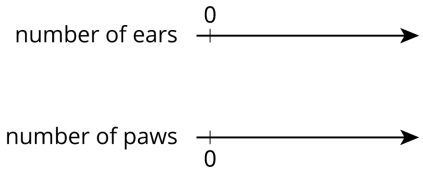
2. $26.91

Problem 6

(from Unit 2, Lesson 7)
A pet owner has 5 cats. Each cat has 2 ears and 4 paws.

1. Complete the double number line to show the numbers of ears and paws for 1, 2, 3, 4, and 5 cats.

2. If there are 3 cats in the room, what is the ratio of ears to paws?



3. If there are 4 cats in the room, what is the ratio of paws to ears?

4. If all 5 cats are in the room, how many more paws are there than ears?

Solution

1. Ears: 2, 4, 6, 8, 10; Paws: 4, 8, 12, 16, 20

2. $6 : 12$

3. $16 : 8$

4. 10

Problem 7

(from Unit 2, Lesson 5)
Each of these is a pair of equivalent ratios. For each pair, explain why they are equivalent ratios or draw a representation that shows why they are equivalent ratios.

1. $5 : 1$ and $15 : 3$

2. $25 : 5$ and $10 : 2$

3. $198 : 1{,}287$ and $2 : 13$

Solution

Answers vary. Sample response:

1. Multiplying the numbers in the first ratio by 3 gives the numbers in the second ratio.

2. Multiplying the numbers in the second ratio by 10 gives the numbers in the first ratio.

3. Multiply 2 by 99 (or $100 - 1$), to get 198 (or $200 - 2$), and multiply 13 by 99, to get 1,287 ($1,300 - 13$).

Lesson 10

Problem 1

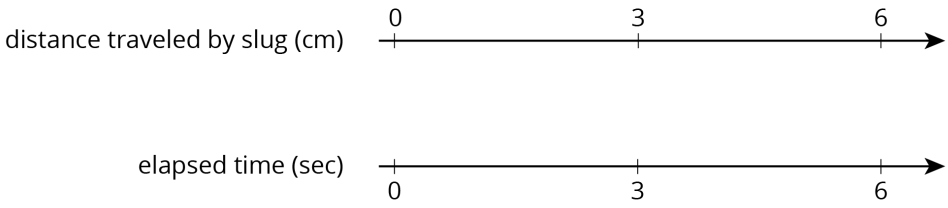
A slug travels 3 centimeters in 3 seconds. A snail travels 6 centimeters in 6 seconds. Both travel at constant speeds. Mai says, “The snail was traveling faster because it went a greater distance.” Do you agree with Mai? Explain or show your reasoning.

Solution

Answers vary. Sample responses:

- I disagree. The slug and the snail are both traveling 1 centimeter per second. They are traveling at the same speed.

- I disagree. The double number line for the slug shows that in 6 seconds it also travels 6 centimeters.



Problem 2

If you blend 2 scoops of chocolate ice cream with 1 cup of milk, you get a milkshake with a stronger chocolate flavor than if you blended 3 scoops of chocolate ice cream with 2 cups of milk. Explain or show why.

Solution

Answers vary. Sample responses:

- 3 scoops of chocolate ice cream with 2 cups of milk is 1.5 scoops of chocolate ice cream per cup of milk. This is less chocolate ice cream per cup of milk than in the first mixture (2 scoops of chocolate ice cream per cup of milk), so the first mixture has stronger chocolate flavor.

- 2 scoops of chocolate ice cream with 1 cup of milk will taste the same as 4 scoops of chocolate ice cream with 2 cups of milk. This mixture has an extra scoop of chocolate ice cream so will taste more chocolatey than 3 scoops of chocolate ice cream and 2 cups of milk.

Problem 3

There are 2 mixtures of light purple paint.

- Mixture A is made with 5 cups of purple paint and 2 cups of white paint.
- Mixture B is made with 15 cups of purple paint and 8 cups of white paint.

Which mixture is a lighter shade of purple? Explain your reasoning.

Solution

Mixture B is lighter. Explanations vary. Sample responses:

- Mixture A contains 2.5 cups of purple paint per cup of white paint. Mixture B contains only 1.875 cups of purple paint per cup of white paint. Less purple paint for the same amount of white paint will result in a lighter shade of pink.

- The ratio of purple paint to white paint in Mixture A is $5:2$. The ratio of purple paint to white paint in Mixture B is $15:8$. The amount of purple paint in Mixture B is 3 times the amount of Mixture A, but the amount of white paint in B is 4 times the amount of A.

Problem 4

Tulip bulbs are on sale at store A, at 5 for $11.00, and the regular price at store B is 6 for $13. Is each store pricing tulip bulbs at the same rate? Explain how you know.

Solution

No. Explanations vary. Sample response: At store A, 30 bulbs would cost $66, but at store B, 30 bulbs would cost $65.

Problem 5

(from Unit 2, Lesson 9)
A plane travels at a constant speed. It takes 6 hours to travel 3,360 miles.

1. What is the plane's speed in miles per hour?

2. At this rate, how many miles can it travel in 10 hours?

Solution

1. 560 because $3,360 \div 6 = 560$.

2. In 10 hours, it can travel 5,600 miles because $10 \cdot 560 = 5,600$.

Problem 6

(from Unit 2, Lesson 8)
A pound of ground beef costs $5. At this rate, what is the cost of:

1. 3 pounds?

2. $\frac{1}{2}$ pound?

3. $\frac{1}{4}$ pound?

4. $\frac{3}{4}$ pound?

5. $3\frac{3}{4}$ pounds?

Solution

1. $15 (because $5 \cdot 3 = 15$)

2. $2.50 (because $\frac{1}{2} \cdot 5 = 2\frac{1}{2}$)

3. $1.25 (because $\frac{1}{4} \cdot 5 = 1\frac{1}{4}$)

4. $3.75 (three times the cost of $\frac{1}{4}$ pound)

5. $18.75 (the total cost of 3 pounds and $\frac{3}{4}$ pound)

Problem 7

(from Unit 2, Lesson 7)
In a triple batch of a spice mix, there are 6 teaspoons of garlic powder and 15 teaspoons of salt. Answer the following questions about the mix. If you get stuck, create a double number line.

1. How much garlic powder is used with 5 teaspoons of salt?

2. How much salt is used with 8 teaspoons of garlic powder?

3. If there are 14 teaspoons of spice mix, how much salt is in it?

4. How much more salt is there than garlic powder if 6 teaspoons of garlic powder are used?

Solution

1. 2 teaspoons

2. 20 teaspoons

3. 10 teaspoons

4. 9 teaspoons

Lesson 11

Problem 1

Complete the table to show the amounts of yellow and red paint needed for different-sized batches of the same shade of orange paint.

yellow paint (quarts)	red paint (quarts)
5	6

Explain how you know that these amounts of yellow paint and red paint will make the same shade of orange as the mixture in the first row of the table.

Solution

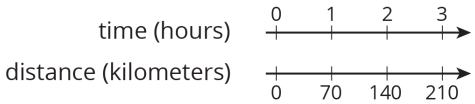
Answers vary. Sample response:

yellow paint (paint)	red paint (quarts)
5	6
$\frac{5}{4}$	\frac32 or equivalent
\frac52	3 or equivalent
\frac{15}{4}	\frac{9}{2} or equivalent

Each row is a multiple of the first row.

Problem 2

A car travels at a constant speed, as shown on the double number line.



How far does the car travel in 14 hours? Explain or show your reasoning.

Solution

980 kilometers. Possible strategy: Make a table because there isn't enough room to continue the double number line that far.

time (hours)	distance (kilometers)
1	70
2	140
3	210
4	980

Problem 3

The olive trees in an orchard produce 3,000 pounds of olives a year. It takes 20 pounds of olives to make 3 liters of olive oil. How many liters of olive oil can this orchard produce in a year? If you get stuck, consider using the table.

olives (pounds)	olive oil (liters)
20	3
100	
3,000	

Solution

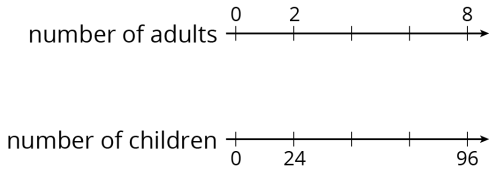
The orchard produces 450 liters of olive oil per year. Possible strategy:

olives (pounds)	olive oil (liters)
20	3
100	15
3,000	450

Problem 4

(from Unit 2, Lesson 6)

At a school recess, there needs to be a ratio of 2 adults for every 24 children on the playground. The double number line represents the number of adults and children on the playground at recess.



1. Label each remaining tick mark with its value.

2. How many adults are needed if there are 72 children? Circle your answer on the double number line.

Solution

1. Adults: 0, 2, 4, 6, 8. Children: 0, 24, 48, 72, 96.

2. 6 adults. The portion of the double number line at 6 adults and 72 children is circled.

Problem 5

(from Unit 2, Lesson 10)
While playing basketball, Jada's heart rate goes up to 160 beats per minute. While jogging, her heart beats 25 times in 10 seconds. Assuming her heart beats at a constant rate while jogging, which of these activities resulted in a higher heart rate? Explain your reasoning.

Solution

Playing basketball. Sample explanation: 25 times in 10 seconds means 150 heartbeats per minute (25 \boldcdot 6 = 150). 150 beats per minute is lower than 160 beats per minute, so Jada's heart rate is lower when she goes jogging than when she plays basketball.

Problem 6

(from Unit 2, Lesson 8)
A shopper bought the following items at the farmer's market:

1. 6 ears of corn for $1.80. What was the cost per ear?

2. 12 apples for $2.88. What was the cost per apple?

3. 5 tomatoes for $3.10. What was the cost per tomato?

Solution

1. $0.30

2. $0.24

3. $0.62

Lesson 12

Problem 1

Priya collected 2,400 grams of pennies in a fundraiser. Each penny has a mass of 2.5 grams. How much money did Priya raise? If you get stuck, consider using the table.

number of pennies	mass in grams
1	2.5
	2,400

Solution

$9.60. Possible strategy:

number of pennies	mass in grams
1	2.5
1,000	2,500
4	10
40	100
960	2,400

Problem 2

Kiran reads 5 pages in 20 minutes. He spends the same amount of time per page. How long will it take him to read 11 pages? If you get stuck, consider using the table.

time in minutes	number of pages
20	5
	1
	11

Solution

44 minutes

time in minutes	number of pages
20	5
4	1
44	11

Problem 3

Mai is making personal pizzas. For 4 pizzas, she uses 10 ounces of cheese.

number of pizzas	ounces of cheese
4	10

a. How much cheese does Mai use per pizza?

b. At this rate, how much cheese will she need to make 15 pizzas?

Solution

Mai uses 2.5 ounces of cheese per pizza, because 10 \div 4 = 2.5. She will need 37.5 ounces of cheese for 15 pizzas, because 2.5 \boldcdot 15=37.5.

Problem 4

Clare is paid $90 for 5 hours of work. At this rate, how many seconds does it take for her to earn 25 cents?

Solution

Clare earns 25 cents every 50 seconds. She earns $18 per hour, and an hour has 3,600 seconds. $18 is 72 quarters, and 3,600 \div 72 = 50.

Problem 5

(from Unit 2, Lesson 10)
A car that travels 20 miles in \frac12 hour at constant speed is traveling at the same speed as a car that travels 30 miles in \frac34 hour at a constant speed. Explain or show why.

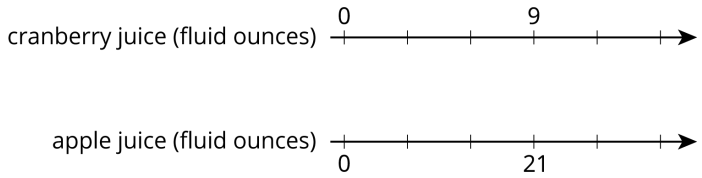
Solution

Answers vary. Sample responses:

- Both cars go 10 miles in \frac{1}{4} of an hour so they are traveling at the same speed.
- In 1 hour, both cars travel 40 miles so they are both traveling at the same speed.

Problem 6

(from Unit 2, Lesson 6)
Lin makes her favorite juice blend by mixing cranberry juice with apple juice in the ratio shown on the double number line. Complete the diagram to show smaller and larger batches that would taste the same as Lin's favorite blend.



Solution

Cranberry (cups): 0, 3, 6, 9, 12, 15. Apple (cups): 0,7,14, 21, 28, 35

Problem 7

(from Unit 2, Lesson 5)
Each of these is a pair of equivalent ratios. For each pair, explain why they are equivalent ratios or draw a representation that shows why they are equivalent ratios.

1. 600:450 and 60:45

2. 60:45 and 4:3

3. 600:450 and 4:3

Solution

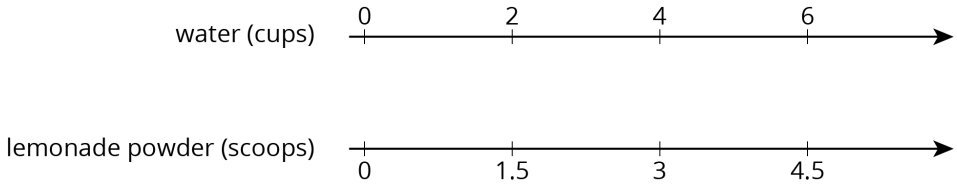
Answers vary. Sample response:

1. 60 \boldcdot 10=600 and 45 \boldcdot 10=450.
2. Multiplying 4 and 3 by 15 gives 60 and 45.
3. Multiply 4 by 150 to get 600 and multiply 3 by 150 to get 450. Or use problems 4 and 5 together: problem 4 shows that 600:450 is equivalent to 60:45 and problem 5 shows that 60:45 is equivalent to 4:3. This means that 600:450 is equivalent to 4:3.

Lesson 13

Problem 1

The double number line shows how much water and how much lemonade powder to mix to make different amounts of lemonade.



Make a table that represents the same situation.

Solution

water (cups)	lemonade powder (scoops)
0	0
2	1.5
4	3
6	4.5

Problem 2

A bread recipe uses 3 tablespoons of olive oil for every 2 cloves of crushed garlic.

1. Complete the table to show different-sized batches of bread that taste the same as the recipe.

2. Draw a double number line that represents the same situation.

3. Which representation do you think works better in this situation? Explain why.

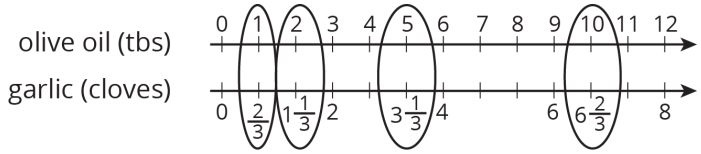
olive oil (tablespoons)	crushed garlic (cloves)
3	2
1	
2	
5	
10	

Solution

1.

olive oil (tablespoons)	crushed garlic (cloves)
3	2
1	\frac23
2	1\frac13
5	3\frac13
10	6\frac23

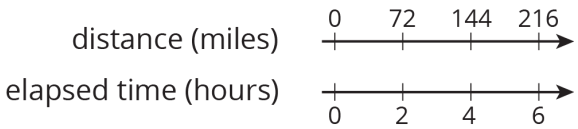
2.



3. Answers vary. Sample response: The table is more convenient because the rows of the table can be listed in any order and without worrying about placing numbers accurately on the number line.

Problem 3

Clare travels at a constant speed, as shown on the double number line.



At this rate, how far does she travel in each of these intervals of time? Explain or show your reasoning. If you get stuck, consider using a table.

1. 1 hour
2. 3 hours
3. 6.5 hours

Solution

Explanations vary. Sample responses:

1. 36 miles. 1 hour is half of 2 hours, so half of 72 is 36. She traveled 36 miles in 1 hour.

2. 108 miles. Since the rate is 36 miles per hour, to find her distance in 3 hours, multiply 36 by 3. She traveled 108 miles in 3 hours.

3. 234 miles. Multiply the rate by 6.5. She traveled 234 miles in 6.5 hours.

distance (miles)	elapsed time (hours)
72	2
36	1
108	3
234	6.5

Problem 4

(from Unit 2, Lesson 9)
Lin and Diego travel in cars on the highway at constant speeds. In each case, decide who was traveling faster and explain how you know.

1. During the first half hour, Lin travels 23 miles while Diego travels 25 miles.

2. After stopping for lunch, they travel at different speeds. To travel the next 60 miles, it takes Lin 65 minutes and it takes Diego 70 minutes.

Solution

Explanations vary. Sample response:

1. Diego traveled faster because he covered more distance than Lin in the same amount of time.
2. Lin traveled faster because she covered the same distance as Diego but in less time.

Problem 5

(from Unit 2, Lesson 3)
A sports drink recipe calls for \frac{5}{3} tablespoons of powdered drink mix for every 12 ounces of water. How many batches can you make with 5 tablespoons of drink mix and 36 ounces of water? Explain your reasoning.

Solution

3 batches. Each batch has \frac{5}{3} tablespoons of drink mix, so 3 batches will have 5 tablespoons of drink mix, since 3 \boldcdot \frac{5}{3} = 5. Similarly, we can make 3 batches with 36 ounces of water, since 3 \boldcdot 12 = 36.

Problem 6

(from Unit 1, Lesson 18)
In this cube, each small square has side length 1 unit.

1. What is the surface area of this cube?

2. What is the volume of this cube?

Solution

1. 54 square units
2. 27 cubic units

Lesson 14

Problem 1

A chef is making pickles. He needs 15 gallons of vinegar. The store sells 2 gallons of vinegar for $3.00 and allows customers to buy any amount of vinegar. Decide whether each of the following ratios correctly represents the price of vinegar.

1. 4 gallons to $3.00

2. 1 gallon to $1.50

3. 30 gallons to $45.00

4. $2.00 to 30 gallons

5. $1.00 to \frac23 gallon

Solution

1. No. (The ratio is not equivalent; 4 gallons of vinegar would cost $6).

2. Yes.

3. Yes.

4. No. (The ratio is not equivalent; 2 gallons of vinegar cost $3, and $30 would buy 20 gallons).

5. Yes.

Problem 2

A caterer needs to buy 21 pounds of pasta to cater a wedding. At a local store, 8 pounds of pasta cost $12. How much will the caterer pay for the pasta there?

1. Write a ratio for the given information about the cost of pasta.

2. Would it be more helpful to write an equivalent ratio with 1 pound of pasta as one of the numbers, or with $1 as one of the numbers? Explain your reasoning, and then write that equivalent ratio.

3. Find the answer and explain or show your reasoning.

Solution

1. Answers vary. Sample responses: $12 for every 8 pounds; $12 to 8 pounds; 8 pounds to $12.

2. Answers vary. Sample response: Finding 1 pound would be easier and more helpful. The cost of 1 pound can be easily found by dividing $12 by 8 and the result (the unit rate) can be multiplied by 21. The ratio is $1.50 to 1 pound.

3. $31.50. Possible reasonings: 21 \boldcdot (1.50) = 31.50.

pasta (pounds)	cost (dollars)
8	12
1	1.50
21	31.50

Problem 3

Lin is reading a 47-page book. She read the first 20 pages in 35 minutes.

1. If she continues to read at the same rate, will she be able to complete this book in under 1 hour?

2. If so, how much time will she have left? If not, how much more time is needed? Explain or show your reasoning.

Solution

No, it will take Lin 82.25 minutes to finish her book. Possible strategies:

1. Using a table:

number of pages	times in minutes
20	35
1	1.75 (or equivalent)
47	82.25 (or equivalent)

   Additional 22.25 or 22\frac{1}{4} minutes (or 22 minutes and 15 seconds) are needed.

2. 40 pages will take 70 minutes, which is already more than an hour, so Lin can not finish the 47-page book in an hour.

Problem 4

Diego can type 140 words in 4 minutes.

1. At this rate, how long will it take him to type 385 words?

2. How many words can he type in 15 minutes?

If you get stuck, consider creating a table.

Solution

Answers vary. Sample response:

number of words	number of minutes
140	4
1	\frac{1}{35}
385	11
35	1
525	15

1. It will take 11 minutes to type 385 words.

2. He can type 525 words in 15 minutes.

Problem 5

(from Unit 2, Lesson 10)
A train that travels 30 miles in \frac13 hour at a constant speed is going faster than a train that travels 20 miles in \frac12 hour at a constant speed. Explain or show why.

Solution

Answers vary. Sample responses:

- In 1 hour, the first train will travel 90 miles, while the second train only travels 40 miles. The first train is going faster.

- The train traveling 30 miles in \frac{1}{3} of an hour takes \frac{1}{9} of an hour to go 10 miles. The train traveling 20 miles in \frac{1}{2} of an hour takes \frac{1}{4} of an hour to go 10 miles. This means that the first train is traveling faster.

Problem 6

(from Unit 1, Lesson 14)
Find the surface area of the polyhedron that can be assembled from this net. Show your reasoning.

Solution

224 square inches. Reasoning varies. Sample reasoning: The three rectangular faces have areas 48, 40, and 40 square inches. Each triangle has a base of 12 inches and a height of 8 inches, so each triangle has an area of 48 square inches. 48 + 40 +40 + 2(48) = 224.

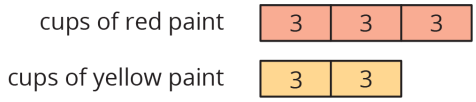
Lesson 15

Problem 1

Here is a tape diagram representing the ratio of red paint to yellow paint in a mixture of orange paint.

1. What is the ratio of yellow paint to red paint?

2. How many cups total of orange paint will this mixture yield?



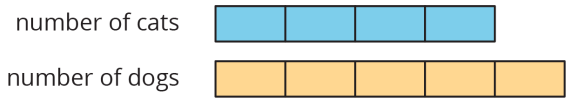
Solution

1. 2:3 (or equivalent)

2. 15 cups

Problem 2

At the kennel, the ratio of cats to dogs is 4:5. There are 27 animals in all. Here is a tape diagram representing this ratio.



1. What is the value of each small rectangle?

2. How many dogs are at the kennel?

3. How many cats are at the kennel?

Solution

1. Each unit is 3, because 4+5=9 and 27\div9=3.

2. There are 15 dogs, because 3\boldcdot 5=15.

3. There are 12 cats, because 3\boldcdot 4=12.

Problem 3

Last month, there were 4 sunny days for every rainy day. If there were 30 days in the month, how many days were rainy? Explain your reasoning. If you get stuck, consider using a tape diagram.

Solution

There were 6 rainy days, because 4+1=5, so there are 5 units total. 30\div5=6, so each unit is worth 6.

Problem 4

(from Unit 2, Lesson 12)
Noah entered a 100-mile bike race. He knows he can ride 32 miles in 160 minutes. At this rate, how long will it take him to finish the race? Use each table to find the answer. Next, explain which table you think works better in finding the answer.

Table A:

distance (miles)	elapsed time (minutes)
32	160
1	
100	

Table B:

distance (miles)	elapsed time (minutes)
32	160
96	
4	
100	

Solution

He will finish the race in 500 minutes (or equivalent).

Table A:

distance (miles)	elapsed time (minutes)
32	160
1	5
100	500

Table B:

distance (miles)	elapsed time (minutes)
32	160
96	480
4	20
100	500

Answers vary. Sample response: The first table is more efficient, but they both work in getting the answer.

Problem 5

(from Unit 2, Lesson 13)
A cashier worked an 8-hour day, and earned $58.00. The double number line shows the amount she earned for working different numbers of hours. For each question, explain your reasoning.

1. How much does the cashier earn per hour?

2. How much does the cashier earn if she works 3 hours?

Solution

1. $7.25 per hour. Possible reasoning: 14.5 \div 2= 7.25

2. $21.75. Possible reasoning: (7.25) \boldcdot 3 = 21.75

Problem 6

(from Unit 2, Lesson 10)

A grocery store sells bags of oranges in two different sizes.

- The 3-pound bags of oranges cost $4.
- The 8-pound bags of oranges for $9.

Which oranges cost less per pound? Explain or show your reasoning.

Solution

The 8-pound bags cost less per pound. Possible strategies:

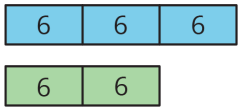
- Compare the cost for 24 pounds of oranges for both types of bags. 24 pounds cost $32 when sold in 3-pound bags. 24 pounds cost $27 when sold in 8-pound bags.

- Compare how much can be bought for the same amount of money. $36 can buy 27 pounds of oranges in 3-pound bags, or it can buy 32 pounds in 8-pound bags.

Lesson 16

Problem 1

Describe a situation that could be represented with this tape diagram.



Solution

Answers vary. Sample response: There are 30 people at a movie. The ratio of teenagers to adults is 3 to 2. There are 18 teenagers and 12 adults.

Problem 2

There are some nickels, dimes, and quarters in a large piggy bank. For every 2 nickels there are 3 dimes. For every 2 dimes there are 5 quarters. There are 500 coins total.

1. How many nickels, dimes, and quarters are in the piggy bank? Explain your reasoning.

2. How much are the coins in the piggy bank worth?

Solution

1. 80 nickels, 120 dimes, 300 quarters. Possible strategies:
    - For every 2 nickels there are 3 dimes, so for every 4 nickels there are 6 dimes. For every 2 dimes there are 5 quarters, so for every 6 dimes there are 15 quarters. The ratio of nickels to dimes to quarters is 4 to 6 to 15, a total of 25 coins in the group. There are 500 coins, which means 20 groups of coins, since 500 \div 25 = 20. There are 80 nickels (20 \boldcdot 4=80), 120 dimes (20 \boldcdot 6=120), and 300 quarters (20 \boldcdot 15=300).

    - Using a table: