Lesson 11

# Percentage Contexts

## Goals

- Comprehend "interest," "markup," "markdown," and "commission" as other contexts that involve adding or subtracting a percentage of the initial amount.
- Determine the original dollar amount before a markup, markdown, or commission.
- Explain (orally) how to calculate the new dollar amount after a markup, markdown, or commission.

## Learning Target

I understand and can solve problems about commission, interest, markups, and discounts.

## Lesson Narrative

In this lesson, students are introduced to more applications of percent increase and decrease: interest, markups, discounts, and commissions. It is not necessary for students to memorize the meanings of these terms. The goal is for students to see that there are many different ways that percent increase and decrease are applied to money in the real world. In this lesson students practice finding:

- The new amount after the increase or decrease.
- The percentage that the increase or decrease is of the original amount.

As students make sense of what various percentages refer to in the context of a real-world situation, they reason abstractly and quantitatively.

## Student Learning Goal

Let's learn about more situations that involve percentages.

### Access for Students with Diverse Abilities

- Representation (Activity 1, Activity 2)

### Access for Multilingual Learners

- MLR8: Discussion Supports (Activity 1, Activity 2)

### Instructional Routines

- 5 Practices
- Card Sort
- MLR8: Discussion Supports
- Take Turns

### Required Materials

**Materials to Gather**

- Math Community Chart: Activity 1
- Four-function calculators: Activity 2

**Materials to Copy**

- Percentage Situations Cards (1 copy for every 2 students): Activity 1

### Required Preparation

**Lesson:**
It is recommended that students be provided access to four-function calculators so that they can focus on reasoning about how numbers are related to each other, representing those relationships, and deciding which operations are appropriate (rather than focusing on computation).

## Lesson Timeline

| Warm-up | Activity 1 | Activity 2 | Lesson Synthesis | Assessment: Cool-down |
|---|---|---|---|---|
| 5 min | 20 min | 10 min | 10 min | 5 min |

## Warm-up
## Leaving a Tip

5 min

### Activity Narrative

The purpose of this *Warm-up* is to help students connect their current work with percentage contexts to their prior work on efficient ways of finding percent increase.

### Launch

Consider telling students that these questions may have more than one correct answer. Arrange students in groups of 2.

Give 2 minutes of quiet think time followed by partner discussion.

Then hold a whole-class discussion.

### Student Task Statement

Which of these expressions represent a 15% tip on a $20 meal? Which represent the total bill?

**A.** $15 \cdot 20$

**B.** $20 + 0.15 \cdot 20$

**C.** $1.15 \cdot 20$

**D.** $\frac{15}{100} \cdot 20$

The last expression represents the tip, while the second and third expressions represent the total bill.

### Activity Synthesis

For each expression, ask a few students to explain whether they think it represents the total bill, the tip, or neither. For each expression, select a student to explain their reasoning. Invite other students to share whether they agree or disagree and why, or how they might explain it differently.

## Activity 1
## Card Sort: Percentage Situations

20 min

### Activity Narrative

In this partner activity, students take turns matching situations to terms that describe applications of percent increase and decrease: sales tax, interest, gratuity/tip, markdown/discount, markup, commission, and depreciation. The situations are written on slips of paper and the terms are listed on a sorting mat.

It is not necessary for students to memorize the meanings of all these financial terms. The goal is for students to see that there are many different ways that percent increase and decrease are applied to money in the real world. As students trade roles explaining their thinking and listening, they have opportunities to explain their reasoning and critique the reasoning of others.

**Instructional Routines**

**Card Sort**

**ilclass.com/r/10783726**

Please log in to the site before using the QR code or URL.

**Instructional Routines**

**MLR8: Discussion Supports**

**ilclass.com/r/10695617**

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**Instructional Routines**

**Take Turns**

**ilclass.com/r/10573524**

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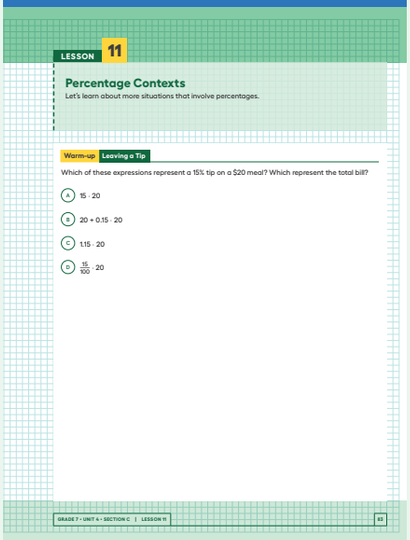
**Student Workbook**


LESSON 11

Percentage Contexts

Let's learn about more situations that involve percentages.

Warm-up Leaving a Tip

Which of these expressions represent a 15% tip on a $20 meal? Which represent the total bill?

A. $15 \cdot 20$

B. $20 + 0.15 \cdot 20$

C. $1.15 \cdot 20$

D. $\frac{15}{100} \cdot 20$

**Access for Students with Diverse Abilities (Activity 1, Student Task)**

**Representation: Access for Perception.**

Ask students to read the situations aloud to their partner. Students who both listen to and read the information will benefit from extra processing time.

*Supports accessibility for: Language, Attention*

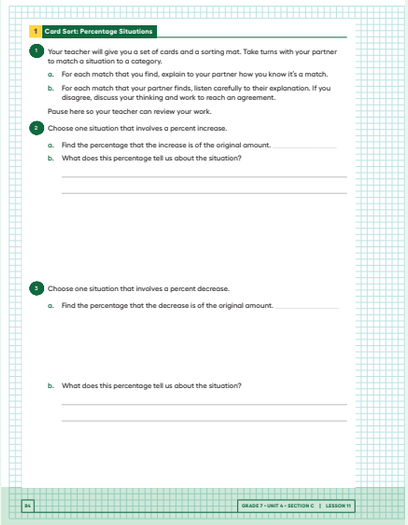
**Access for Multilingual Learners (Activity 1, Student Task)**

**MLR8: Discussion Supports.**

Students should take turns finding a match and explaining their reasoning to their partner. Display the following sentence frame for all to see: "I noticed _____ , so I matched ..." Encourage students to challenge each other when they disagree.

*Advances: Reading, Conversing*

**Student Workbook**



1 Card Sort: Percentage Situations

1. Your teacher will give you a set of cards and a sorting mat. Take turns with your partner to match a situation to a category.
   a. For each match that you find, explain to your partner how you know it's a match.
   b. For each match that your partner finds, listen carefully to their explanation. If you disagree, discuss your thinking and work to reach an agreement.

Pause here so your teacher can review your work.

2. Choose one situation that involves a percent increase.
   a. Find the percentage that the increase is of the original amount.
   b. What does this percentage tell us about the situation?

3. Choose one situation that involves a percent decrease.
   a. Find the percentage that the decrease is of the original amount.
   b. What does this percentage tell us about the situation?

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## Launch

### Math Community

Display the Math Community Chart for all to see. Give students a brief quiet think time to read the norms, or invite a student to read them out loud. Tell students that during this activity they are going to practice looking for their classmates putting the norms into action. At the end of the activity, students can share what norms they saw and how the norm supported the mathematical community during the activity.

Display the sorting mat for all to see. Consider reading the terms aloud and inviting students to chorally repeat them. However, it is not necessary to explain the meaning of the terms at this time. Tell students that each situation matches one of the terms on the mat. Some of the terms match more than one situation.

Explain how to set up and do the activity. If time allows, demonstrate the steps with a student as a partner. Consider demonstrating productive ways to agree or disagree, for example, by explaining mathematical thinking or asking clarifying questions.

Arrange students in groups of 2. Give each group a sorting mat and a set of slips cut from the blackline master.

Give students 5–6 minutes of partner work time to sort the slips.

When each group finishes sorting, check their work, and let them know which slips, if any, need to be revised. When their sorting is correct, instruct students to answer the rest of the questions.

### Student Task Statement

1. Your teacher will give you a set of cards and a sorting mat. Take turns with your partner to match a situation to a category.
   - **a.** For each match that you find, explain to your partner how you know it's a match.
   - **b.** For each match that your partner finds, listen carefully to their explanation. If you disagree, discuss your thinking and work to reach an agreement.

Sales Tax:

- "Lin bought a picture book ..."

Gratuity/Tip:

- "Kiran ate breakfast ..."

Markup:

- "A car dealership paid ..."

Depreciation:

- "Elena's neighbors paid ..."

Interest:

- "Andre is saving money ..."
- "Clare's aunt used a credit card ... "

Markdown/Discount:

- "Tyler bought a shirt …"
- "Priya used a coupon …"

Commission:

- "Diego's uncle sells computers …"
- "For each $50 gym membership …"

Pause here so your teacher can review your work.

**2.** Choose one situation that involves a percent increase.

**a.** Find the percentage that the increase is of the original amount.

**b.** What does this percentage tell us about the situation?

Sample responses:

- Lin's sales tax is $7.\overline{3}\%$ of the price of the book.
- Andre's interest is 3% of his starting balance.
- Clare's aunt's interest is 1.5% of the account balance.
- Kiran's tip is about 15.4% of the price of the meal.
- The car dealership's markup is 50% of their cost.

**3.** Choose one situation that involves a percent decrease.

**a.** Find the percentage that the decrease is of the original amount.

**b.** What does this percentage tell us about the situation?

Sample responses:

- Tyler's discount was 25% of the regular price.
- Priya's discount was 10% of the regular price.
- Diego's uncle's commission was 20% of the total sale.
- The gym employee's commission is 16% of the membership fee.
- Elena's neighbors lost 30% of the original price due to depreciation.

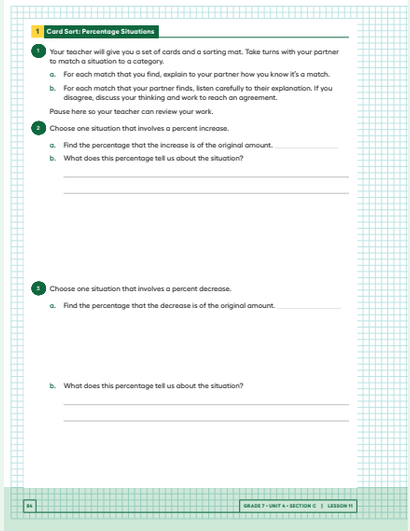
## Activity Synthesis

Invite students to share which situations they sorted under each word. Ask them:

- *"What made you decide to put these situations under this descriptor?"*
- *"Were there any situations that you were really unsure of? What made you decide on where to sort them?"*

Invite students to share their sentences describing what the percent increase or decrease told us about the situation. If they do not specify what amount corresponds to 100%, ask them to revise their sentence to add in that information. For example, if a student says "Andre's interest was 3%," they could rephrase this as "Andre's interest was 3% of his starting balance."

**Student Workbook**



1 Card Sort: Percentage Situations

1. Your teacher will give you a set of cards and a sorting mat. Take turns with your partner to match a situation to a category.
   a. For each match that you find, explain to your partner how you know it's a match.
   b. For each match that your partner finds, listen carefully to their explanation. If you disagree, discuss your thinking and work to reach an agreement.

   Pause here so your teacher can review your work.
2. Choose one situation that involves a percent increase.
   a. Find the percentage that the increase is of the original amount. _____
   b. What does this percentage tell us about the situation?

3. Choose one situation that involves a percent decrease.
   a. Find the percentage that the decrease is of the original amount. _____
   b. What does this percentage tell us about the situation?

**Instructional Routines**

**5 Practices**

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**Instructional Routines**

**MLR8: Discussion Supports**

**ilclass.com/r/10695617**

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Answer students' remaining questions about any of these contexts. Tell students there is a chart at the end of the lesson that they can use as a reference tool during future lessons. The key takeaway is that these are all different ways that percent increase or percent decrease are applied to money in the real world.

| | paid to: | how it works: |
|---|---|---|
| sales tax | the government | added to the price of the item |
| gratuity (tip) | the server | added to the cost of the meal |
| interest | the lender (or account holder) | added to the balance of the loan, credit card, or bank account |
| markup | the seller | added to the price of an item so the seller can make a profit |
| markdown (discount) | the customer | subtracted from the price of an item to encourage the customer to buy it |
| depreciation | the buyer | subtracted from the price of an item as the item gets older |
| commission | the salesperson | subtracted from the payment the store collects |

### Math Community

Conclude the discussion by inviting 2–3 students to share a norm they identified in action. Provide this sentence frame to help students organize their thoughts in a clear, precise way:

- "I noticed our norm '_____' in action today, and it really helped me/my group because _____."

## Activity 2

## A Car Dealership

10 min

### Activity Narrative

In this activity, students apply their understanding of percent increase and decrease to a context involving markup and markdown. They see that a 32% increase followed by a 10% decrease of that new amount does not result in a 22% increase of the original amount. As students relate the percentages to the quantities they represent, they reason abstractly and quantitatively.

Monitor for students who use these different strategies to calculate the discounted price of the car:

- Create a diagram to represent the situation.
- Multiply the retail price by 0.1, and then subtract this amount.
- Multiply the retail price by 0.9.
- Multiply the wholesale price by 1.22.

Plan to have students present in this order to support moving them from the more concrete to the more abstract and efficient. Note that the last strategy on the list incorrectly oversimplifies the situation.

## Launch

Arrange students in groups of 2.

Give students 5 minutes of quiet work time followed by time for partner discussion.

Then hold a whole-class discussion.

If needed, explain to students that profit is the amount of markup from the wholesale price of an item to the retail price of an item. The profit can be expressed as a percentage of the wholesale price.

Select students who used each strategy described in the *Activity Narrative* to share later. Aim to elicit both key mathematical ideas and a variety of student voices, especially from students who haven't shared recently.

### Student Task Statement

A car dealership pays a wholesale price of $12,000 to purchase a vehicle.

1. The car dealership wants to make a 32% profit.
   a. By how much will they mark up the price of the vehicle?

      $3,840, because 0.32 • 12,000 = 3,840

   b. After the markup, what is the retail price of the vehicle?

      $15,840, because 12,000 + 3,840 = 15,840 (or 1.32 • 12,000 = 15,840)
2. During a special sales event, the dealership offers a 10% discount off of the retail price.
   a. After the discount, how much will a customer pay for this vehicle?

      $14,256, because 0.9 • 15,840 = 14,256

   b. After the discount, what percent profit will the dealership make?

      18.8%, because 14,256 ÷ 12,000 = 1.188

### Are You Ready for More?

This car dealership pays the salesperson a bonus for selling the car equal to 6.5% of the sale price. How much commission did the salesperson lose when they decided to offer a 10% discount on the price of the car?

$102.96 (Before the discount, the salesperson would have earned a bonus of $1,029.60. After the discount, the salesperson only earned $926.64, so the salesperson lost $102.96.)

### Access for Students with Diverse Abilities (Activity 2, Student Task)

**Representation: Develop Language and Symbols.**

Support understanding of the problem, by inviting students to act it out. For example, have students enact the roles of the wholesaler, dealership, and customer by exchanging a toy car as well as different amounts of play money.

*Supports accessibility for: Conceptual Processing, Language*

### Access for Multilingual Learners (Activity 2, Student Task)

**MLR8: Discussion Supports.**

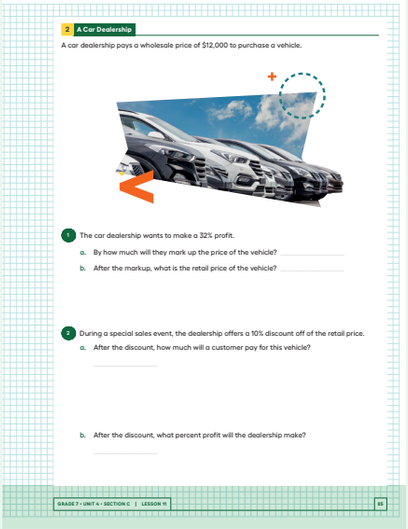
Use multimodal examples to show the meaning of monetary terms like "wholesale price," "retail price," and "sale price." Use verbal descriptions along with gestures, drawings, or concrete objects to show the relationships between these terms and other terms that students are already familiar with, such as "markup" and "discount."

*Advances: Listening, Representing*

### Building on Student Thinking

Throughout this activity, it is important that students attend to the meanings of particular words and remain clear on the meaning of the different values they find. For example, "wholesale price," "retail price," and "sale price" all refer to specific dollar amounts. Help students organize their work by labeling the different quantities they find or creating a graphic organizer.

**Student Workbook**



2 A Car Dealership

A car dealership pays a wholesale price of $12,000 to purchase a vehicle.

1. The car dealership wants to make a 32% profit.
   a. By how much will they mark up the price of the vehicle? _____
   b. After the markup, what is the retail price of the vehicle? _____

2. During a special sales event, the dealership offers a 10% discount off of the retail price.
   a. After the discount, how much will a customer pay for this vehicle?
   b. After the discount, what percent profit will the dealership make?

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## Activity Synthesis

The purpose of this discussion is to compare different strategies for finding the sale price after both a markup and a markdown. Invite previously selected students to share how they found the price the customer pays for the car. Sequence the discussion of the strategies in the order listed in the *Activity Narrative*. If possible, record and display the students' work for all to see.

Connect the different responses to the learning goals by asking questions, such as:

- *"How does the 10% discount show up in each method?"*
- *"Why do the different approaches lead to the same outcome?"*
- *"Are there any benefits or drawbacks to one strategy compared to another?"*

The key takeaway is that finding 90% of the retail price is equivalent to—and more efficient than—calculating the 10% discount and then subtracting that amount from the retail price.

If a student tried to find the sale price by calculating 122% of the wholesale price, ask

- *"Why does this approach lead to a different outcome?"*

If no student tried to find the sale price by calculating 122% of the wholesale price, consider asking

- *"Jada thought that the final markup percentage would be 22%, because 32 – 10 = 22. Why is this incorrect?"*

## Lesson Synthesis

Share with students,

- *"Today we studied lots of different situations where people use percentages."*

To review the new contexts, consider asking students:

- *"What are some situations in life in which people encounter percentages?"*
- *"Give examples of situations where you would encounter tax, tip, markup, markdown, commission."*

  buying things; eating at a restaurant; a company wants to make money; a store is having a sale; a salesperson sells something

- *"When an item is marked down 10%, why does it make sense to multiply the price by 0.9?"*

  Since there is 10% off of the price, the new cost is 90% of the original.

- *"When an item is marked up 25%, why does it make sense to multiply the price by 1.25?"*

  Since the item now costs 100% plus an extra 25%, the new item costs 1.25 times the original.

## Lesson Summary

There are many everyday situations where a percentage of an amount of money is added to or subtracted from that amount in order to be paid to some other person or organization:

| | goes to | how it works |
|---|---|---|
| sales tax | the government | added to the price of the item |
| gratuity (tip) | the server | added to the cost of the meal |
| interest | the lender (or account holder) | added to the balance of the loan, credit card, or bank account |
| markup | the seller | added to the price of an item so the seller can make a profit |
| markdown (discount) | the customer | subtracted from the price of an item to encourage the customer to buy it |
| commission | the salesperson | subtracted from the payment that is collected |

For example,

- If a restaurant bill is $34 and the customer pays $40, they left $6 dollars as a tip for the server. That is 18% of $34, so they left an 18% tip. From the customer's perspective, this can be thought of as an 18% increase of the restaurant bill.
- If a realtor helps a family sell their home for $200,000 and earns a 3% commission, then the realtor makes $6,000, because $(0.03) \cdot 200{,}000 = 6{,}000$, and the family gets $194,000, because $200{,}000 - 6{,}000 = 194{,}000$. From the family's perspective, this can be thought of as a 3% decrease on the sale price of the home.

## Cool-down

## The Cost of a Bike

5 min

The purpose of this activity is to check whether students can solve a problem involving a markup and a discount.

## Student Task Statement

The bike store marks up the wholesale cost of all of the bikes they sell by 30%.

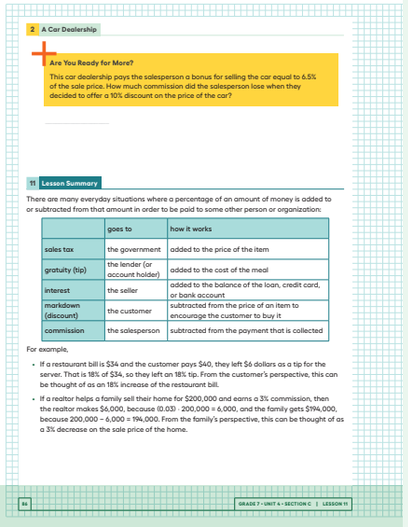
1. Andre wants to buy a bike that has a price tag of $125. What was the wholesale cost of this bike?

   $96.15 (125 ÷ 1.3 = 96.15)

2. If the bike is discounted by 20%, how much will Andre pay (before tax)?

   $100 (125 · 0.8 = 100)

## Student Workbook



2 A Car Dealership

Are You Ready for More?

This car dealership pays the salesperson a bonus for selling the car equal to 6.5% of the sale price. How much commission did the salesperson lose when they decided to offer a 10% discount on the price of the car?

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## Responding To Student Thinking

**Points to Emphasize**

If students struggle with solving problems involving markup and discount, plan to review this concept as opportunities arise over the next several lessons. For example, multiple students to share their thinking about the situations in this activity:

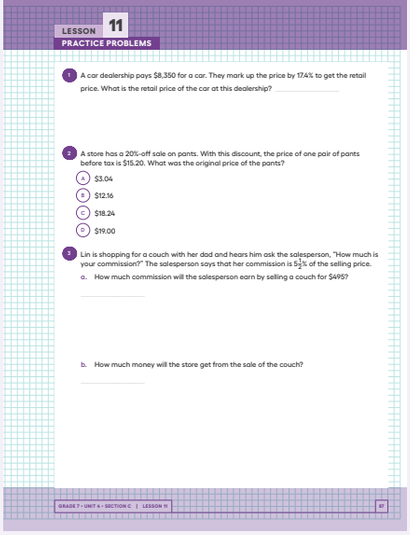
Grade 7, Unit 4, Lesson 12, Activity 1 Info Gap: Sporting Goods

Lesson 11

## Practice Problems

5 Problems

Student Workbook



LESSON 11
PRACTICE PROBLEMS

1. A car dealership pays $8,350 for a car. They mark up the price by 17.4% to get the retail price. What is the retail price of the car at this dealership?

2. A store has a 20%-off sale on pants. With this discount, the price of one pair of pants before tax is $15.20. What was the original price of the pants?
   - A. $3.04
   - B. $12.16
   - C. $18.24
   - D. $19.00

3. Lin is shopping for a couch with her dad and hears him ask the salesperson, "How much is your commission?" The salesperson says that her commission is $5\frac{1}{2}$% of the selling price.
   a. How much commission will the salesperson earn by selling a couch for $495?

   b. How much money will the store get from the sale of the couch?

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### Problem 1

A car dealership pays $8,350 for a car. They mark up the price by 17.4% to get the retail price. What is the retail price of the car at this dealership?

$9802.90 (although most dealerships round to the nearest 5 or 10)

### Problem 2

A store has a 20%-off sale on pants. With this discount, the price of one pair of pants before tax is $15.20. What was the original price of the pants?

**A.** $3.04

**B.** $12.16

**C.** $18.24

**D.** $19.00

### Problem 3

Lin is shopping for a couch with her dad and hears him ask the salesperson, "How much is your commission?" The salesperson says that her commission is $5\frac{1}{2}$% of the selling price.

**a.** How much commission will the salesperson earn by selling a couch for $495?

$27.23

**b.** How much money will the store get from the sale of the couch?

$467.77

## Problem 4

from Unit 4, Lesson 9

A college student takes out a $7,500 loan from a bank. What will the balance of the loan be after one year (assuming the student has not made any payments yet):

**a.** if the bank charges 3.8% interest each year?

$7,785.00

**b.** if the bank charges 5.3% interest each year?

$7,897.50

## Problem 5

from Unit 4, Lesson 5

Match the situations with the equations.

| | | |
|---|---|---|
| 4 | **A.** Mai slept for $x$ hours, and Kiran slept for $\frac{1}{10}$ less than that. | **1.** $y = 2.33x$ |
| 3 | **B.** Kiran practiced the piano for $x$ hours, and Mai practiced for $\frac{2}{5}$ less than that. | **2.** $y = 1.375x$ |
| 1 | **C.** Mai drank $x$ oz of juice, and Kiran drank $\frac{4}{3}$ more than that. | **3.** $y = 0.6x$ |
| 5 | **D.** Kiran spent $x$ dollars, and Mai spent $\frac{1}{4}$ less than that. | **4.** $y = 0.9x$ |
| 8 | **E.** Mai ate $x$ grams of almonds, and Kiran ate 1.5 times more than that. | **5.** $y = 0.75x$ |
| 7 | **F.** Kiran collected $x$ pounds of recycling, and Mai collected $\frac{3}{10}$ less than that. | **6.** $y = 1.6x$ |
| 2 | **G.** Mai walked $x$ kilometers, and Kiran walked $\frac{3}{8}$ more than that. | **7.** $y = 0.7x$ |
| 6 | **H.** Kiran completed $x$ puzzles, and Mai completed $\frac{3}{5}$ more than that. | **8.** $y = 2.5x$ |

**Student Workbook**


11 Practice Problems

4 from Unit 4, Lesson 9
A college student takes out a $7,500 loan from a bank. What will the balance of the loan be after one year (assuming the student has not made any payments yet):
a. if the bank charges 3.8% interest each year?
b. if the bank charges 5.3% interest each year?

5 from Unit 4, Lesson 5
Match the situations with the equations.
A Mai slept for $x$ hours, and Kiran slept for $\frac{1}{10}$ less than that.
B Kiran practiced the piano for $x$ hours, and Mai practiced for $\frac{2}{5}$ less than that.
C Mai drank $x$ oz of juice, and Kiran drank $\frac{4}{3}$ more than that.
D Kiran spent $x$ dollars, and Mai spent $\frac{1}{4}$ less than that.
E Mai ate $x$ grams of almonds, and Kiran ate 1.5 times more than that.
F Kiran collected $x$ pounds of recycling, and Mai collected $\frac{3}{10}$ less than that.
G Mai walked $x$ kilometers, and Kiran walked $\frac{3}{8}$ more than that.
H Kiran completed $x$ puzzles, and Mai completed $\frac{3}{5}$ more than that.
1 $y = 2.33x$
2 $y = 1.375x$
3 $y = 0.6x$
4 $y = 0.9x$
5 $y = 0.75x$
6 $y = 1.6x$
7 $y = 0.7x$
8 $y = 2.5x$

Learning Targets
+ I understand and can solve problems about commission, interest, markups, and discounts.

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