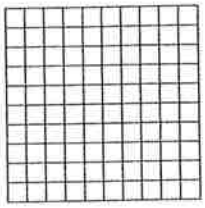
Percents

Walsh - 6th

PLUG IN Writing a Percent as a Fraction

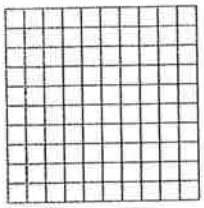
A **percent** is a special **ratio**. It is a rate per 100.

This model has 100 equal parts.



I see! The whole model shows 100%.

You can show 20% by shading 20 parts.



I get it! 20% means 20 out of 100 equal parts.

You can write a percent as a fraction.

20 parts of 100 parts is the same as $\frac{20}{100}$.

So, 20% = $\frac{20}{100}$.

OK! So 20% is the same as twenty hundredths.

Words to Know

percent
a ratio that compares a number to 100; parts per hundred

50% means 50 out of 100 equal parts.

30% is 30 per 100.

ratio
a comparison of two numbers

$\frac{60}{100}$

60 out of 100

DISCUSS If Gina has read 7% of the books in the library, what does that mean?

A You can write a percent as a fraction.

DO Write 75% as a fraction.

1. Understand the problem.

   Think: 75% means 75 per ____.

2. Write the number in front of the percent sign as the numerator and 100 as the denominator.

   75% = $\frac{\square}{\square}$

I know! Since percent means per 100, I can drop the denominator and write the numerator with a % sign!

B You can write a fraction as a percent.

DO Write $\frac{23}{100}$ as a percent.

1. Understand the problem.
2. Write the percent.

Think: $\frac{23}{100}$ is the same as _____ per 100.

$\frac{23}{100}$ = _____%

C You can write a percent for a real-world problem.

DO Eleven out of 100 people who were surveyed like oatmeal for breakfast. What percent of the people surveyed like oatmeal?

1. Understand the problem.
2. Write a fraction.
3. Write the percent.

Out of 100 people, _____ like oatmeal.

As a fraction, 11 out of 100 is written $\frac{\square}{\square}$.

As a percent, it is written _____.

PRACTICE

Write the percent as a fraction.

1. 1%

   _____

2. 4%

   _____

3. 60%

   _____

4. 35%

   _____

Write the fraction as a percent.

5. $\frac{50}{100}$

   _____

6. $\frac{15}{100}$

   _____

Write a percent for the problem.

7. Jaime had 100 boxes of cookies to sell. He sold 81 boxes. What percent of the boxes did Jaime sell?

   _____

8. Of the first 100 customers to walk into the grocery store, 9 bought flowers. What percent of the customers bought flowers?

   _____

Finding a Percent of a Number

To find a percent of a number, multiply the percent by the number.

$30\% \text{ of } 50 = 30\% \times 50$

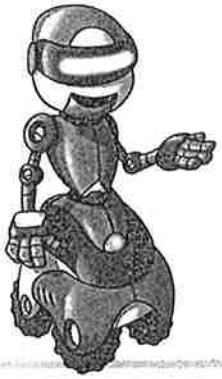
Write the percent as a fraction out of 100.

$$30\% = \frac{30}{100}$$

Rewrite the whole number as a fraction and multiply.

$$\frac{30}{100} \times 50 = \frac{30}{100} \times \frac{50}{1}$$
$$= \frac{30 \times 50}{100 \times 1}$$
$$= \frac{1{,}500}{100}$$
$$= 15$$

I remember! I write the number in front of the percent sign as the numerator and 100 as the denominator.



Multiply the numerators and multiply the denominators.

How would you find 30% of 100? Explain.

A You can find a percent of a number by using fractions.

Find 40% of 120.

1. Write a multiplication problem.
2. Write the percent as a fraction out of 100.
3. Multiply and then simplify the answer.

_____% × **120**

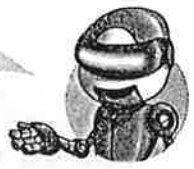
$40\% = \frac{\square}{\square}$

_____% × 120 = $\frac{\square}{\square} \times 120$

$\frac{\square}{\square} \times \frac{120}{1} = \frac{\square}{\square} =$ _____

40% of 120 is _____.

A tape diagram divides a whole into equal parts or percents.



B You can use a tape diagram to find a percent.

DO Find 70% of 200.

1. Make a tape diagram with 200 as the whole. Label the percent for each part.
2. Shade all of the parts up to 70%. Circle the part that aligns with 70%.
3. Write the number.

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
20	40	60	80	100	120	140	160	180	200

70% of 200 is _____.

DISCUSS Explain how you would use the tape diagram to find 20% of 200.

PRACTICE

Find the percent of the number by using fractions.

1. 50% of 300 is _____.
2. 10% of 20 is _____.
3. 15% of 80 is _____.
4. 1% of 700 is _____.

Find the percent of the number by using the tape diagram.

5. 30% of 90 is _____.

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
9	18	27	36	45	54	63	72	81	90

6. 90% of 350 is _____.

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
35	70	105	140	175	210	245	280	315	350

READY TO GO Percents

You can use a tape diagram to find the whole when given a part and a percent. The whole is 100%.

30 is 60% of what number?

1. Fill in the part and the percent. Write 30 in the box for 60%.

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
					30				

2. Find the size of each part.
There are 6 equal parts up to and including 30. Think: That is $30 \div 6 = 5$, so each part increases by 5.

3. Fill in the parts in the tape diagram starting with 5 in the first box.

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
5	10	15	20	25	30	35	40	45	50

4. Find the whole.
The number in the last box is 100%, or the whole.

30 is 60% of 50.

I see! 30 is the part and 50 is the whole.

DISCUSS How would you use a tape diagram to solve this problem: 39 is 30% of what number?

LESSON LINK

PLUG IN

You can write a percent as a fraction, and a fraction as a percent.

$$48\% = \frac{48}{100}$$

$$\frac{17}{100} = 17\%$$

POWER UP

You can use fractions to find a percent of a number.

90% of 70

$$\frac{90}{100} \times \frac{70}{1} = \frac{6{,}300}{100} = 63$$

90% of 70 is 63.

GO!

I get it! A percent compares a part to 100, and I can use a percent to find a part of a whole.

WORK TOGETHER

Use a Tape Diagram to solve problems with percents.

- The tape diagram shows 45 in the box for 30%.
- There are 3 equal parts up to and including 45. Since $45 \div 3 = 15$, the numbers start at 15 and increase by 15 each time.
- 150 is in the 100% box. So 45 is 30% of 150.

45 is 30% of what number?

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		45							

Skip count by 15s.

The whole, or 100%, is 150.

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
15	30	45	60	75	90	105	120	135	150

Tape Diagram can be found on p. 217.

A Find the unknown number by using a tape diagram.

DO

64 is 80% of what number?

1. Fill in the part that you know.
2. Find the size of each part.
3. Fill in the rest of the diagram.
4. Find the whole number.

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

64 ÷ _____ = _____

Each part increases by _____.

64 is 80% of _____.

DISCUSS

Krishna made the following tape diagram to solve this problem:
30 is 20% of what number?

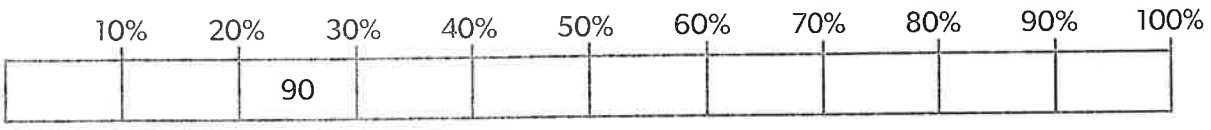
10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		20							

What can you tell Krishna about his work?

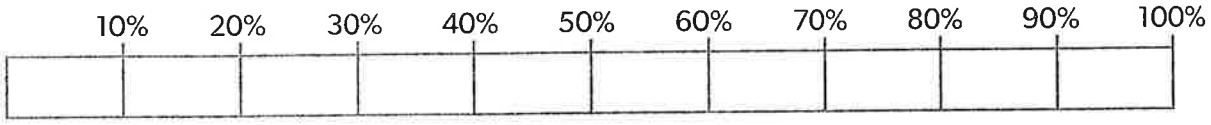
REMEMBER
Begin by writing 90 in the 30% box.

Find the unknown number by using a tape diagram.

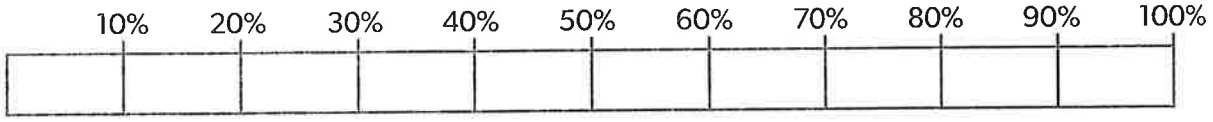
90 is 30% of what number? _____



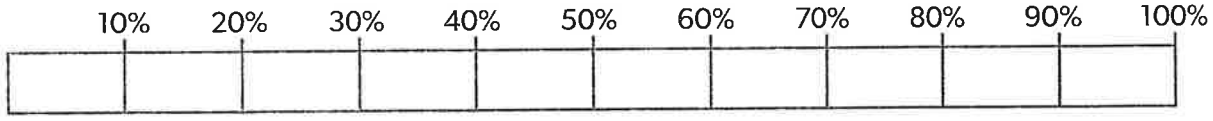
28 is 40% of what number? _____



3. 91 is 70% of what number? _____

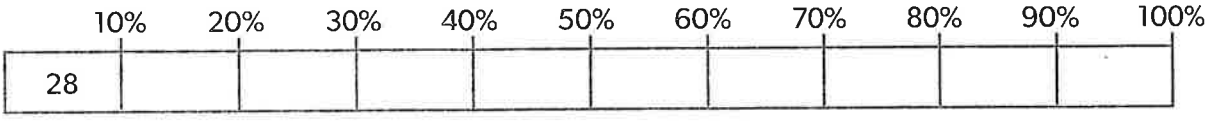


4. 2 is 20% of what number? _____



Solve the problem by using a tape diagram.

5. There are 28 students in Mrs. Chung's sixth grade class. This is 10% of all sixth graders in the school. What is the total number of sixth graders in the school?



_____ students

HINT
The total number of students in the school is the whole, and 28 is a part.

Tape Diagrams can be found on p. 219.

Find the unknown number.

6 40 is 50% of what number? _____

7 4 is 20% of what number? _____

8 12 is 30% of what number? _____

Solve.

9 14 club members have birthdays in the summer. This is 20% of the birthdays in the club. How many club members are there? _____

I know! The part is given in each problem, and I write the part in the box to the left of the percent on the tape diagram.

10 60% of Herbert's movies are adventure movies. He has 18 adventure movies. How many movies does Herbert have in all? _____

DISCUSS

Apply the Concept

Malke knows that 10% of an unknown number is 12, and she wants to find the unknown number.

What tool can she use to solve this problem?

How can she use that tool to find the unknown number?

What is the unknown number?

ALL ABOARD!

Max knows that 20% of travel club members have traveled outside of the country. According to his survey, 12 members of the club have traveled outside of the country. How many members does the travel club have?

READ

- What is the problem asking you to find?

  The total number of members

- What do you need to know to solve the problem?

  _____% of members have traveled outside of the country.

  _____% of the total number is equal to _____.

- What tool can you use to solve this problem?

  You can use a tape diagram.

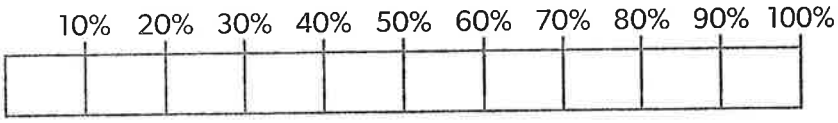
SOLVE

Label a tape diagram.

Write the number _____ in the box for _____%.

Find the size of each equal part. **12** ÷ _____ = _____

Fill in the boxes on the diagram.



What number is in the 100% box? _____

So 12 is 20% of _____.

CHECK

Use fractions to find 20% of 60.

Set up a multiplication sentence. 20% of 60 = _____ × _____

Rewrite the percent as a fraction. = _____ × _____

Rewrite the whole number as a fraction. = _____ × _____

Multiply. = _____ = _____

The travel club has _____ members.

I know! I can use tape diagrams to solve percent problems.

PRACTICE

Use the problem-solving steps to help you.

1 Mariah knows that 50% of sixth graders in her school have dogs. There are 45 sixth graders who have dogs. How many sixth graders attend Mariah's school?

CHECKLIST
- ☐ READ
- ☐ PLAN
- ☐ SOLVE
- ☐ CHECK

2 The owner of a dress shop ordered 33 dresses from a new designer. The designer's dresses now make up 30% of all dresses in the shop. How many dresses are in the shop in all?

CHECKLIST
- ☐ READ
- ☐ PLAN
- ☐ SOLVE
- ☐ CHECK

3 The school nurse made the following morning announcement:
"So far, only 30 students in our school have gotten a flu shot. That is only 20% of the students in this school."
How many students attend the school?

CHECKLIST
- ☐ READ
- ☐ PLAN
- ☐ SOLVE
- ☐ CHECK

LESSON 15

Independent and Dependent Variables

PLUG IN Missing Values in Input/Output Tables

To find missing numbers in an input/output table, you can look for a pattern.

Input (x)	Output (y)	
2	0	← 2 − **2** = 0
3	1	← 3 − **2** = 1
4	2	← 4 − **2** = 2
5	?	← 5 − **2** = 3

I can find the missing output by subtracting 2 from its input. The missing output is 3.

You can look at the relationship between each **input** and its **output** to find the **rule** for the table.

You can list the numbers as **ordered pairs**. (input, output): (2, 0), (3, 1), (4, 2), (5, 3)

Words to Know

input
a number that is entered

output
the number that results when a procedure is applied to an input

ordered pair
a pair of values in the form (x, y)
(2, 1)

rule
a procedure that is applied to an input to get an output

DISCUSS Why is it important to look at both the inputs and outputs to find the relationship?

A You can use an input/output relationship to find a missing output.

DO Find the missing output for this input/output table.

Input (x)	Output (y)
2	7
3	8
4	9
5	?

1. Determine how 2 and 7 are related (first row).
2. Determine how 3 and 8 are related (second row).
3. Determine how 4 and 9 are related (third row).
4. Find the missing output based on what you discovered for the first three rows.

7 is **5** more than 2.

8 is _____ more than 3.

9 is _____ more than 4.

10 is _____ more than 5.

The missing output is _____.

The input and output values can be written as ordered pairs.

B You can use an input/output relationship to find a missing input.

DO

Find the missing input and write the answer in an ordered pair.

1. Determine the relationship between each input and its output.
2. Find the rule.
3. Use that relationship to find the missing number.
4. Write the answer in an ordered pair.

Input (x)	Output (y)	
1	3	← 1 × 3 = 3
2	6	← 2 × ___ = 6
4	12	← 4 × ___ = 12
?	21	← ___ × ___ = 21
10	30	← 10 × ___ = 30

The rule is: multiply each input by _____ to find each output.

_____ × _____ = _____ The missing input is _____.

The ordered pair is (_____, _____).

PRACTICE

Find the missing output.

1 (10, 8), (9, 7), (8, 6), (7, 5), (6, ?)

Input (x)	Output (y)
10	8

The missing output is: _____.

2 (30, 15), (28, 14), (26, 13), (24, 12), (22, ?)

Input (x)	Output (y)
30	15

The missing output is: _____.

Determine the rule. Find the missing input or output. Write the answer in an ordered pair.

3

Input (x)	Output (y)	
1	5	← _____
2	10	← _____
4	20	← _____
5	25	← _____
	40	← _____

The ordered pair is (_____, _____).

4

Input (x)	Output (y)	
0	4	← _____
3	7	← _____
6	10	← _____
8		← _____
11	15	← _____

The ordered pair is (_____, _____).

Writing Equations for Input/Output Tables

Input (x)	1	2	3	4	5
Output (y)	2	4	6	8	10

In the table, the input, x, is the **independent variable**. The output, y, is the **dependent variable**.

The output depends on the input, so it is the dependent variable.

The relationship between x and y can be represented by an **equation**.

The equation will show the rule for x and y.

The rule for the table is: multiply each input by 2 to get the output. So, the equation is $y = 2x$.

Each y-value (dependent variable) is equal to 2 times its x-value (independent variable).

Words to Know

dependent variable
in a two-variable equation, the variable whose value depends on the independent variable

independent variable
in a two-variable equation, the variable whose value determines the dependent variable

equation
a number sentence with an equal (=) sign

Discuss Could the input/output table above also be represented by the equation $y = x + 1$? Explain.

A You can write an equation for a rule.

Try Write an equation to represent the table.

1. Find the relationship between the input values and the output values.
2. Find the rule for the table.
3. Use the rule to write an equation.

Input (x)	Output (y)	
0	3	← 0 + 3 = 3
1	4	← 1 + ___ = 4
2	5	← 2 + ___ = 5
3	6	← 3 + ___ = 6
4	7	← 4 + ___ = 7

The rule is: Add _____ to each _____ to get its _____.

The equation is $y =$ _____ + _____.

An equation is a number sentence with an = sign.

B You can write an equation for a rule.

DO Write an equation to represent the table.

1. Find the relationship between the input values and the output values.
2. Find the rule for the table.
3. Use the rule to write an equation.

Input (x)	1	2	3	4	5
Output (y)	6	12	18	24	30

I can **multiply** each x-value by _____ to get its y-value.

The rule is: _____

The equation is _____.

DISCUSS

Input (x)	4	8	12	16	20
Output (y)	1	2	3	4	5

Aaron wrote the equation $y = x \div 4$ to represent the input/output table.

Corie wrote the equation $y = \frac{1}{4}x$ for the same lable. Compare the two equations.

PRACTICE

Find the rule and write an equation for the table.

1

Input (x)	Output (y)	
1	0	← 1 − 1 = 0
2	1	← _____
3	2	← _____
4	3	← _____
5	4	← _____

The rule is: _____

_____

The equation is: _____.

2

Input (x)	Output (y)	
3	1	← _____
6	2	← _____
9	3	← _____
12	4	← _____
15	5	← _____

The rule is: _____

_____.

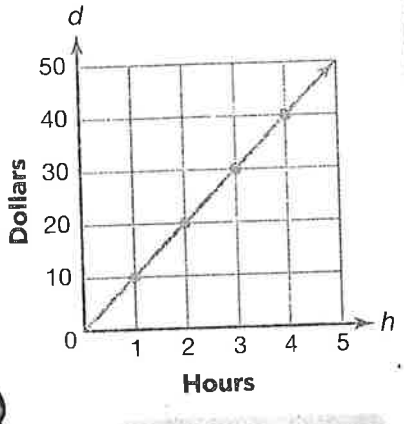
The equation is: _____.

READY TO GO Independent and Dependent Variables

The table shows the relationship between h, the number of hours Kelly works, and d, the number of dollars she earns.

Hours Worked (h)	Dollars Earned (d)
0	0
1	10
2	20
3	30
4	40

The graph shows the same relationship. The dependent variable is d, and the independent variable is h.



You can list the values in ordered pairs (h, d): (0, 0), (1, 10), (2, 20), (3, 30), (4, 40).

Each d-value is 10 times its h-value.

The equation $d = 10h$ also shows this relationship.

I see! The variables are not always x and y.

The number of dollars, d, that Kelly earns depends on how many hours, h, she works.

I can use the values in ordered pairs to help me write an equation.

DISCUSS Given a graph, explain which values show the dependent and independent variables.

LESSON LINK

PLUG IN

You can use a pattern or a rule to find a missing value in a table.

Input (x)	Output (y)	
0	2	← 0 + 2 = 2
1	3	← 1 + 2 = 3
2	4	← 2 + 2 = 4
3	5	← 3 + 2 = 5
4	6	← 4 + 2 = 6

POWER UP

You can use the rule for a table to write an equation.

Input (x)	Output (y)
0	1
1	2
2	3
3	4
4	5

The rule is: add 1 to each input to get its output.

The equation is: $y = x + 1$

GO!

I get it! I can use tables, equations, and graphs to help me understand dependent and independent variables.

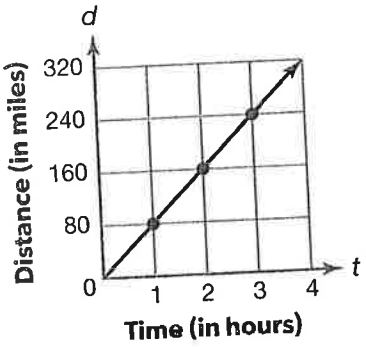
I can use the x- and y-values in ordered pairs to write an equation.

WORK TOGETHER

- Identify the dependent and independent variables in the graph. Write an equation to show the relationship.
- The dependent variable is d, and the independent variable is t.
- Three ordered pairs shown on the graph are (1, 80), (2, 160) and (3, 240).
- Each d value is 80 times its t value.
- The equation is $d = 80t$.

The graph shows the distance, d, in miles, that a train travels in t hours.

The distance traveled depends on the time spent traveling.

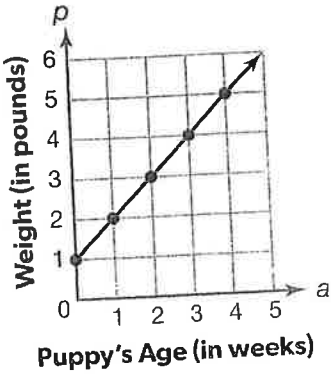


A You can use an equation to represent a situation.

DO The graph shows the average weight of a puppy at different weeks.

1. Analyze the relationship between the weight and the age.
2. Decide which variable depends on the other.
3. Identify dependent and independent variables.
4. List the ordered pairs shown on the graph.
5. Determine the rule.
6. Write an equation.

Puppy's Age (a)	Weight (p)
0	1
1	2
2	3
3	4
4	5



The _____ depends on its _____.

The dependent variable is _____.

The independent variable is _____.

Five ordered pairs are (_____, _____), (_____, _____), (_____, _____), (_____, _____), (_____, _____).

Each p-value is _____ its a-value.

The equation is $p =$ _____.

What are some strategies for identifying dependent and independent variables?

PRACTICE

Identify the dependent and independent variables.

1. The table shows the distances that a motorboat traveled over time.

Time in Hours (t)	Miles Traveled (m)
0	0
1	30
2	60
3	90
4	120

independent variable:

_____

dependent variable:

_____

2. The table shows how much Dwayne earns for mowing lawns.

Lawns Mowed (m)	Dollars Earned (d)
1	12
2	24
3	36
4	48
5	60

independent variable:
m, lawns mowed

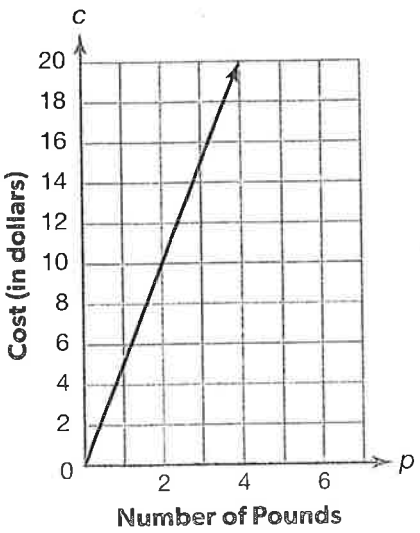
dependent variable:

_____

REMEMBER
The value of the dependent variable is affected by the value of the independent variable.

Identify the dependent and independent variables.

3. The graph shows the prices for different weights of cheddar cheese at a deli.



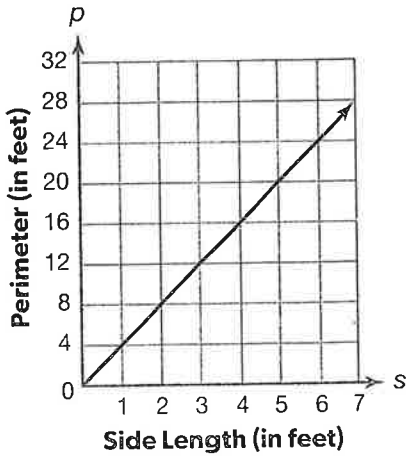
independent variable:

_____

dependent variable:

_____

4. The graph shows the lengths of sides of squares and their perimeters.



independent variable:

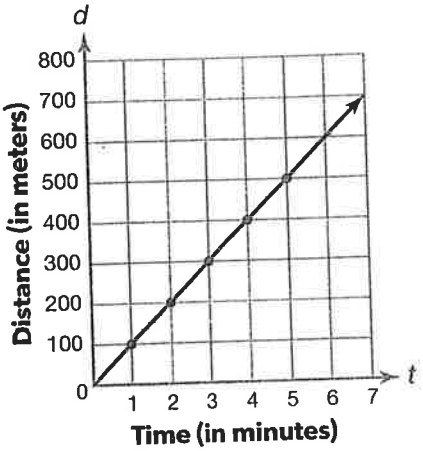
_____

dependent variable:

_____

Identify ordered pairs for the graph. Then write an equation.

5 The graph shows the distance, d, in meters, that Teresa ran each minute, t, of her training run.



Five ordered pairs are:

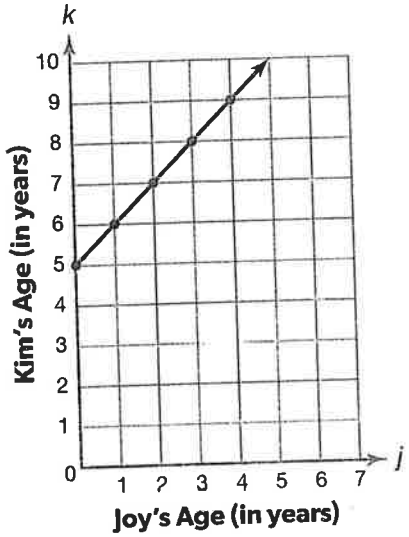
(_____, _____), (_____, _____),

(_____, _____), (_____, _____),

(_____, _____).

The equation is: _____.

6 The graph shows Joy's age, j, and Kim's age, k. Joy is Kim's younger sister. They share a birthday but are different ages.



Five ordered pairs are:

(_____, _____), (_____, _____),

(_____, _____), (_____, _____),

(_____, _____).

The equation is: _____.

DISCUSS

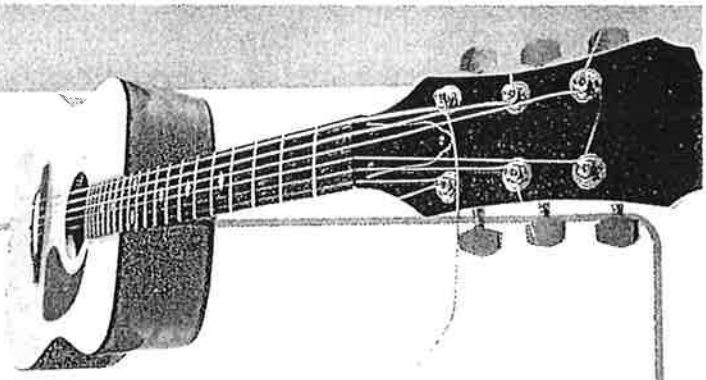
See the Relationship

In each ordered pair below, one number shows a, the total amount paid for movie tickets. The other number shows n, the number of movie tickets purchased.

(1, 11), (2, 22), (3, 33), (4, 44), (5, 55)

Are these ordered pairs in the form (a, n) or in the form (n, a)? Use what you know about dependent and independent variables to explain.

PROBLEM SOLVING

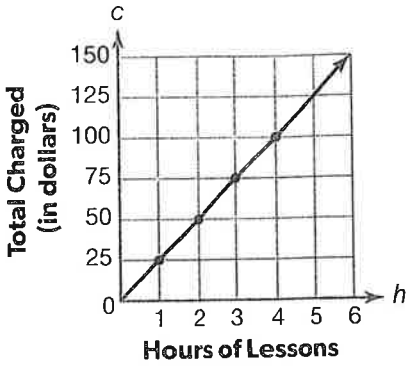


PICK IT UP

READ

The graph shows the total amounts charged by a guitar teacher and the numbers of hours of lessons given.

Identify the independent and dependent variables. Write an equation to show the relationship.



PLAN

- What is the problem asking you to find?

  You need to find the independent variable and the _____.

  You need to write a(n) _____.

- How can you write the equation?

  Use the relationship between the *c*- and *h*- values to write an equation.

SOLVE

The _____ depends on the _____.

So, _____ is the independent variable and _____ is the dependent variable.

List the four ordered pairs for the points shown on the graph.

(_____, _____), (_____, _____), (_____, _____), (_____, _____).

Each *c*-value is _____ times its *h*-value. The equation is _____.

CHECK

The graph shows that the teacher charges $50 for 2 hours of lessons.

Use the equation and substitute 2 for *h*. _____

Does *c* equal 50? _____

The independent variable is _____.

The dependent variable is _____.

The equation is _____.

PRACTICE

Use the problem-solving steps to help you.

1 The ordered pairs (p, d) below show the relationship between the number of large pizzas ordered, p, and the total price, in dollars, d.

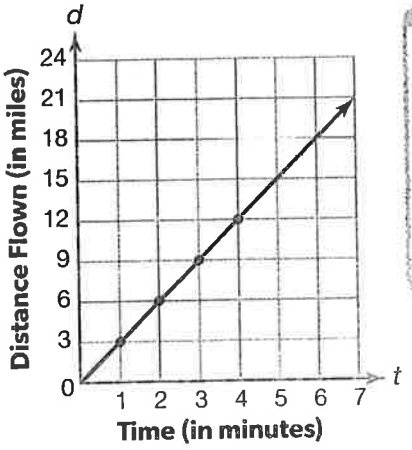
(1, 8), (2, 16), (3, 24), (4, 32), (5, 40)

Identify the independent variable and the dependent variable. What equation shows the relationship between the number of pizzas ordered and the total price?

CHECKLIST
- ☐ READ
- ☐ PLAN
- ☐ SOLVE
- ☐ CHECK

2 The graph shows the speed at which a peregrine falcon is flying.

Identify the independent and dependent variables. What equation shows the relationship between the time that the falcon has flown and the distance?



CHECKLIST
- ☐ READ
- ☐ PLAN
- ☐ SOLVE
- ☐ CHECK

3 The table below shows a person's distance from a lightning flash and the time it takes the person to hear thunder.

Identify the independent and dependent variables. What equation shows the relationship between the distance from a lightning flash and the time it takes to hear thunder?

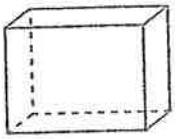
Distance from Flash in Miles (d)	Time to Hear in Seconds (t)
5	1
10	2
15	3
20	4

CHECKLIST
- ☐ READ
- ☐ PLAN
- ☐ SOLVE
- ☐ CHECK

LESSON 17 Volume

PLUG IN Finding Volume

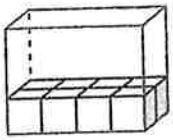
Volume is the amount of space inside a three-dimensional figure. Volume is measured in **cubic units (units^3)**.

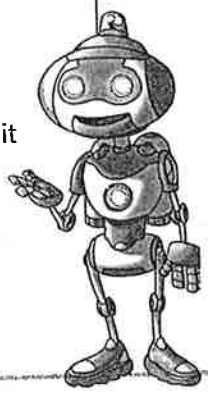


1 cubic unit

I can count the number of cubes that fit inside the prism.

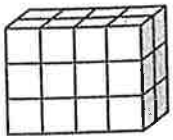
Count the number of cubes that cover the base of the rectangular prism.





8 cubic units cover the base.

Count the number of equal layers. Multiply that number by the number of cubes in the base.



There are 3 layers, each with 8 cubes.

$3 \times 8 = 24$. So the volume is 24 cubic units.

Words to Know

volume
the amount of space inside a three-dimensional figure

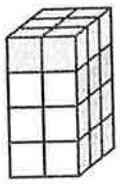
cubic units (units^3)
units used to measure volume

DISCUSS How is volume different from area?

A You can find the volume of a figure made from cubes.

DO Find the volume of the rectangular prism. Each cube is 1 cubic unit.

1. Count the number of cubic units in the top layer.
2. Count the number of layers.
3. Multiply to find the volume.



There are 6 cubic units in the top layer.

There are _____ layers.

_____ × _____ = _____

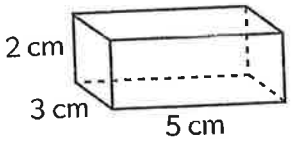
The volume is _____ cubic units.

I get it! A formula helps me find the volume faster.

B You can find the volume by using a formula.

DO Find the volume of the rectangular prism.

1. Use the formula for the volume of a rectangular prism.
2. Substitute the length, width, and height into the formula.
3. Multiply.



Volume = *length* × *width* × *height*

$V = l \times w \times h$

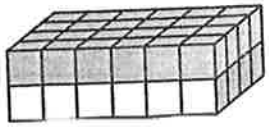
5 × _____ × _____ = _____

The volume is _____ cubic centimeters.

PRACTICE

Find the volume by counting cubic units.

1



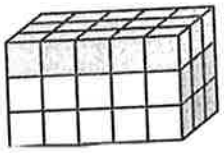
There are 24 cubic units in the top layer.

There are _____ layers.

2 × _____ = _____

The volume is _____ cubic units.

2



There are _____ cubic units in the top layer.

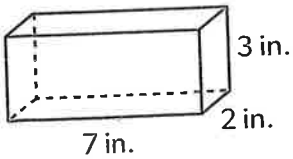
There are _____ layers.

_____ × _____ = _____

The volume is _____ cubic units.

Find the volume by using a formula.

3



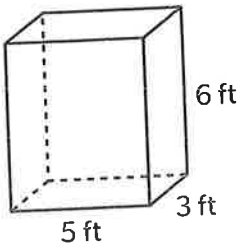
Volume = *length* × *width* × *height*

$V = l \times w \times h$

7 × _____ × _____ = _____

The volume is _____ cubic inches.

4



Volume = *length* × *width* × *height*

$V = l \times w \times h$

_____ × _____ × _____ = _____

The volume is _____ cubic feet.

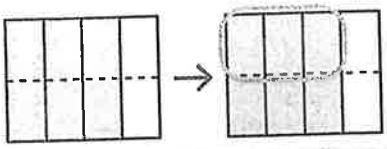
POWER UP Multiplying Fractions

When multiplying fractions, you take a part of another fraction. Multiply $\frac{1}{2} \times \frac{3}{4}$.

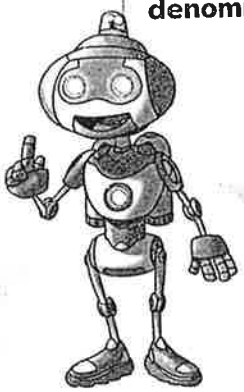
You can use a model.

Start with a model for $\frac{3}{4}$. Separate the model in half.

Shade $\frac{1}{2}$ of the $\frac{3}{4}$.



$\frac{3}{8}$ of the figure is shaded to represent both fractions.



You can find the product by multiplying the fractions.

Multiply the **numerators**. Then multiply the **denominators**. **Simplify** the answer if necessary.

$$\frac{1}{2} \times \frac{3}{4} = \frac{1 \times 3}{2 \times 4} = \frac{3}{8}$$

You can say $\frac{1}{2} \times \frac{3}{4}$ as "$\frac{1}{2}$ of $\frac{3}{4}$."

Words to Know

numerator
the number above the line in a fraction that tells how many equal parts are being used

denominator
the number below the line in a fraction that tells how many equal parts are in the whole

simplify
to divide the numerator and denominator of a fraction by the greatest common factor

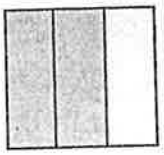
$$\frac{4}{8} = \frac{4 \div 4}{8 \div 4} = \frac{1}{2}$$

Discuss If you multiply the whole number 1 and a proper fraction, will the product be less than or greater than 1? Explain.

A You can use a model to multiply fractions.

Do Find $\frac{1}{4} \times \frac{2}{3}$.

1. Start with a model for $\frac{2}{3}$. Separate the model for $\frac{2}{3}$ into fourths.
2. Shade $\frac{1}{4}$ of the $\frac{2}{3}$.
3. Find the fraction of the whole model that is shaded.
4. Simplify your answer.



$\frac{\square}{\square}$ of the figure is shaded.

$$\frac{\square}{\square} = \frac{\square \div \boxed{2}}{\square \div \boxed{2}} = \frac{\square}{\square}$$

$$\frac{1}{4} \times \frac{2}{3} = \frac{\square}{\square}$$

I can rename a mixed number as an improper fraction this way: multiply the whole number by the denominator, then add the numerator. The denominator stays the same.

B You can multiply mixed numbers and fractions.

DO

Find $\frac{3}{4} \times 2\frac{1}{2}$.

1. Write the mixed number as an improper fraction.
2. Rewrite the problem with the improper fraction.
3. Multiply the numerators. Multiply the denominators.
4. Simplify. Write the improper fraction as a mixed number.

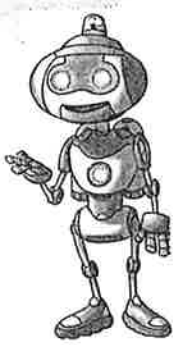
$2\frac{1}{2} = \frac{\square}{2}$

$\frac{3}{4} \times 2\frac{1}{2} = \frac{3}{4} \times \frac{\square}{\square}$

$= \frac{\square \times \square}{\square \times \square} = \frac{\square}{\square}$

Simplify.

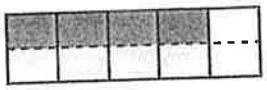
$\frac{\square}{\square} = \_\_\_\_ \div \_\_\_\_ = \square\frac{\square}{\square}$



DISCUSS

Brandon made this model to show $\frac{1}{2} \times \frac{4}{5}$. He says the product is $\frac{8}{10}$.

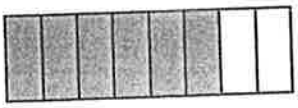
What can you tell Brandon about his work?



PRACTICE

Find the product. Simplify your answer.

1. $\frac{1}{2} \times \frac{6}{8}$



$\frac{\square}{\square} = \frac{\square}{\square}$

2. $\frac{3}{5} \times \frac{2}{6}$

____

3. $\frac{1}{2} \times 3\frac{4}{5} \rightarrow \frac{1}{2} \times \frac{\square}{\square} \rightarrow \frac{\square \times \square}{\square \times \square} = \frac{\square}{\square}$

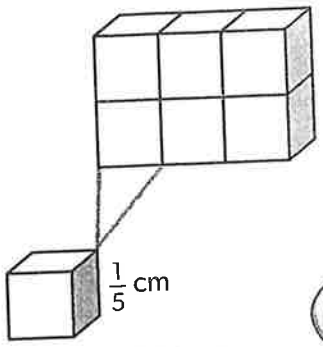
$\frac{\square}{\square} = \_\_\_\_ \div \_\_\_\_ = \square\frac{\square}{\square}$

4. $2\frac{3}{4} \times 1\frac{1}{3}$

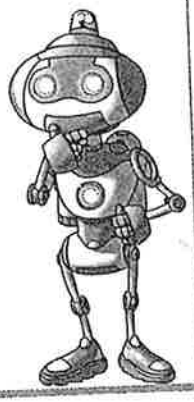
____

READY TO GO Volume

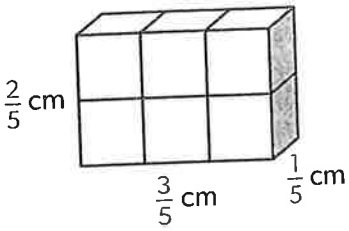
Sometimes when finding volume of figures, the unit cubes have edge lengths that are fractions.



Each unit cube measures $\frac{1}{5}$ cm in length, width, and height.



Use a formula to find the volume of the rectangular prism. Volume = length × width × height.



$$V = l \times w \times h$$
$$= \frac{3}{5} \times \frac{1}{5} \times \frac{2}{5}$$
$$= \frac{6}{125} \text{ cm}^3$$

The volume of the prism is $\frac{6}{125}$ cubic centimeters.

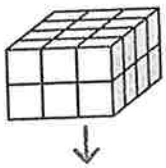
DISCUSS In the problem above, is there another way to find the volume of the rectangular prism? Explain.

LESSON LINK

PLUG IN

You can find the volume of one unit cube or a group of unit cubes.

$V = lwh$



$3 \times 4 \times 2 = 24 \text{ units}^3$

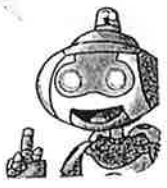
POWER UP

You can find the product of fractions by multiplying the numerators and then multiplying the denominators.

$$\frac{1}{2} \times \frac{4}{5} = \frac{1 \times 4}{2 \times 5} = \frac{4}{10} = \frac{2}{5}$$

GO!

I get it! I can use what I know about multiplying fractions to find the volume of figures whose edge lengths are fractions.



WORK TOGETHER

You can use the formula $V = Bh$ to find the volume of a rectangular prism.

- In the formula $V = Bh$, B stands for the area of the base, which is $l \times w$.
- Fill in the numbers in the formula. Rename $4\frac{1}{2}$ as $\frac{9}{2}$. Multiply to get the product of $\frac{45}{4}$.
- The improper fraction $\frac{45}{4}$ is simplified to a mixed number of $11\frac{1}{4}$.
- The volume of the rectangular prism is $11\frac{1}{4}$ cubic feet.

$V = Bh$

$= (l \times w) \times h$

$= \left(4\frac{1}{2} \times 1\right) \times 2\frac{1}{2}$

$= \left(\frac{9}{2} \times 1\right) \times \frac{5}{2}$

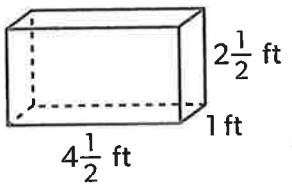
$= \frac{9}{2} \times \frac{5}{2}$

$= \frac{45}{4}$

Simplify.

$\frac{45}{4} = 45 \div 4 = 11\frac{1}{4}\ \text{ft}^3$

The B represents the area of the base and is equal to length × width.



Volume Formulas can be found on p. 215.

A You can use a formula to find the volume of a rectangular prism.

DO Find the volume of the prism.

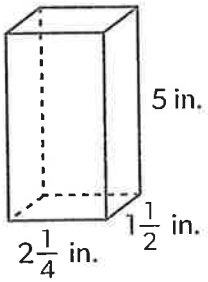
1. Write the formula and replace the variables with the given numbers.
2. Rename the mixed numbers as improper fractions.
3. Multiply.
4. Simplify the answer.

$V = lwh$

$= \_\_\_\_ \times \_\_\_\_ \times \_\_\_\_$

$= \_\_\_\_ \times \_\_\_\_ \times \_\_\_\_$

$= \_\_\_\_$



Simplify.

$\frac{\square}{\square} = \_\_\_\_ \div \_\_\_\_ = \square\frac{\square}{\square}$

The volume of the rectangular prism is ____ in.^3.

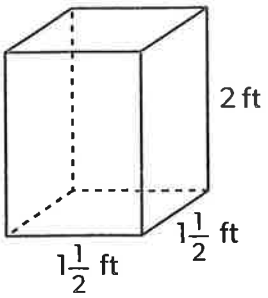
DISCUSS Allen found the volume of a number cube with an edge length of $1\frac{1}{2}$ cm. He says the total volume ~~is less than 1 cubic cm~~. ~~What can you tell~~ Allen about his work?

I know! I can use a formula to find ~~the volume.~~

PRACTICE

Find the volume of the rectangular prism.

1



$V = Bh$

$= (\_\_\_\_ \times \_\_\_\_) \times \_\_\_\_$

$= (\_\_\_\_ \times \_\_\_\_) \times \_\_\_\_$

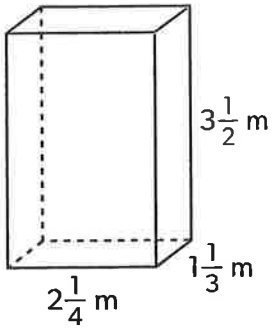
$= \_\_\_\_ \times \_\_\_\_$

$= \_\_\_\_$

$= \_\_\_\_$

The volume is $\_\_\_\_$ ft^3.

2



HINT:
Write each mixed number as an improper fraction.

$V = Bh$

$= (2\frac{1}{4} \times \_\_\_\_) \times \_\_\_\_$

$= (\_\_\_\_ \times \_\_\_\_) \times \_\_\_\_$

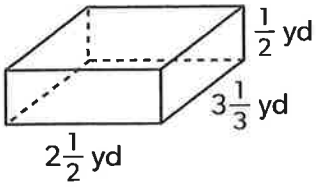
$= \_\_\_\_ \times \_\_\_\_$

$= \_\_\_\_$

$= \_\_\_\_$

The volume is $\_\_\_\_$ m^3.

3



$V = lwh$

$= \_\_\_\_ \times \_\_\_\_ \times \_\_\_\_$

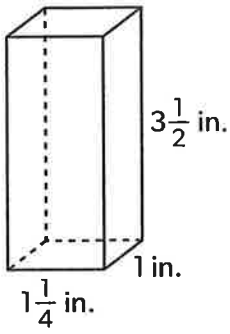
$= \_\_\_\_ \times \_\_\_\_ \times \_\_\_\_$

$= \_\_\_\_$

$= \_\_\_\_$

The volume is $\_\_\_\_$ yd^3.

4



REMEMBER
Whole numbers can be written as fractions.

$V = lwh$

$= (1\frac{1}{4} \times \_\_\_\_) \times \_\_\_\_$

$= \_\_\_\_ \times \_\_\_\_ \times \_\_\_\_$

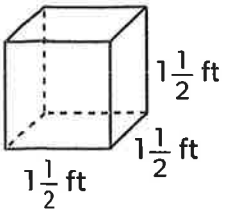
$= \_\_\_\_$

$= \_\_\_\_$

The volume is $\_\_\_\_$ $in.^3$.

Find the volume of the rectagular prism.

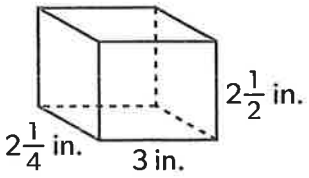
5



Use the formula $V = lwh$.

The volume is _____ ft^3.

6



Use the formula $V = Bh$.

The volume is _____ $in.^3$.

Solve.

7 A garden storage box is shaped like a cube. One side of the box is $\frac{2}{3}$ meter long. What is the volume of the garden storage box? _____

8 A container of blueberries is $4\frac{1}{2}$ inches long, $4\frac{1}{2}$ inches wide, and $1\frac{1}{2}$ inches tall. What is the volume of the container of blueberries? _____

I know! A cube has edges that are all the same length.

DISCUSS

See the Relationship

Suri wants to find the volume of a rectangular prism.

She knows the area of the base is 24 cm^2 and the height is $2\frac{1}{2}$ cm.

How can she find the volume of the rectangular prism? What is the volume of the rectangular prism?

I remember! The area of the base is the same as length × width.

PROBLEM SOLVING

KEEPING IT COOL

READ

Ryan wants to fill his new cooler with ice. The cooler is in the shape of a rectangular prism. The height of the cooler is $1\frac{1}{4}$ ft, the width is $2\frac{1}{4}$ ft, and the length is 3 ft. How many cubic feet of ice will fill the cooler?

PLAN

- What is the problem asking you to find?

  The _____ of Ryan's cooler

- What do you need to know to solve this problem?

  The length is _____. The width is _____. The height is _____.

- What formula can you use to find volume? _____

SOLVE

Write the formula for the volume of a rectangular prism. _____

Fill in the numbers. $V =$ _____ × _____ × _____

Rename each number as an improper fraction. = _____ × _____ × _____

Multiply. = _____

Simplify the answer. = _____

CHECK

Use the formula $V = Bh$ to check your work.

Find the area of the base. $B = lw$

$B =$ _____ × _____ = _____

Fill in the numbers in the formula. $V =$ _____ × _____

Rename each mixed number as an improper fraction. = _____ × _____

Multiply. = _____

Simplify the answer. = _____

_____ cubic feet of ice will fill the cooler.

PRACTICE

Use the problem-solving steps to help you.

I remember! The base is the same as length × width.

1 Ellie buys a storage cabinet that is $3\frac{1}{4}$ m tall. The base of the cabinet has an area of $\frac{3}{4}$ m^2. Find the volume of the storage cabinet.

CHECKLIST
- ☐ READ
- ☐ PLAN
- ☐ SOLVE
- ☐ CHECK

2 Anton has a new laundry basket that measures $1\frac{1}{2}$ feet tall. The length is $2\frac{1}{2}$ feet, and the width is 2 feet. Find the volume of Anton's new laundry basket.

CHECKLIST
- ☐ READ
- ☐ PLAN
- ☐ SOLVE
- ☐ CHECK

3 Maria brought home 250 cubic centimeters of beach sand from her vacation. She wants to know if the sand will fit in a small glass jar that measures $8\frac{1}{2}$ centimeters tall and has a base that is $30\frac{1}{4}$ square centimeters. Find the volume of the glass jar and tell whether Maria's sand will fit inside.

CHECKLIST
- ☐ READ
- ☐ PLAN
- ☐ SOLVE
- ☐ CHECK

6th Grade Math

Alice M. Harte Charter

Mr. Walsh

Emergency Break Packet

(Part 1)

* Show All Work on Loose-Leaf *

In Case of an unscheduled break from school, complete the following packet along with the lessons in your purple break workbook.

Domain 3: Cumulative Assessment for Lessons 17–23

1. Which expression represents "subtract a number n from 10, then multiply by 9 cubed"?

   A. $9^3 \times (n - 10)$

   B. $9^3 + 10n$

   C. $9^3 - 10n$

   D. $9^3 \times (10 - n)$

2. What is the value of the expression below when $b = 4$?

   $7b + 6$

   A. 34

   B. 46

   C. 53

   D. 80

3. Which expression is equivalent to $5(9 + t)$?

   A. $45t$

   B. $45 + 5t$

   C. $45 \mid t$

   D. $14t$

4. Which number is a solution for the inequality below?

   $\frac{x}{4} \geq 20$

   A. 6

   B. 16

   C. 25

   D. 90

5. Vikram needs to buy 72 juice boxes for a community picnic. At the store, juice boxes are sold in packs of 3 juice boxes each. Which shows the equation that represents the situation and the number of packs of juice boxes Vikram needs to buy?

   A. $\frac{j}{3} = 72$; 216 juice packs

   B. $j - 3 = 72$; 75 juice packs

   C. $3j = 72$; 24 juice packs

   D. $j + 3 = 72$; 72 juice packs

6. Which equation best represents the relationship between x and y shown in the table?

x	0	1	2	3
y	1	3	5	7

   A. $y = x + 1$

   B. $y = 3x$

   C. $y = 3x - 2$

   D. $y = 2x + 1$

7. Angelina wants to buy a pair of jeans and a sweater that costs $38. She does not want to spend more than $80 for the jeans and the sweater. Which inequality best represents j, the amount that Angelina can spend on the jeans?

A. $j > 42$

B. $j \geq 42$

C. $j < 42$

D. $j \leq 42$

8. What is the value of y in the following equation?

$$\frac{1}{3}y = 9$$

A. 3

B. 9

C. 27

D. 81

9. Describe the expression $12 + (n \div 6)$ in words.

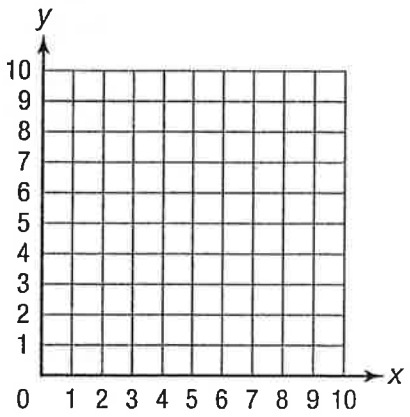
_____

10. The equation $y = x - 3$ describes how the variables x and y are related.

A. Complete the table of values below for $y = x - 3$. Show all your work.

x	$y = x - 3$	y	(x, y)
3			
5			
7			
9			

B. Graph $y = x - 3$ on the coordinate grid below.



DOMAIN

3 Review

Evaluate each expression.

1. $9^2 - 5^2$

_____

2. $72 - 20 \div 4 + 2^3$

_____

3. $108 \div (2 + 1)^2$

_____

4. $7 \times 5^2 - 4 \times 8$

_____

5. $2^4 \div 4 + 13$

_____

6. $85 - 6^2 \div 3$

_____

Write an algebraic expression for each verbal expression. Let n = the number.

7. 29 more than a number

_____

8. 61 decreased by a number

_____

9. the quotient of 45 and a number

_____

10. subtract 31 from a number

_____

Write a verbal expression for each algebraic expression.

11. $26m$

_____

12. $w - 34$

_____

13. $16 + y$

_____

14. $x \div 8$

_____

Evaluate the algebraic expression for the given value of the variable.

15. $68 - y^2$ for $y = 5$

_____

16. $104 - 6c + 3$ for $c = 1\frac{1}{2}$

_____

17. $30a - 8 \times 3 + 4$ for $a = 4.6$

_____

18. $9.7 + 3.1w - 1.9$ for $w = 2.3$

_____

Choose the best answer.

19. Which expression is equivalent to $d + d + d + d + d$?

A. $5 + d$ **B.** $5d$

C. d^5 **D.** $\frac{d}{5}$

20. Which expression is equivalent to $w \times w \times w$?

A. $w + 3$ **B.** $3w$

C. w^3 **D.** $\frac{w}{3}$

Write an equivalent expression for each expression.

21. $s + s + s$

_____

22. $p \times p \times p \times p \times p$

_____

23. $x \times x$

_____

24. $n + n + n + n$

_____

Use the distributive property to write an equivalent expression for each expression.

25. $3(y + 5)$

_____

26. $5(4 + 3k)$

_____

27. $7(3n + p)$

_____

28. $10(6w + 2x)$

_____

Write which of the numbers, if any, is a solution of the equation.

29. $35x = 24.5$ Try: 0.7, 0.8, 0.9 _____

30. $2\frac{3}{8} + y = 5\frac{3}{4}$ Try: $3\frac{1}{4}, 3\frac{1}{8}, 3\frac{3}{8}$ _____

Write which numbers, if any, are solutions of the inequality.

31. $n + 9 < 15$ $n \stackrel{?}{=}$ 3, 5, 6, 7, 9 _____

32. $6x > 138$ $x \stackrel{?}{=}$ 22, 23, 24, 25 _____

33. $y - 7 \leq 29$ $y \stackrel{?}{=}$ 22, 30, 36, 38 _____

34. $23 + r \geq 50$ $r \stackrel{?}{=}$ 20, 25, 27, 30 _____

For questions 35–38, write an inequality for each situation.

35. Kendall has at least 20 sports cards. _____

36. Ryder hiked no more than 8 miles. _____

37. Adela saved more than $36. _____

38. Kazuo lost fewer than 9 points. _____

39. Lauren is 6 years older than Erik. Write an equation to show the relationship between Lauren's age, *L*, and Erik's age, *E*. Make a table of values. Then graph the relationship. Use *Math Tool: Grids* to draw the graph. How old will Lauren be when Erik is 18 years old?

_____

Solve.

40. Mulan earns $14 per hour. Write and solve an equation to find how many hours she worked if she earned $112.

_____

41. Dennis spent $5 less on lunch than he spent on dinner. Dennis spent at most $12 on dinner. Write and solve an inequality to find how much Dennis spent on lunch.

_____

42. CREATE Write a word problem that can be solved by the equation $108 \div r = 12$.

_____

43. REWRITE Refer to question 41 and suppose that Dennis spends *at least* $12 on dinner. Modify the equation and your solution to fit the new problem.

_____