Name _____ Period _____ Date _____

UNIT 2
STUDENT PACKET

Math Links
GRADE 7

PERCENT AND SCALE

Parent (or Guardian) signature _____

MY WORD BANK

Explain the mathematical meaning of each word or phrase, using pictures and examples when possible. See **Student Resources** for mathematical vocabulary.

percent (as a number) percent of a number	percent decrease in quantity discount
percent increase in quantity markup	scale scale drawing scale factor

OPENING PROBLEM: USING COUPONS

[7.RP.3, 7.NS.3, 7.EE.3; SMP 1, 2, 3, 4, 5]

Bridget has four coupons for the CAMY's department store.

Coupon A offers 25% off any item.	Coupon B offers $20 off any item.
Coupon C offers 10% off any item.	Coupon D offers $10 off any item.

She needs to buy the following items.

- One set of sheets for $45.
- One set of 4 pillows for $60.
- One mattress for $400.
- One bed frame for $120.

If she is allowed to use only one coupon per item, how should she use her coupons to save the most money?

PERCENT INCREASE AND DECREASE

We will learn some common vocabulary related to percent. We will learn how to find percent increases and decreases.

[7.RP.3, 7.NS.3, 7.EE.2, 7.EE.3; SMP1, 2, 3, 4, 5, 6, 7, 8]

GETTING STARTED

1. Use the distributive property to multiply 10 times 1.5 by filling in the blanks below.

   10(1.5) = ____(1) + 10(____)

   = ____ + ____

   = ____

2. Multiply 6 times 1.8 using the same procedure as in problem 1.

3. In problems 1 and 2, how is the 1 in 1.5 the same as the 1 in 1.8?

Write each decimal as a percent value.

4. 0.055	5. 1.2

Write each percent value as a decimal.

6. $2\frac{1}{2}\%$	7. 135%

8. $12 is what percent of $48?

Solve using mental strategies. (See "chunking strategies" in **Student Resources**.)

9. 50% of $240	10. 25% of $240	11. 10% of $240	12. 1% of $240

Estimate. Then check with a multiplication procedure to find the actual amount.

13. 19% of $240		14. 4.5% of $240	
Estimate	Actual	Estimate	Actual

PERCENT INCREASE OR DECREASE

1. Your teacher will give you a set of cards. Read each card and determine whether it is an example of a percent increase or a percent decrease.

Percent Increase	Percent Decrease

2. Explain why each of the following is a percent increase or percent decrease example.

a. The purchase price of an item on a 25% off sale.	b. The total bill at a restaurant after a 10% sales tax.

3. Create one example for each.

Percent Increase	
Percent Decrease	

4. Many people provide services for which they receive gratuities (tips). Better service frequently gets the worker a better tip. List four jobs for which workers might receive tips.

5. Record the meanings of <u>percent</u>, <u>percent of a number</u>, <u>percent decrease in a quantity/discount</u>, and <u>percent increase in a quantity/markup</u> in **My Word Bank**.

PRACTICE 1

Use mental chunking strategies to find the tip and total amounts below.

Original amount	10% Tip		5% Tip		15% Tip		20% Tip	
	Tip	Total	Tip	Total	Tip	Total	Tip	Total
1. $60								
2. $90								
3. $25								

Use chunking or a multiplication procedure to find the missing values below.

Original amount	% of Change	Amount of Change	Final Amount	work space as needed
4. $200	10% raise			
5. $70		$35 markup		
6. $120		$6 off coupon		
7. $25	10% pay cut			
8. $50	2.5% commission			
9. $20.45	20% discount			
10. $32		$2.40 sales tax		
11. $225		$9 simple interest		

ESTIMATING PERCENT INCREASES AND DECREASES

Follow your teacher's directions for (1) – (3).

(1) The price of a car was _____. It was then marked up _____. Find the new price.

Partner A: Estimate.	Partner B: Compute with a calculator.

(2) A winter coat that sells for _____ is discounted _____. Find the discounted price.

Partner B: Estimate.	Partner A: Compute with a calculator.

(3) A large book was priced at _____ and is on sale for _____. Find the percent of decrease.

Partner A: Estimate.	Partner B: Compute with a calculator.

4. A cell phone is $149 and is marked up to $249.99. Find the percent of increase.

Estimate.	Compute with a calculator.

5. A hoverboard priced at $149.99 is now on sale for 15.5% off. Find the discounted price.

Estimate.	Compute with a calculator.

6. Record the meanings of discount and markup in **My Word Bank**.

PRACTICE 2

Compute.

1. Find 5% of $20.	2. Find 20% of $5.
3. Explain or demonstrate why problems 1 and 2 have the same answers.	

4. A backpack is marked down 40%. The original price was $49.50. What is the price of the backpack after the markdown?

Estimate.	Compute.

5. A jacket is on sale for 25% off. The sale price is $27.00. What was the original price?

Estimate.	Compute.

6. Is a 20% discount, followed by an extra 25% discount the same as a 45% discount?

SALES AND SALES TAXES

Follow your teacher's directions for (1) and (2).

(1) A shirt costs _____ and there is _____ sales tax. Show the calculator keystrokes needed to find the total cost, and find the total cost.

(2) Pants cost _____, and sales tax is _____.

Show the keystrokes and find the total using Robin's strategy.	Show the keystrokes and find the total using Maya's strategy.

Compute. Use a calculator and round appropriately.

3. While shopping at Bulls-Eye department store you purchase craft glue for $8.99 and a shirt for $25.99. The city sales tax is 10.25%. Compute the sales tax and total.	4. At Super Sales Electronics you purchase ear buds for $29.99 and a flash drive for $12.49. The city sales tax is 8.25%. Compute the sales tax and total.

Use any method to calculate the following.

5. The original price of a pair of socks is $8.00. What is the price after a 10% markdown?	6. Find the total cost of the socks after paying a 5.5% sales tax on the discounted price.

7. Explain the difference between "for sale," "on sale," and "sales tax."

PRACTICE 3

Use a calculator as needed and round appropriately.

1. A department store is having a sale on jackets. The original cost of a jacket that Marika wants to buy is $90.

   a. If the jacket is marked down to $72, what is the percent discount?

   b. Sales tax in this location is 9.6%. What is the sales tax amount for the discounted jacket?

   c. Marika has $75 to spend on the jacket. Will this be enough money? Explain.

2. Ella wants to buy a $140 MP3 player that is on sale for 25% off.

   a. Ella says, “Since I’m taking off 25%, and 1 – 0.25 = 0.75, I only have to pay 75% of the price.” Calculate the sale price according to Ella’s method, and then check whether it is correct using another method.

   b. Use any method to calculate the final price with a 6% sales tax on the discounted price.

PRACTICE 4

Use a calculator as needed and round appropriately.

1. A.J. saves $100 to buy new earbuds. If he has to pay 8% sales tax, what is the maximum price the earbuds can be?

2. Min buys one video game for $20 and another for $30. The total at the register is $53.50. What is the tax rate that Min paid?

3. Your bill at a restaurant before tax is $32.80. The sales tax is 9.25%. You decide to leave a tip of 20%. Find the total cost including tax and tip if…

   a. you tip only on the pre-tax amount.

   b. you tip on the post-tax amount.

4. A pair of shoes you like, the Wonder Walkers, cost $100 at Splendid Soles.

   a. Splendid Soles puts the Wonder Walkers on sale at 10% off for a week. What is the sale price?

   b. The shoes are selling very well, so Splendid Soles decides to increase the sale price by 10% for next week. How much will they sell for next week?

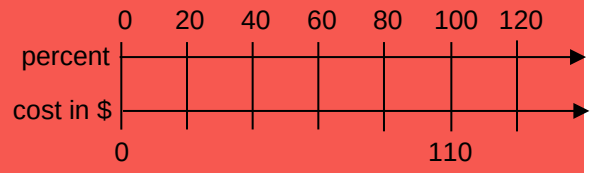
   c. With a 10% decrease, and then a 10% increase, explain why the Wonder Walkers are not back to their original $100 price.

BUYING A SKATEBOARD

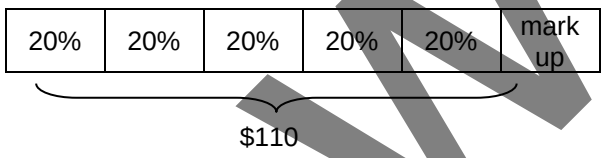
Hans and Franz each want to buy the "Thriller" skateboard. At Bullseye Department Store, the Thriller sells for $110 now, and the store manager tells them all skateboards will be marked up 20% next week. They want to figure out how expensive the skateboard will be.

1. Hans started to draw a double number line to determine the markup, and Franz started a tape diagram. Study their work and then finish what they started to find the new price.

Hans' work:

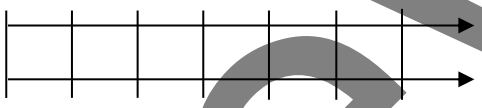


Franz's work:



2. Dieter is skateboard shopping at the same store. He wants to buy the "Citadel" skateboard that currently sells for $140. How much will the Citadel cost after the 20% markup? Use the same methods as problem 1 and show all your work.

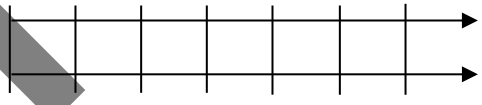
Hans' method:



Franz's method:

3. Hans and Franz went to a different store and got a pleasant surprise. The Thriller skateboard was marked down 20% to $90. What was the price before the discount? Use the same methods again.

Hans' method:



Franz's method:

USING COUPONS REVISITED

1. Go back to the opening problem. Recall that Bridget was shopping at CAMY's Department Store. Did you make the best choices for Bridget? Use this space to verify your choices or revise your work as needed.

2. Micah has the same coupons as Bridget, but is going to use them at LOOMY's Department Store. At this store, Micah may use all four coupons on the same item abnd wants to buy a $1,200 TV.

   Does the order in which Micah uses his coupons matter? _____ Explain how Micah can use all four coupons to get the cheapest TV using words or numbers.

PERCENT APPLICATIONS

We will solve real life percent problems using various methods.
[7.RP.2c, 7.RP.3, 7.NS.3, 7.EE.2, 7.EE.3; SMP1, 2, 3, 4, 5, 6]

GETTING STARTED

1. Opa got 24 out of 40 items correct on a quiz. What percent correct is this?

2. It is common for a clothing store to buy merchandise from a manufacturer and then mark up the price by about 100% when selling the item.

   a. What does it mean to mark up the price of a pair of jeans by 100%?

   b. If a clothing store buys jeans for $25 each, what will be the selling price of the jeans after a 100% markup?

   c. When these jeans are purchased, a 9% sales tax is required. What is the total cost of purchasing these jeans?

Solve for *x*.

3. $160 = x + 75$	4. $200 = 0.2x$

INCOME AND COMMISSION

Follow your teacher's directions for (1) – (3).

Talia's older sister earns _____ in gross income and pays _____in taxes.

(1) Let *G* represent _____ *G* = _____

Let *N* represent _____ *N* = _____

(2) Jordan's dad sells _____ worth of merchandise and earns a commission of _____.

Let *C* represent _____ *C* = _____

(3) _____ is the amount of money earned before taxes and other deductions.

_____ is the amount of money earned after taxes and other deductions.

A _____ is the amount of money that a sales person earns, often based on a percentage of sales.

4. Jordan's dad sells computers. His recent monthly sales are shown below.

January: $14,000 February: $3,000 March: $25,400

Jordan's dad received 2.5% in commission on sales and then paid 28% in taxes. What is the net income that Jordan's dad made after taxes?

PRACTICE 5

1. Roe is a barber, earns a gross income of $56,000 per year, and is taxed at a rate of 24%. What is Roe's net income?

First estimate. Then compute.

2. Dollar amount sold: $5,040
   Commission percent: 5%
   Find the commission amount.

   Estimate:

   Compute:

   What's the difference between your estimate and the actual amount?

   Is this a big difference?

3. Commission percent: 20%
   Commission amount: $225
   Find the dollar amount sold.

   Estimate:

   Compute:

   What's the difference between your estimate and the actual amount?

   Is this a big difference?

PRACTICE 6

1. Ms. Garcia is a teacher. Her gross income is $76,000 per year, and her net income is $56,240. At what rate is Ms. Garcia taxed?

First estimate. Then compute.

2. Salary: $3,500
   Taxes: $720
   Find the tax rate.

   Estimate:

   Compute:

   What's the difference between your estimate and the actual percent?

   Is this a big difference?

3. Dollar amount sold: $1,000
   Commission percent: 3.5%
   Taxes on commission: 8%
   Find the net income.

   Estimate:

   Compute:

   What's the difference between your estimate and the actual amount?

   Is this a big difference?

SIMPLE INTEREST

Follow your teacher's directions for (1) – (3).

(1) Jacob borrowed _____ for _____ years at an annual rate of _____ simple interest.

Let *P* represent _____ *P* = _____

Let R represent _____ *R* = _____

Let T represent _____ *T* = _____

Let I represent _____ $I = P \bullet R \bullet T$ _____

Let A represent _____ $A = P + I$ _____

(2) _____ is an initial amount of money borrowed or invested.

The _____ is the percent charged or paid to use money.

The length of _____ of the loan or investment, typically in years.

_____ is an amount paid or charged for the use of money.

The_____ is the sum of the principal and the interest.

(3) Explain Jacob's misunderstanding.

Find the missing amounts for each loan situation below. Use a calculator.

	Principal	**Interest Rate**	**Time to Repay**	**Interest to Repay**	**Total Amount to Repay**	work space as needed
4.	$500	7%	4 years			
5.	$1,250	5.75%	6 years			
6.		8%	3 years	$480		
7.	$2,500	7.5%		$750		
8.	$3,000		5 years	$937.50		

PRACTICE 7

Jonatan has $2,000 saved to buy a new car, and he will get a loan from Abuelo Roberto to pay the rest. Abuelo will charge Jonatan simple interest and they will work out a payment plan. Jonatan is looking at an electric car, hybrid, or gasoline-powered SUV.

First determine the total amount of money that Jonatan will need to repay.

	Electric Car	**Hybrid Car**	**SUV (gas)**
1. Price	$31,600	$27,750	$42,000
2. Amount to borrow	$_____	$_____	$_____
3. Interest rate	5.25%	5.25%	5.25%
4. Time to repay the loan	6 years	6 years	6 years
5. Total interest	$_____	$_____	$_____
6. Total amount to repay	$_____	$_____	$_____

Abuelo asks Jonatan to pay him back in monthly installments over 6 years.

7. Monthly payment	$_____	$_____	$_____

8. If Jonatan has a job that pays $500 per week (net income), about what percentage of his salary will go to monthly payments on the electric car? _____ On the hybrid car? _____ On the gasoline car? _____

9. Which car do you think Jonatan should choose? In your explanation, discuss other financial and environmental considerations you think he should make.

PRACTICE 8

1. Mark was on an elliptical machine at the gym. After 6 minutes the screen showed that he was 20% done with his workout. How long was his workout?

2. Rosando said to Carlos, "You're taking 25% off for your discount, and then adding 6% sales tax. Since 25 – 6 = 19, just take off 19%." Critique Rosando's reasoning.

3. Malek's credit card has an annual simple interest rate of 16%. Malek's current balance is $325 and Malek plans to pay it off in two years. How much simple interest will Malek pay? What is the total amount that Malek will repay?

4. You invest some money at a 5% annual interest rate. The total amount that you get back is $5,520, which includes $720 in interest. How much was the principal? How long was the investment?

5. Antoine works on commission and is paid 2.5% of sales. What dollar amount would Antoine have to sell in order to earn $2,000 in commission?

SCALE DRAWINGS

We will learn the meaning of scale factor and scale. We will make and interpret scale drawings.
[7.RP.3, 7.NS.3, 7.EE.3, 7.G.1; SMP5, 6]

GETTING STARTED

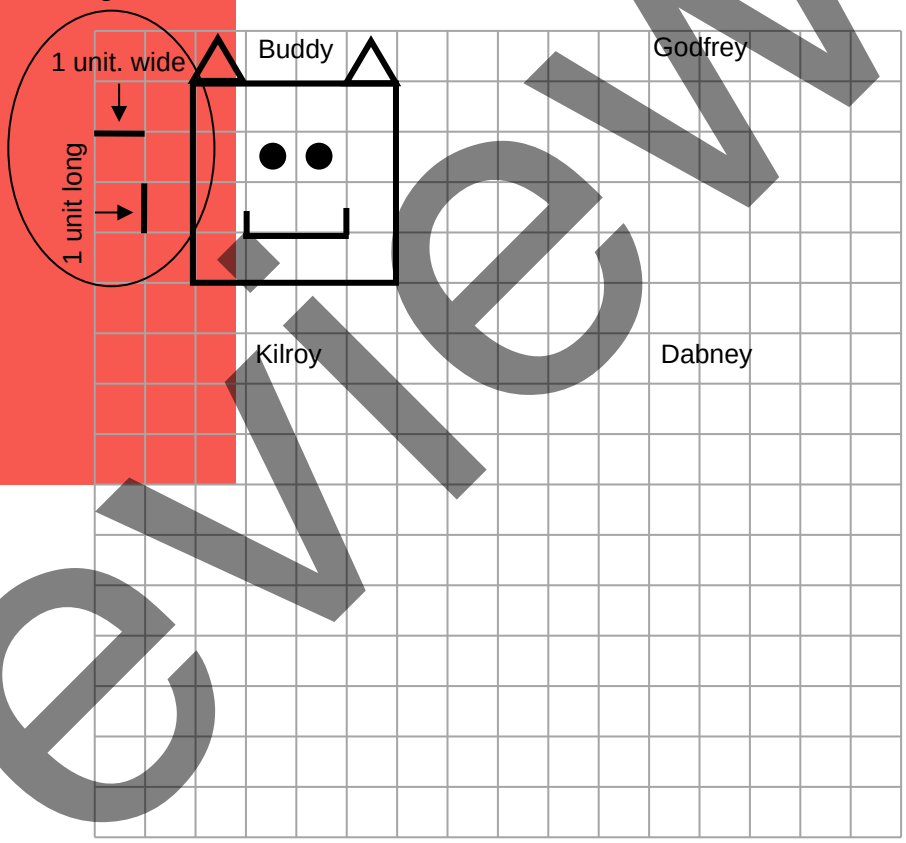
Attend to all parts of Buddy's face given the following directions to create three more faces. Pay close attention to "width" and "length."

1. Godfrey's face is twice as wide and just as long as Buddy's face. Draw Godfrey's face.

2. Kilroy's face is twice as long and just as wide as Buddy's face. Draw Kilroy's face.

3. Dabney's face is twice as long and twice as wide as Buddy's face. Draw Dabney's face.

4. Which two faces look the most alike? Explain.



5. Find the area of a sheet of paper whose width is $8\frac{1}{2}$ inches and height is 11 inches.

6. Arman needs 6 ribbons that are $\frac{3}{4}$ yard each for a costume. How much ribbon does Arman need?

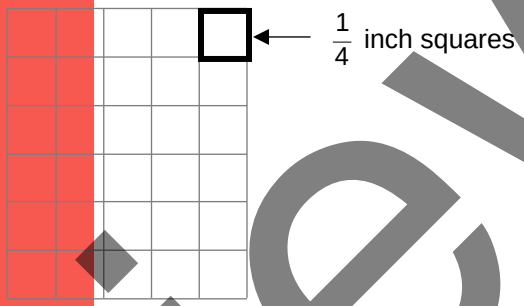
THE BIRDHOUSE

Follow your teacher's directions for (1) – (6).

(1) Draw the face of the birdhouse on plain paper. Label the dimensions.

(2) Draw the face of the birdhouse on the grid below. Label the dimensions. We will refer to this as the _____.

The picture below is a _____.



(3)

One inch on the scale drawing represents _____ on the actual drawing.

(4) _____ is a ratio of the lengths of the _____ to the lengths of the _____.

The ratio of the scale drawing to the actual drawing is 1 : ____.

(5) _____ _____ is a multiplier.

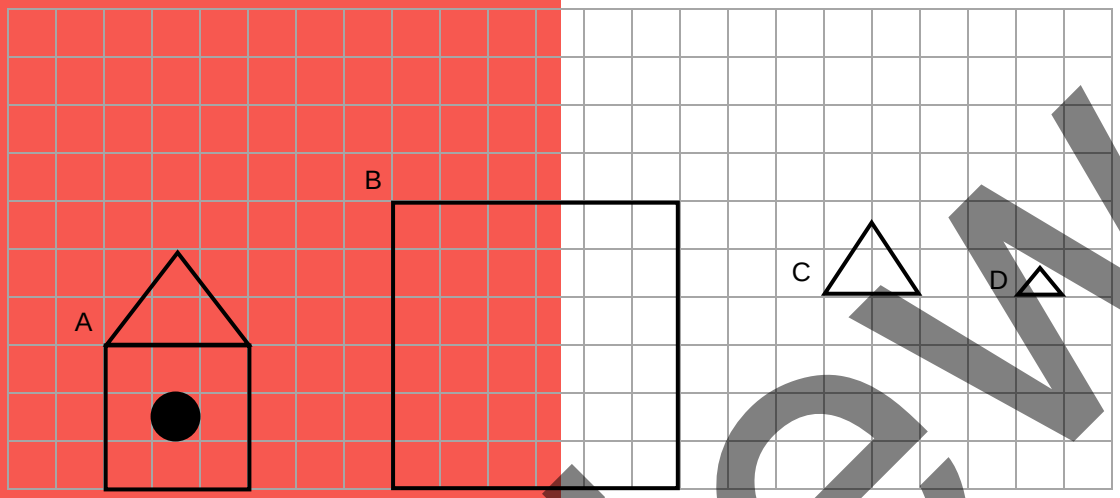
Actual length ×___ = scale length. Scale factor = ___. This is a(n) _____.

(6) Suppose you had the scale drawing of the birdhouse above, and you wanted to make a template for the face of the actual birdhouse. Would this be an enlargement or a reduction? _____ What would be the scale factor? _____

7. Record the meanings of scale, scale factor, and scale drawing in **My Word Bank**.

PRACTICE 9

1. Natasha wants to build a birdhouse. The actual drawing is below (A). She also wants to make scale drawings B, C, and D. Complete these three drawings.



2. Complete the table.

Drawing	Reduction or enlargement compared to drawing A?	Scale factor (multiplier) compared to drawing A		Scale (ratio) compared to drawing A
		as a number	as a percent	
A		1		_____ : 1
B				
C				
D				

3. A Little Free Library® is a book exchange where anyone may take books or leave books. A Little Free Library often stands on a post, similar to a mailbox. Octavia wants to build a Little Free Library on a post that is 4 feet high. On her scale drawing, she makes the height 4 inches.

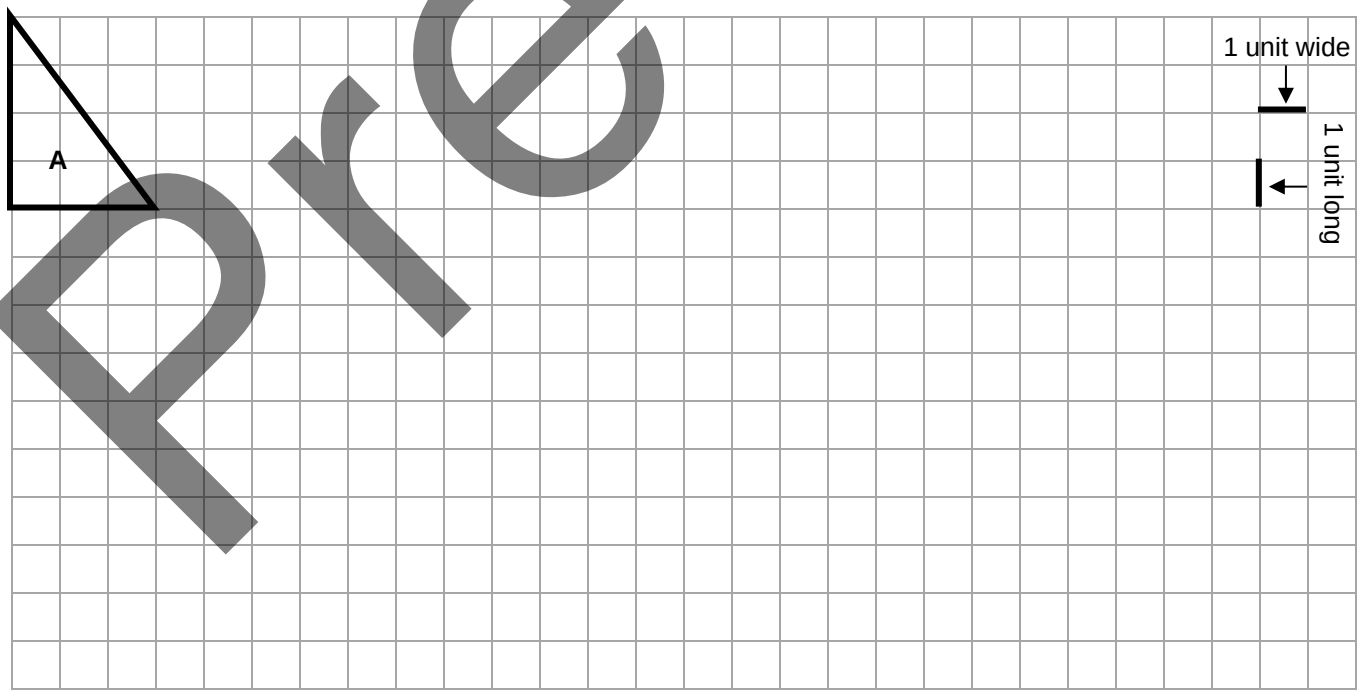
   Is Octavia's scale drawing an enlargement or a reduction of the mailbox? _____

   Octavia says, "The scale is 4 in : 4 ft, so it can also be written 4 : 4, which is equivalent to 1 : 1. Therefore, the scale factor is 1." Correct Octavia's thinking.

PRACTICE 10

Based on triangle A below, complete the table and draw each triangle on the grid paper.

Triangle	Compared to Triangle A: Scale factor as a percent	Scale factor as a number	Scale (ratio)	Enlargement/ Reduction (write E or R)	Height (length)	Base (width)	Area
A	100%			neither			
B	300%		3 : 1				
C		$0.5 = \frac{1}{2}$					
D	25%						
E		2					
F	150%						



MATCHING SCALE DRAWINGS OF TRIANGLES AND RECTANGLES

1. One figure is scale drawing of the other if…

2. Your teacher will give you some geometric shapes. Cut them out. Determine which figures are scale drawings of the others. Then complete this table.

Actual Figure	Scale drawing of figure	Scale factor	Enlargement or reduction?	Measures of angles in the actual figure	Measures of angles in the corresponding figure
S					
V					
P					
F					
E					
C					

3. What do you notice about the sum of the measures of the angles in the triangles?

4. What do you notice about corresponding angles in the triangles?

   Does this relationship hold up for the rectangles?

PRACTICE 11: EXTEND YOUR THINKING

Refer to **Practice 10**.

1. Compare the side lengths and areas of triangles. Complete the table.

Compare Triangles…	**A to E**	**A to B**	**D to A**	**D to F**	**E to C**
When side lengths are multiplied by ….	2				
Areas are multiplied by…		9			

2. Generalize the relationship observed above:
   When the side lengths of a triangle are multiplied by *n*, the area is multiplied by _____.

3. Show work to determine if your rule holds up when comparing two other triangles.

Refer to **Getting Started** of this lesson.

4. Complete the table.

Face	**Dimensions** (units)	**Area** (square units)	**Scale drawing of Buddy?**	**Scale factor** (if it exists)	**Scale** (if it exists)
Buddy	4 × 4			1	1 : 1
Godfrey					
Kilroy					
Dabney					

5. List all of the faces that are scale drawings of Buddy. Explain.

6. Compare Buddy and Dabney. Dabney's dimensions are each ____ times Buddy's, and his area is ____ times Buddy's. Does this agree with the rule you created for the triangles above?

A FLOOR PLAN

Architects use scale drawings to represent actual building floor plans. Use a ruler to measure some scale drawings of rooms in centimeters and determine their actual dimensions in meters.

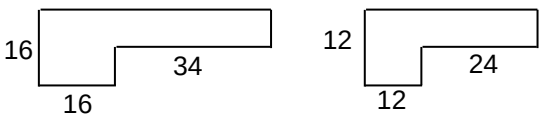
Scale: 2 cm : 3 m

	Room	Drawing length	Drawing width	Actual length	Actual width
1.	Bath	_____ cm	_____ cm	_____ m	_____ m
2.	Bedroom 2				
3.	Laundry				
4.	Dining Room	3 cm			
5.	Bedroom 1			6 m	
6.	Living Room				

7. Ming looks at the scale and thinks that the scale factor is $\frac{2}{3}$. Why is Ming incorrect?

8. If the length and width of the dining room in the scale drawing were increased by 2 cm each, what would be the new actual dimensions of the dining room?

9. Why is it impossible for the drawings to the right be scale drawings of the same actual room?



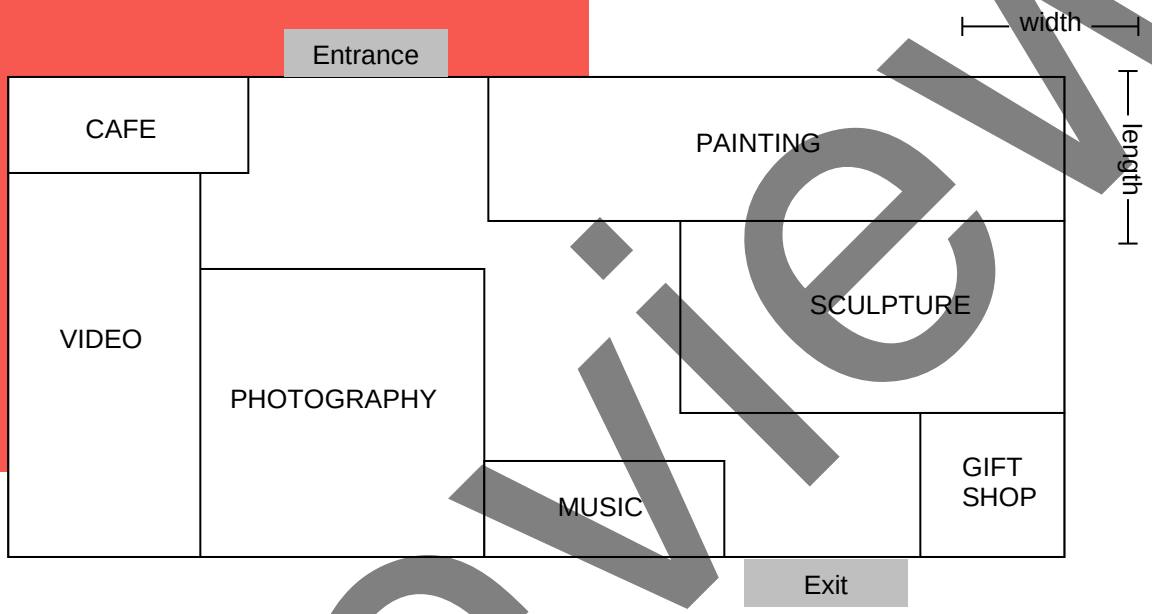
(drawing lengths given in cm)

PRACTICE 12

Here is a scale drawing of a museum floor plan. The floor of the photography room is a square with actual side lengths equal to 22.5 feet.

1. Find the scale of this drawing using a customary ruler in inches, rounding all measurements to the nearest $\frac{1}{4}$ inch (0.25"). Then write the scale in these three different equivalent ways.

_____ in : 22.5 ft 3 in : _____ ft 1 in : _____ ft



Complete the table below.

	Room	Drawing length	Drawing width	Drawing area	Actual length	Actual width	Actual area
2.	Cafe						
3.	Video						
4.	Painting						
5.	Sculpture						
6.	Gift shop						

7. What is the scale factor? Is this an enlargement or reduction?

REVIEW

WHY DOESN'T IT BELONG?: PERCENT AND SCALE

For each set of four statements, find a statement that does not belong and explain why. Then choose at least one more statement and explain why it doesn't belong.

N sales tax	**E** sale
R interest rate	**D** tip

F $9.84 doubled	**L** half of $36.36
O 12% of $164	**P** 164% of $12

B $40 increased by 10% plus another $4	**U** $20 increased by 40%
S $80 decreased by 40%	**K** $48

G Final price on a $10.25 item marked up 10%	**N** Sale price on a $20 item that's 45% off
A A $11 item	**T** Final price on a $5 item marked up 120%

POSTER PROBLEMS: PERCENT AND SCALE

Part 1: Your teacher will divide you into groups.

- Identify members of your group as A, B, C, or D. I am group member _____.
- Each group will start at a numbered poster. Our group start poster is _____.
- Each group will have a different color marker. Our group marker is _____.

Part 2: Do the problems at the posters.

Problem 1 (or 5)	Problem 2 (or 6)	Problem 3 (or 7)	Problem 4 (or 8)
You earn $15.25 per hour at your job and your boss gives you a 6% raise.	A jacket costs $64 and there is a 30% discount.	Dinner with friends costs $42.50 and you leave a 15% tip.	Your favorite boots are on sale for $80 and sales tax is 8.25%.

A. Copy the fact statement. Does this problem suggest a percent increase or percent decrease?

B. Write two questions that can be answered with these facts.

C. Answer the first question. Show work.

D. Answer the second question. Show work.

Part 3: Return to your seats. Refer to your original poster problem.

Add some information to the facts of your story. Then write another question that may be answered with your facts, and answer it.

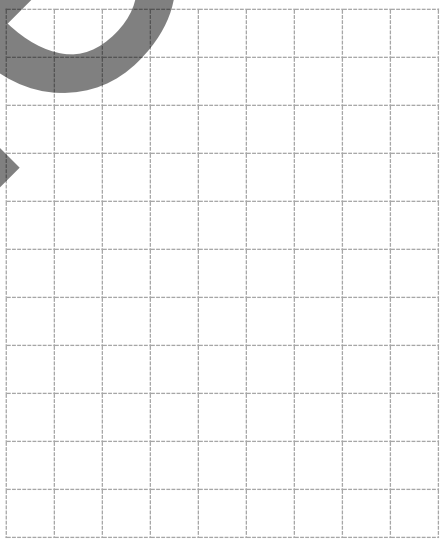
Share your stories with classmates. Try to solve each other's problems.

SPORTS PLAYING SURFACES

1. Complete the table with scale drawing measurements, scale, and scale factor.

SPORT SURFACE			SCALE DRAWING 1		SCALE DRAWING 2	
Type	**Actual Length**	**Actual Width**	**Scale Length 1**	**Scale Width 1**	**Scale Length 2**	**Scale Width 2**
Volleyball Court	60 ft	30 ft			3 in	1.5 in
Basketball Court	85 ft	50 ft				
Bowling Lane	60 ft	5 ft				
			(Scale) 1 in : 10 ft (Scale Factor 1) _____		(Scale 2) _____ : _____ (Scale Factor 2) _____	

2. How many of the six scale drawings of sports courts above can you cut from one sheet of blank paper? Cut, label, and write in the scale dimensions. Show with a drawing to the right.

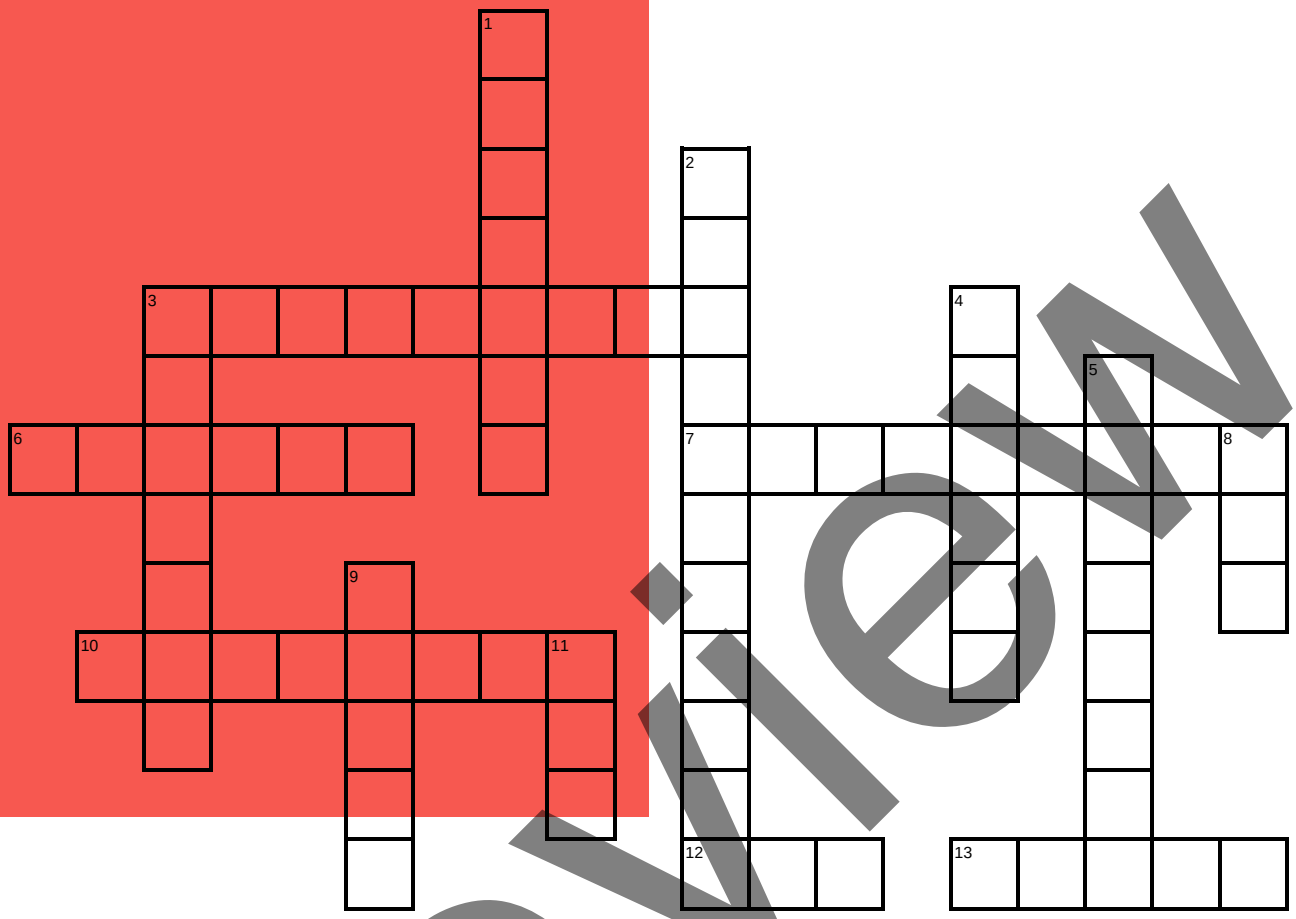


3. Choose two scale drawings where one represents an enlargement of the other. Describe the enlargement. What is the scale factor? What is the scale? What is the relationship of their areas?

4. Choose two different scale drawings where one is a reduction of the other. Describe the reduction. What is the scale factor? What is the scale? What is the relationship of their areas?

5. Choose two drawings that are NOT scale drawings of each other. Explain how you know.

VOCABULARY REVIEW



Across

3 an amount borrowed or loaned

6 an increase in price

7 Scale factor between 0 and 1 is a ____.

10 money paid to borrow money

12 added fee required by the government

13 Scale is a ____ of lengths.

Down

1 Blueprint or map is an example of a scale _____

2 a drawing increased in size compared to the original

3 per hundred

4 Multiplier of dimensions in drawing is a scale ____.

5 decrease in cost of an item

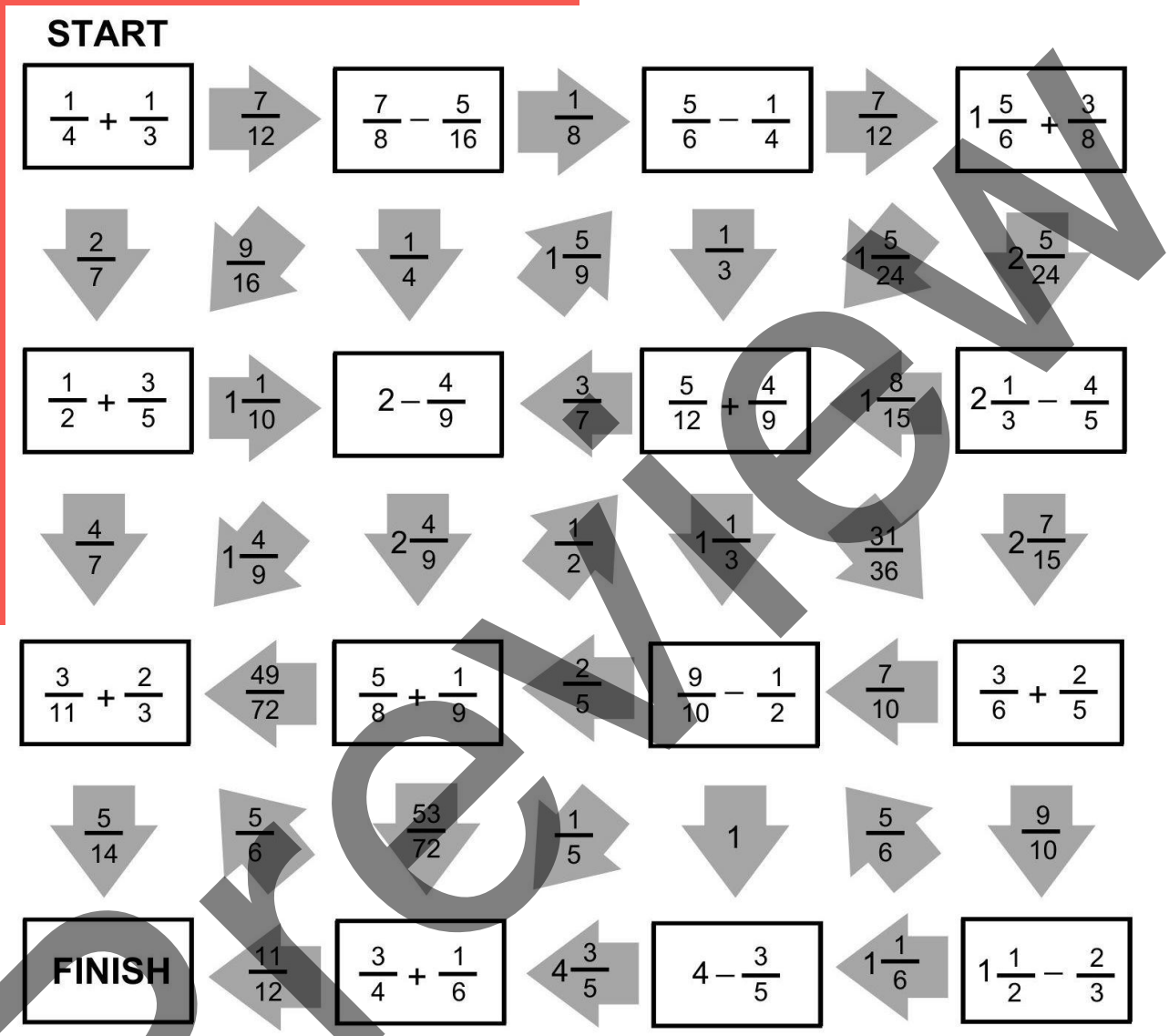
8 income after taxes

9 income before taxes

11 gratuity

SPIRAL REVIEW

1. **Math Path Fluency Challenge**: Use what you know about addition and subtraction of signed decimals to find the correct path from Start to Finish.



2. Complete the table:

Fraction			$\frac{3}{20}$	$\frac{23}{50}$		$\frac{1}{3}$
Decimal		0.8			1.04	
Percent	75%					

SPIRAL REVIEW
Continued

Evaluate each expression.

3. $3(4 + 4) – (5 – 1)$	4. $(14 + 18) \div 4 – 2$	5. $24 \div (5 – 3)^3 + 5 \bullet 4$
6. $2^3(3^1)$	7. $3^2 + 2^4$	8. $\frac{16 \div 2 + 4}{3^2 – 1}$

Simplify each expression. Evaluate if $m = 4$.

9. $\frac{2(m + 4m)}{9m – 4m}$	10. $4(m + 2) + m + 7 + 3(m – 1) – 8m$

11. Four friends go to lunch and share the cost equally. If the lunch bill is $27.04, how much will each friend pay?

12. Nico has $2\frac{5}{8}$ cups of popcorn. He wants to share it equally between himself and two friends. How many cups of popcorn will each person get?

13. Flo ate $\frac{1}{4}$ of $\frac{1}{2}$ of Hank's pizza. How much of the whole pizza did Flo eat?

SPIRAL REVIEW
Continued

Two stores sell erasers. Complete the tables, rules, double number lines, and graphs for each store.

14a. Table

INK BE GONE
4 for $5

quantity (x)	Cost in \$ (y)
4	
8	
2	
1	

15a. Table

ERASE AWAY
6 for $6.60

quantity (x)	Cost in \$ (y)
6	
12	
3	
1	

14b. Rule: _____

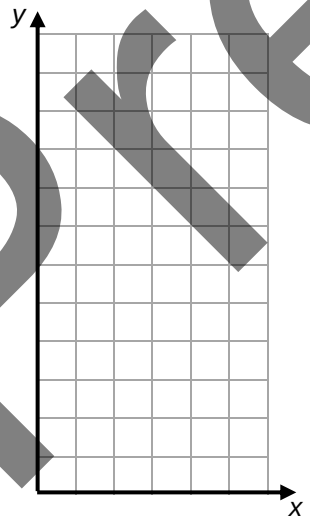
15b. Rule: _____

Double Number Lines

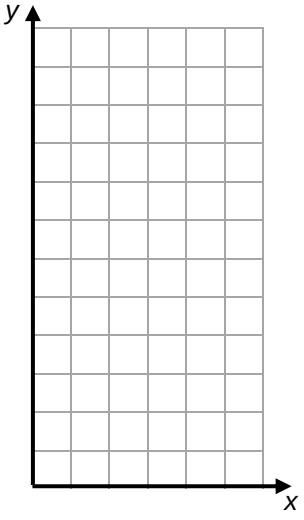
14c.

15c.

14d. Graph



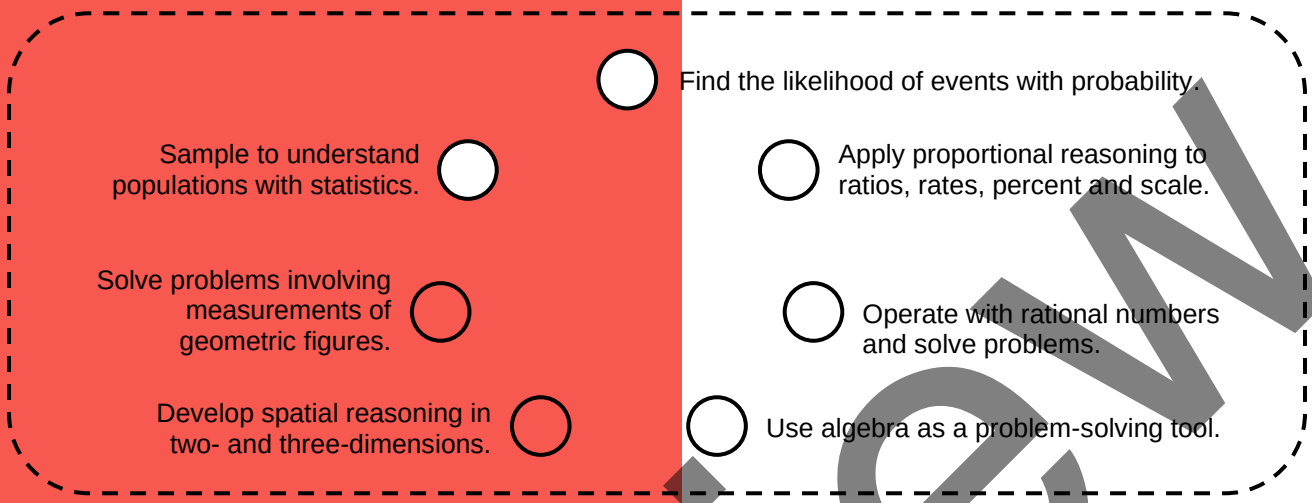
15d. Graph



16. _____ have the lower unit price because…

REFLECTION

1. **Big Ideas**. Shade all circles that describe big ideas in this unit. Draw lines to show connections that you noticed.



   Give an example from this unit of one of the connections above.

2. **Unit Progress.** Go back to **Monitor Your Progress** on the cover and complete or update your responses. Explain something you understand better now than before.

3. **Mathematical Practices.** Explain ways that you attended to precision with vocabulary or computations [SMP6]. Then circle one more SMP on the back of this packet that you think was addressed in this unit and be prepared to share an example.

4. **Making Connections.** Choose an application of percent and explain how what you learned about percents may be useful to you in the future.

STUDENT RESOURCES

Word or Phrase	Definition
decrease in a quantity	The decrease in a quantity is the original value minus the new value. The percent decrease in a quantity is the value of the ratio of the decrease to the original quantity, expressed as a percent. Last year, there were 200 students in the school. This year, there are 178 students in the school. The decrease in the number of students is 200 – 178 = 22. Since $\frac{22}{200} = \frac{11}{100}$, the percent decrease is 11%.
discount	The discount (or markdown) of an item is the decrease in the price of the item; that is, the original price of the item minus the new price. The percent discount is the percent decrease in the price of the item; that is, the value of the ratio of the decrease to the original value, expressed as a percent. Last week, the price of an MP3 player was $200. This week, the price is $178. The discount is 200 – 178 = 22. Since $\frac{22}{200} = \frac{11}{100}$, the percent discount is 11%.
increase in a quantity	The increase in a quantity is the new value minus the original value. The percent increase in a quantity is the value of the ratio of the increase to the original quantity, expressed as a percent. Last year there were 200 students in school. This year, there are 208 students. The increase in the number of students is 208 – 200 = 8. Since $\frac{8}{200} = \frac{4}{100}$, the percent increase is 4%.
markup	The markup on an item is the increase in the price of the item, that is, the new price of the item minus the original price. The percent markup is the percent increase in the price of the item. Last week, the price of an MP3 player was $200. This week, the price is $208. The markup is 208 – 200 = 8. Since $\frac{8}{200} = \frac{4}{100}$, the percent markup is 4%.
percent	A percent is a number expressed in terms of the unit 1% = $\frac{1}{100}$. To convert a positive number to a percent, multiply the number by 100. To convert a percent to a number, divide the percent by 100. $4 = 4 \times 100\% = 400\%$. Fifteen percent = 15% = $\frac{15}{100} = 0.15$.

Word or Phrase	Definition
percent decrease in a quantity	See decrease in a quantity.
percent increase in a quantity	See increase in a quantity.
percent of a number	A percent of a number is the product of the percent and the number. It represents the number of parts per 100 parts. 15% of 300 is $\frac{15}{100} \bullet 300 = 45$. If 45 out of 300 students are boys, then 15 out of every 100 students are boys, and 15% of the students are boys.
ratio	A ratio is a pair of positive numbers in a specific order. The ratio of *a* to *b* is denoted by *a* : *b* (read "*a* to *b*," or "*a* for every *b*"). The ratio of 3 to 2 is denoted by 3 : 2. The ratio of dogs to cats is 3 to 2. There are 3 cups of water for every 2 cups of juice. The fraction $\frac{3}{2}$ does not represent this ratio, but it does represent the *value of the ratio* (or the unit rate).
scale	In a scale drawing of a figure, the scale is the ratio of lengths in the scale drawing to lengths in the actual figure. The blueprint of a house floorplan has a scale of 1 inch to 5 feet, or 1 in : 5 ft. Each inch on the blueprint represents 5 feet. The map has a scale of 3 centimeters to 10 kilometers, or 3 cm : 10 km. Each 3 centimeters on the map represents 10 kilometers.
scale drawing	A scale drawing of a geometric figure is a drawing in which all lengths have been multiplied by the same scale factor. A blueprint (drawing to scale) of a house floorplan is a scale drawing.
scale factor	A scale factor is a positive number which multiplies some quantity. To make a scale drawing of a figure, we multiply all lengths by the same scale factor. If the scale factor is greater than 1, the drawing is an enlargement, and if the scale factor is between 0 and 1, the drawing is a reduction.

Some Fraction-Decimal-Percent Equivalents

$\frac{1}{2} = \frac{50}{100} = 0.5 = 50\%$ $\frac{1}{4} = \frac{25}{100} = 0.25 = 25\%$ $\frac{3}{4} = \frac{75}{100} = 0.75 = 75\%$ $\frac{5}{4} = \frac{125}{100} = 125 = 125\%$ Conversion strategy: Think: $\frac{3}{4}\left(\frac{25}{25}\right) = \frac{75}{100} = 75\%$	$\frac{1}{10} = \frac{10}{100} = 0.1 = 10\%$ $\frac{3}{10} = \frac{30}{100} = 0.3 = 30\%$ $\frac{5}{10} = \frac{50}{100} = 0.5 = 50\%$ Conversion strategy: Think: $\frac{3}{10} = \frac{30}{100}$, so $0.3 = 0.30 = 30\%$	$\frac{1}{25} = \frac{4}{100} = 0.04 = 4\%$ $\frac{16}{25} = \frac{64}{100} = 0.64 = 64\%$ $\frac{9}{50} = \frac{18}{100} = 0.18 = 18\%$ Conversion strategy: Think: 25(4) = 100, so $\frac{16}{25}\left(\frac{4}{4}\right) = \frac{64}{100} = 64\%$
$\frac{3}{20} = \frac{15}{100} = 0.15 = 15\%$ $\frac{13}{20} = \frac{65}{100} = 0.65 = 65\%$ $\frac{19}{20} = \frac{95}{100} = 0.95 = 95\%$ Conversion strategy: Think: 20 nickels in a dollar $\frac{1}{20}$ of a dollar is \$0.05	$\frac{1}{5} = \frac{2}{10} = 0.2 = 20\%$ $\frac{2}{5} = \frac{4}{10} = 0.4 = 40\%$ $\frac{3}{5} = \frac{6}{10} = 0.6 = 60\%$ $\frac{4}{5} = \frac{8}{10} = 0.8 = 80\%$ Conversion strategy: Think: If I know tenths, I can easily convert to hundredths.	$\frac{1}{8} = \frac{12.5}{100} = 0.125 = 12.5\%$ $\frac{3}{8} = \frac{37.5}{100} = 0.375 = 37.5\%$ $\frac{5}{8} = \frac{62.5}{100} = 0.625 = 62.5\%$ $\frac{7}{8} = \frac{87.5}{100} = 0.875 = 87.5\%$ Conversion strategy: Think: $\frac{1}{4} = \frac{25}{100}$, so half of $\frac{1}{4}$ is $\frac{1}{8} = \frac{12.5}{100}$ $= 12.5\%$

Using "Chunking Strategies" to Find Percents of Numbers	
We use the word "chunking" to describe a process of decomposing and composing numbers to make calculations easier, especially when done mentally. Another way to describe this is "taking numbers apart and putting them back together." For example, if adding 17 and 26, we might decompose each number into tens and ones, adding 10 + 20 = 30, and 7 + 6 = 13, and finalizing the sum by adding 30 + 13 = 43.	
Think	**Example**
Finding 100% of something is the same as finding all of it.	100% of \$80 = \$80 100% \$80
Finding 50% of something is the same as finding half of it. This is the same as multiplying by $\frac{1}{2}$ or dividing by 2.	50% of \$80 = $\frac{1}{2}$ (\$80) = \$40 \$80 ÷ 2 = \$40 50% | 50% \$80
Finding 25% of something is the same as finding one-fourth of it. This is the same as multiplying by $\frac{1}{4}$ or dividing by 4.	25% of \$80 = $\frac{1}{4}$ (\$80) = \$20 \$80 ÷ 4 = \$20 25% | 25% | 25% | 25% \$80
Finding 10% of something is the same as finding one-tenth of it. This is the same as multiplying by $\frac{1}{10}$ or dividing by 10.	10% of \$80 = $\frac{1}{10}$ (\$80) = \$8 \$80 ÷ 10 = \$8
Finding 1% of something is the same as finding one-hundredth of it. This is the same as multiplying by $\frac{1}{100}$ or dividing by 100.	1% of \$80 = $\frac{1}{100}$ (\$80) = \$0.80 \$80 ÷ 100 = \$0.80
Finding 20% of something is the same as doubling 10% of it.	20% of \$80 = 2(\$8) = \$16
Finding 5% of something is the same as halving 10% of it.	5% of \$80 = $\frac{1}{2}$ (\$8) = \$4
Finding 15% of something is the same as adding 10% of it and 5% of it.	15% of \$80 = \$8 + \$4 = \$12

Using Multiplication to Find Percents of Numbers

Some percents are hard to find mentally. For example, finding 17% of something is the same as finding $\frac{17}{100} = 0.17$ of it. In this case, it may be easier to find the percent by using the definition of a percent of a number: A percent of a number is the product of the percent and the number.

Find 17% of $80.

Strategy 1: Use fractions

$$\frac{17}{100} \bullet 80 = \frac{17 \bullet 80}{100} = \frac{1360}{100} = 13.60$$

So 17% of $80 is $13.60.

Strategy 2: Use decimals

$(0.17) \bullet (80) = 13.6$ or 13.60
So 17% of $80 is $13.60.

Percent Increase

Percent increases occur frequently as tips, taxes, and price markups. To find a percent increase, find the amount of the increase and add it to the original quantity.

Example	Original amount	Percent increase	Amount of increase	New amount (original + increase)
Leave a **tip** on a restaurant bill.	$40	20%	20% of $40 = $8	$40 + $8 = $48
Pay **tax** on a clothes purchase.	$50	8%	8% of $50 = $4	$50 + $4 = $54
Pay a **markup** on a video game.	$75	10%	10% of $75 = $7.50	$75 + $7.50 = $82.50

Percent Decrease

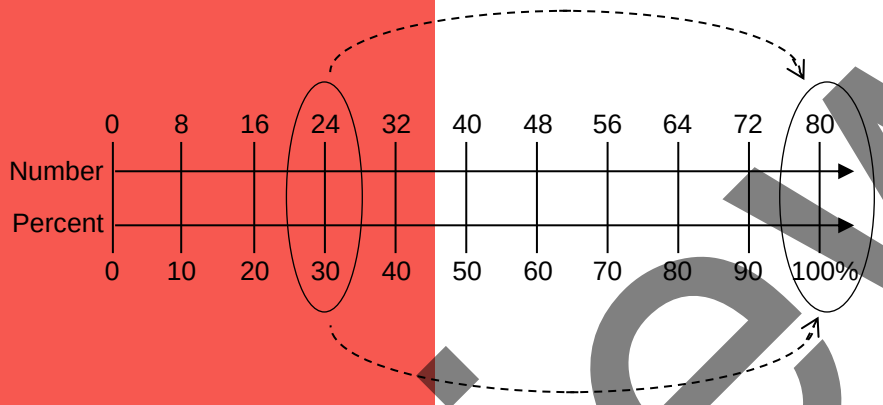
Percent decreases occur frequently as sales and discounts. To find a percent decrease, find the amount of the decrease and subtract it from the original quantity.

Example	Original amount	Percent decrease	Amount of decrease	New amount (original – decrease)
Sale on shoes purchase	$50	25%	25% of $50 = $12.50	$50 – $12.50 = $37.50
Discount on a dress	$90	40%	40% of 90 = $36.00	$90 – $36 = $54

Using Double Number Lines to Solve a Percent Problem: 30% of 80 is what amount?

Strategy 1: Solve on the double number line.

Create a double number line with percents represented in increments of 10% on the bottom line, and the whole number represented in increments on the top. Since the whole is 80 (in this case), count by 8s for the increments (80 ÷ 10 = 8).



Since 30% corresponds to 24 on the double number line, 30% of 80 is 24.

Strategy 2: Identify equivalent ratios on the double number line.

Create equations based on the part to whole ratio relationships.

$$\frac{\text{part}_{number}}{\text{whole}_{number}} = \frac{\text{part}_{percent}}{\text{whole}_{percent}}$$

$$\frac{\boxed{24}}{80} = \frac{30}{100}$$

This equivalence is based on the dotted arrows above.

Create equations based on the part to part ratio relationships.

$$\frac{\text{part}_{number}}{\text{part}_{percent}} = \frac{\text{whole}_{number}}{\text{whole}_{percent}}$$

$$\frac{\boxed{24}}{30} = \frac{80}{100}$$

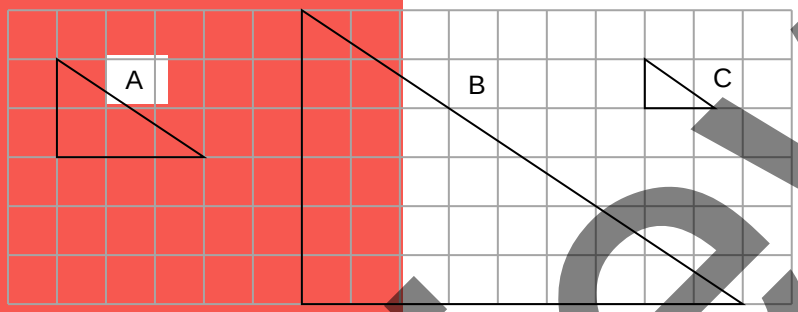
This equivalence is based on the circles above.

Scale Factors

Consider triangle A as the original figure.

To make Triangle B below, multiply each dimension of Triangle A by a scale factor of 3. Triangle B is a 300% enlargement of Triangle A. An enlargement is created when multiplying by a scale factor greater than 1.

To make Triangle C below, multiply each dimension of Triangle A by a scale factor of $\frac{1}{2}$. Triangle C is a 50% reduction of Triangle A. A reduction is created when multiplying by a scale factor between 0 and 1.



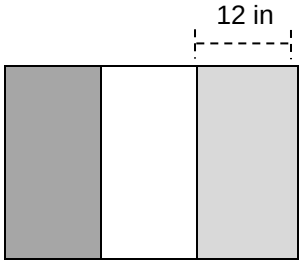
Scale Drawings

The flag of Italy is composed of three stripes (green, white, and red) that divide the flag into thirds. Pictured below is a scale drawing of the flag.

Suppose the original flag is 3 feet by 2 feet, and the scale drawing is 1.5 inches by 1 inch.

This scale may be represented as a ratio:

1.5 in	:	3 ft	→	1.5 in	:	36 in
1 in	:	2 ft	→	1 in	:	24 in
				1	:	24



The scale drawing is a reduction of the flag. The scale factor (value of the ratio) that produces this reduction is $\frac{1}{24}$. In other words, to obtain lengths for the drawing, multiplying the corresponding actual lengths by $\frac{1}{24}$.

COMMON CORE STATE STANDARDS

STANDARDS FOR MATHEMATICAL CONTENT	
7.RP.A	**Analyze proportional relationships and use them to solve real-world and mathematical problems.**
7.RP.2	Recognize and represent proportional relationships between quantities:
c	Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn*.
7.RP.3	Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*
7.NS.A	**Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.**
7.NS.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
7.EE.A	**Use properties of operations to generate equivalent expressions.**
7.EE.2	Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."*
7.EE.B	**Solve real-life and mathematical problems using numerical and algebraic expressions and equations.[1]**
7.EE.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*
7.G.A	**Draw, construct and describe geometrical figures and describe the relationships between them.**
7.G.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

STANDARDS FOR MATHEMATICAL PRACTICE	
SMP1	Make sense of problems and persevere in solving them.
SMP2	Reason abstractly and quantitatively.
SMP3	Construct viable arguments and critique the reasoning of others.
SMP4	Model with mathematics.
SMP5	Use appropriate tools strategically.
SMP6	Attend to precision.
SMP7	Look for and make use of structure.
SMP8	Look for and express regularity in repeated reasoning.

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