

wants to install the new splashpad?

22. Mitena is enrolled in a movie appreciation course. There are 84 students (including Mitena) in the course. After having the students fill out a survey, the professor informs the students that 45.2% chose horror as their favorite movie genre. How many students in Mitena's class chose horror as their favorite movie genre? Round off to the nearest integer.
23. Jady's dorm has a "Rick and Morty night" every Wednesday during the semester. One Wednesday, 27 students from the dorm come to watch the TV show Rick and Morty. Jady knows this is 30% of the dorm's residents. How many students reside in the dorm?
24. **Percent Error.** When performing a scientific experiment that results in quantities of some sort, such as mass in chemistry or momentum in physics, the percent error is often computed. Percent error, $\%E$, is the percent by which the value obtained in an experiment, the observed value O , is different than the value that was expected, the expected value E , in the experiment. The formula is below.
- $$\%E = \frac{|O-E|}{E}$$
- Jim and Kelly are working on a chemistry experiment and expect the result to be 50 grams. However, their result was 48.7 grams. Find Jim and Kelly's percent error.
25. **Percent Error.** See Exercise 24 for the definition of percent error. Hailey and Elsbeth are using an experiment to determine Earth's gravity. The expected value is 9.807 m/s^2 . Their experiment gives them a value of 9.457 m/s^2 . Find the percent error for Hailey and Elsbeth's experiment.

6.2 Discounts, Markups, and Sales Tax



Figure 6.3 Sale prices are often described as percent discounts. (credit: "Close-up of a discount sign" by Ivan Radic/Flickr, CC BY 2.0)

Learning Objectives

After completing this section, you should be able to:

1. Calculate discounts.
2. Solve application problems involving discounts.
3. Calculate markups.
4. Solve application problems involving markups.
5. Compute sales tax.
6. Solve application problems involving sales tax.

Many people first encounter percentages during a retail transaction such as a percent discount (SALE! 25% off!), or through sales tax ("Wait, I thought this was \$1.99?"), a report that something has increased by some percentage of the previous value (NOW! 20% more!!). These are examples of percent decreases and percent increases. In this section, we

discuss decrease, increase, and then the case of sales tax.

Calculating Discounts

Retailers frequently hold sales to help move merchandise. The sale price is almost always expressed as some amount off the original price. These are **discounts**, a reduction in the price of something. The price after the discount is sometimes referred to as the reduced price or the sale price.

When a reduction is a percent discount, it is an application of percent, which was introduced in [Understanding Percent](#). The formula used was $\text{part} = \text{percentage} \times \text{total}$. In a discount application, the discount plays the role of the part, the percent discount is the percentage, and the original price plays the role of the total.

FORMULA

The formula for a discount based on a percentage is $\text{discount} = \text{percent discount} \times \text{original price}$, with the percent discount expressed as a decimal. The price of the item after the discount is $\text{sale price} = \text{original price} - \text{discount}$.

These are often combined into the following formula

$$\text{sale price} = \text{original price} - \text{percent discount} \times \text{original price} = \text{original price} \times (1 - \text{percent discount})$$

When the original price and the percent discount are known, the discount and the sale price can be directly computed.

EXAMPLE 6.10

Calculating Discount for a Percent Discount

Calculate the discount for the given price and discount percentage. Then calculate the sale price.

1. Original price = \$75.80; percent discount is 25%
2. Original price = \$168.90; percent discount is 30%

✓ Solution

1. Substituting the values into the formula $\text{discount} = \text{percent discount} \times \text{original price}$, we find that the discount is $\text{discount} = 0.25 \times 75.80 = 18.95$. The discount is \$18.95.
The sale price of the item is then $\text{sale price} = \text{original price} - \text{discount} = 75.80 - 18.95 = 56.85$, or \$56.85.
2. Substituting the values into the formula $\text{discount} = \text{percent discount} \times \text{original price}$, we find that the discount is $\text{discount} = 0.30 \times 168.90 = 50.67$. The discount is \$50.67.
The sale price of the item is then $\text{sale price} = \text{original price} - \text{discount} = 168.90 - 50.67 = 118.23$, or \$118.23.

> YOUR TURN 6.10

Calculate the discount for the given original price and discount percentage. Then calculate the sale price.

1. Original price = \$1,550.00; percent discount is 32%
2. Original price = \$27.50; percent discount is 10%

Sometimes the original price and the sale price of an item is known. From this, the percent discount can be computed using the formula $\text{discount} = \text{percent discount} \times \text{original price}$, by solving for the percent discount.

EXAMPLE 6.11

Calculating the Percent Discount from the Original and Sale Prices

Determine the percent discount based on the given original and sale prices.

1. Original price = \$1,200.00; sale price = \$900.00
2. Original price = \$36.70; sale price = \$29.52

✓ **Solution**

- Step 1.** Find the discount. Using the original price and the sale price, we can find the discount with the formula $\text{sale price} = \text{original price} - \text{discount}$. Substituting and calculating, we find the discount to be $900.00 = 1,200.00 - \text{discount}$. Solving for the discount gives \$300.00.

Step 2. Find the percent discount. Substituting the discount of \$300.00 and the original price of \$1,200.00, into the formula $\text{discount} = \text{percent discount} \times \text{original price}$, we can find the percent discount.

$$\begin{aligned} 300.00 &= \text{percent discount} \times 1,200.00 \\ \frac{300.00}{1,200.00} &= \text{percent discount} \\ 0.25 &= \text{percent discount} \end{aligned}$$

Converting to percent form, the percent discount is 25%.

- Step 1.** Find the discount. Using the original price and the sale price, we can find the discount with the formula $\text{sale price} = \text{original price} - \text{discount}$. Substituting and calculating, we find the discount to be $29.52 = 36.70 - \text{discount}$. Solving for the discount gives \$7.38.

Step 2. Find the percent discount. Substituting the discount of \$7.38 and the original price of \$36.70, into the formula $\text{discount} = \text{percent discount} \times \text{original price}$, we can find the percent discount.

$$\begin{aligned} 29.52 &= \text{percent discount} \times 36.70 \\ \frac{29.52}{36.70} &= \text{percent discount} \\ 0.2 &= \text{percent discount} \end{aligned}$$

Converting to percent form, the percent discount is 20%.

> **YOUR TURN 6.11**

Determine the percent discount based on the given original and sale prices.

- Original price = \$250.00; sale price = \$162.50
- Original price = \$19.50; sale price = \$17.16

Sometimes the sale price and the percent discount of an item are known. From this, the original price can be found. To avoid multiple steps, though, the formula that we will use is $\text{sale price} = \text{original price} \times (1 - \text{percent discount})$. The original price can be found by solving this equation for the original price.

EXAMPLE 6.12

Calculating the Original Price from the Percent Discount and Sale Price

Determine the original price based on the percent discount and sale price.

- Percent discount 10%; sale price = \$450.00
- Percent discount 75%, sale price = \$90.00

✓ **Solution**

- Using the percent discount and the sale price, we can find the original price with the formula $\text{sale price} = \text{original price} \times (1 - \text{percent discount})$. Substituting and solving for the original price, we find

$$\begin{aligned} \text{sale price} &= \text{original price} \times (1 - \text{percent discount}) \\ 450.00 &= \text{original price} \times (1 - 0.10) \\ 450.00 &= \text{original price} \times (0.90) \\ 500.00 &= \text{original price} \end{aligned}$$

The original price of the item was \$500.00.

- Using the percent discount and the sale price, we can find the original price with the formula

sale price = original price \times (1 – percent discount). Substituting and solving for the original price, we find

$$\text{sale price} = \text{original price} \times (1 - \text{percent discount})$$

$$90.00 = \text{original price} \times (1 - 0.75)$$

$$90.00 = \text{original price} \times (0.25)$$

$$360.00 = \text{original price}$$

The original price of the item was \$360.00.

YOUR TURN 6.12

Determine the original price based on the percent discount and sale price.

1. Percent discount 15%; sale price = \$11.05
2. Percent discount 9%; sale price = \$200.20

Solve Application Problems Involving Discounts

In application problems, identify what is given and what is to be found, using the terms that have been learned, such as discount, original price, percent discount, and sale price. Once you have identified those, use the appropriate formula (or formulas) to find the solution(s).

EXAMPLE 6.13

Determine Discount and New Price a Sale Rack Item

The sale rack at a clothing store is marked “All Items 30% off.” Ian finds a shirt that had an original price of \$80.00. What is the discount on the shirt? What is the sale price of the shirt?

Solution

We are asked to find the discount, and the sale price. We know the percent discount is 30%, or 0.30 in decimal form. The original price was \$80.

Substituting into the percent discount formula, we find that the discount is
 $\text{discount} = \text{percent discount} \times \text{original price} = 0.30 \times 80 = 24$.

The discount is \$24 on that shirt. The sale price is the original price minus the discount, so the sale price is $\$80 - \$24 = \$56$.

YOUR TURN 6.13

1. A bed originally priced at \$550, but is on sale, with a 60% discount. What is the discount on the bed? What is the sale price of the bed?

EXAMPLE 6.14

Determine the Percent Discount of a Bus Pass

An annual pass on the city bus is priced at \$240. The student price, though, is \$168. What is the percent discount for students for the bus pass?

Solution

We know the original price of the item, \$240. We also know the sale price of the item, \$168. From this we know the discount is $\$240 - \$168 = \$72$. Substituting these values into the formula $\text{discount} = \text{percent discount} \times \text{original price}$, we can find the percent discount.

$$\begin{aligned} \text{discount} &= \text{percent discount} \times \text{original price} \\ 72 &= \text{percent discount} \times 240 \\ \frac{72}{240} &= \frac{\text{percent discount} \times 240}{240} \\ 0.3 &= \text{percent discount} \end{aligned}$$

The student percent discount on the bus pass is 30%.

YOUR TURN 6.14

1. A pharmacy offers students at a nearby college a discount. Jerry purchases ibuprofen, which had an original price of \$15.80. The cost to Jerry after the student discount was \$13.43. What is the percent discount for students at the pharmacy?

EXAMPLE 6.15

Finding the Original Price of a New Pair of Tires

Kendra's car developed a flat, and the tire store told her that two tires had to be replaced. She got a 10% discount on the pair of tires, and the sale price came to \$189.00. What was the original price of the tires?

Solution

Using the percent discount and the sale price, we can find the original price with the formula $\text{sales price} = \text{original price} \times (1 - \text{percent discount})$. Substituting and solving for the original price, we find

$$\begin{aligned} \text{sales price} &= \text{original price} \times (1 - \text{percent discount}) \\ 189.00 &= \text{original price} \times (1 - 0.10) \\ 189.00 &= \text{original price} \times (0.90) \\ 210.00 &= \text{original price} \end{aligned}$$

The original price of the two tires Kendra bought was \$210.00.

YOUR TURN 6.15

1. Marisol needed to buy a new microwave. She got a 26% discount. The sale price Marisol paid was \$43.66. What was the original price of the microwave?

VIDEO

[Computing Price Based on a Percent Off Coupon \(https://openstax.org/r/Computing_Price_Based\)](https://openstax.org/r/Computing_Price_Based)

WORK IT OUT

There are cases where retailers allow multiple discounts to be applied. However, it is rare that the discount percentages are added together. For example, if you have a 15% coupon and qualify for a 20% price reduction, the retailer typically does not add those two percentages together to determine the new price. The retailer instead applies one discount, then applies the second discount to the price obtained after the first discount was deducted.

Research the original prices of two different laptops offered by one retail outlet. Assume you will receive a student discount of 12% and your outlet of choice is having a 15% off sale on all laptops.

For each laptop:

1. List the original price and calculate the price after applying the student discount (12%) only.

2. Then find the price after applying the sale discount (15% off) to the price found in Step 1.
3. Determine the total saved on the laptop and what percent discount the total savings represents.
4. Now, apply the discounts in reverse order (first the sale discount, then the student discount).
5. Note anything interesting about your findings.

Calculate Markups

When retailers purchase goods to sell, they pay a certain price, called the **cost**. The retailer then charges more than that amount for the goods. This increase is called the **markup**. This selling price, or **retail price**, is what the retailer charges the consumer in order to pay their own costs and make a profit. Markup, then is very similar to discount, except we add the markup, while we subtract the discount.

FORMULA

The formula for a markup based on a percentage is $\text{markup} = \text{percent markup} \times \text{cost}$, with the percent markup expressed as a decimal. The price of the item after the markup is $\text{retail price} = \text{cost} + \text{markup}$.

These are often combined into the following formula

$$\text{retail price} = \text{cost} + \text{percent markup} \times \text{cost} = \text{cost} \times (1 + \text{percent markup})$$

It should be noted that the formulas used for a markup are very similar to those for a discount, with addition replacing the subtraction.

EXAMPLE 6.16

Determining the Retail Price Based on the Cost and the Percent Markup

Calculate the markup for the given cost and markup percentage. Then calculate the retail price.

1. Cost = \$62.00; percent markup is 15%
2. Cost = \$750.00; percent markup is 45%

Solution

1. Substituting the values into the formula $\text{markup} = \text{percent markup} \times \text{cost}$, we find that the markup is $\text{markup} = 0.15 \times 62.00 = 9.30$. The markup is \$9.30.
The retail price of the item is then $\text{retail price} = \text{cost} + \text{markup}$, or $\$62.00 + \$9.30 = \$71.30$.
2. Substituting the values into the formula $\text{markup} = \text{percent markup} \times \text{cost}$, we find that the markup is $\text{markup} = 0.45 \times 750.00 = 337.50$. The markup is \$337.50.
The retail price of the item is then $\text{retail price} = \text{cost} + \text{markup}$, or $\$750.00 + \$337.50 = \$1,087.50$.

YOUR TURN 6.16

Calculate the markup for the given cost and markup percentage. Then calculate the retail price.

1. Cost = \$1,800.00; percent markup is 22%
2. Cost = \$10.50; percent markup is 10%

Sometimes the cost and the retail price of an item are known. From this, the percent markup can be computed using the formula $\text{markup} = \text{percent markup} \times \text{cost}$, by solving for the percent markup.

EXAMPLE 6.17

Calculating the Percent Markup from the Cost and Retail Price

Determine the percent markup based on the given cost and retail price. Round percentages to two decimal places.

1. Cost = \$90.00; retail price = \$103.50

2. Cost = \$5.20; retail price = \$9.90

✓ **Solution**

1. **Step 1:** Using the cost and the retail price, we can find the markup with the formula retail price = cost + markup. Substituting and calculating, we find the markup to be $103.50 = 90.00 + \text{markup}$. Solving for the markup gives \$13.50.

Step 2: After substituting the markup, \$13.50, and the original price, \$90.00, into the formula markup = percent markup \times cost, we can find the percent markup.

$$13.50 = \text{percent markup} \times 90.00$$

$$\frac{13.50}{90.00} = \text{percent markup}$$

$$0.15 = \text{percent markup}$$

Converting to percent form, the percent markup is 15%.

2. **Step 1:** Using the cost and the retail price, we can find the markup with the formula retail price = cost + markup. Substituting and calculating, we find the markup to be $9.90 = 5.20 + \text{markup}$. Solving for the markup gives \$4.70.

Step 2: After substituting the markup, \$4.70, and the original price, \$5.20, into the formula markup = percent markup \times cost, we can find the percent markup.

$$4.70 = \text{percent markup} \times 5.20$$

$$\frac{4.70}{5.20} = \text{percent markup}$$

$$0.9038 = \text{percent markup}$$

Converting to percent form, the percent markup is 90.38%.

> **YOUR TURN 6.17**

Determine the percent markup based on the given cost and retail price. Round percentages to two decimal places.

1. Cost = \$120.00; retail price = \$190.00
2. Cost = \$0.38; retail price = \$1.14

Sometimes the retail price and the percent markup of an item are known. From this, the cost can be found. To avoid multiple steps, though, the formula that we will use is retail price = cost \times (1 + percent markup). The cost can be found by solving this equation for the cost.

EXAMPLE 6.18

Calculating the Cost from the Percent Markup and Retail Price

Determine the cost based on the percent markup and retail price.

1. Percent markup 20%; retail price = \$10.62
2. Percent markup 125%; retail price = \$26.55

✓ **Solution**

1. Using the percent markup and the retail price, we can find the cost with the formula retail price = cost \times (1 + percent markup). Substituting and solving for the cost, we find

$$\text{retail price} = \text{cost} \times (1 + \text{percent markup})$$

$$10.62 = \text{cost} \times (1 + 0.2)$$

$$10.62 = \text{cost} \times (1.2)$$

$$8.85 = \text{cost}$$

The cost of the item was \$8.85.

2. Using the percent markup and the retail price, we can find the cost with the formula
 $\text{retail price} = \text{cost} \times (1 + \text{percent markup})$. Substituting and solving for the original price, we find
- $$\text{retail price} = \text{cost} \times (1 + \text{percent markup})$$
- $$26.55 = \text{cost} \times (1 + 2.25)$$
- $$26.55 = \text{cost} \times (3.25)$$
- $$11.80 = \text{cost}$$

The cost of the item was \$11.80.

YOUR TURN 6.18

Determine the cost based on the percent markup and retail price.

1. Percent markup 15%; retail price = \$40.25
2. Percent markup 300%; retail price = \$35.96

Solve Application Problems Involving Markups

As before when working with application problems, be sure to look for what is given and identify what you are to find. Once you have evaluated the problem, use the appropriate formula to find the solution(s). These application problems address markups.

EXAMPLE 6.19

Determine Retail Price of a Power Bar

Janice works at a convenience store near campus. It sells protein bars at a 60% markup. If a bar costs the store \$1.30, how much is the retail price at the convenience store?

Solution

We are asked to find the retail price. We know the percent markup is 60%. The cost of the bar was \$1.30. Substituting into the percent markup formula, we find that the markup is $\text{markup} = \text{percent markup} \times \text{cost} = 0.60 \times 1.30 = 0.78$. The markup is \$0.78 on that protein bar. The retail price is the cost plus the markup, so the retail price is $\text{retail price} = \text{cost} + \text{markup} = 1.30 + 0.78 = 2.08$. The retail price is \$2.08.

YOUR TURN 6.19

1. A furniture outlet spends \$360.00 to buy a bed. The store marks up the bed by 250%. What is the retail price of the bed?

EXAMPLE 6.20

Determine the Percent Markup of a Phone

Javi began working at a phone outlet. In a recent shipment, he noticed that the cost of the phone to the store was \$480.00. The phone sells for \$840.00 in the store. What is the percent markup on the phone?

Solution

We know the cost of the phone, \$480. We also know the retail price of the phone, \$840.00. From this we know the markup is $\$840.00 - \$480.00 = \$360.00$. Substituting these values into the formula $\text{markup} = \text{percent markup} \times \text{cost}$, we can find the percent markup.

$$\begin{aligned} \text{markup} &= \text{percent markup} \times \text{cost} \\ 360 &= \text{percent markup} \times 480 \\ \frac{360}{480} &= \frac{\text{percent markup} \times 480}{480} \\ 0.75 &= \text{percent markup} \end{aligned}$$

The markup on the phone is 75%.

YOUR TURN 6.20

1. Maggie does some research into textbook costs. The *Sociology of the Family* text she finds sells for \$234.36 but costs the store only \$189.00. What is the percent markup on the sociology book?

EXAMPLE 6.21

Finding the Cost of a T-Shirt

Bob decided to order a t-shirt for his gaming friend online for \$29.50. He knows the markup on such t-shirts is 18%. What was the t-shirt's cost before the markup?

Solution

Using the percent markup and the retail price, \$29.50, we can find the cost with the formula $\text{retail price} = \text{original price} \times (1 + \text{percent markup})$. Substituting and solving for cost we find

$$\begin{aligned} \text{retail price} &= \text{cost} \times (1 + \text{percent markup}) \\ 29.50 &= \text{cost} \times (1 + 0.18) \\ 29.50 &= \text{cost} \times (1.18) \\ 25.00 &= \text{cost} \end{aligned}$$

The cost of the t-shirt was \$25.00.

YOUR TURN 6.21

1. Tina has opened a retail shop and purchased a unique hat for resale. Tina uses a 50% markup and sells the hat for \$57.00. How much did the hat cost Tina?

Compute Sales Tax

Sales tax is applied to the sale or lease of some goods and services in the United States but is not determined by the federal government. It is most often set, collected, and spent by individual states, counties, parishes, and municipalities. None of these sales tax revenues go to the federal government.

For example, North Carolina has a state sales tax of 4.75% while New Mexico has a state sales tax of 5%. Additionally, many counties in North Carolina charge an additional 2% sales tax, bringing the total sales tax for most (72 of the 100) counties in North Carolina to 6.75%. However, in Durham, the county sales tax is 2.25% plus an additional 0.5% tax used to fund public transportation, bringing Durham County's sales tax to 7%. To find the sales tax in a particular place, then, add other locality sales taxes to the base state sales tax rate.


How much we pay in sales tax depends on where we are, and what we are buying.

To determine the amount of sales tax on taxable purchase, we need to find the product of the purchase price, or marked price, and the sales tax rate for that locality.

FORMULA

To calculate the amount of sales tax paid on the purchase price in a locality with sales tax given in decimal form, calculate $\text{sales tax} = \text{purchase price} \times \text{tax rate}$. The total price is then

$$\text{Total price} = \text{purchase price} + \text{purchase price} \times \text{tax rate} = \text{purchase price} \times (1 + \text{tax rate})$$

 When the sales tax calculation results in a fraction of a penny, then normal rounding rules apply, round up for half a penny or more, but round down for less than half a penny.

You should notice that this is the same as markup, except using a different term. Sales tax plays the role of markup, the purchase price plays the role of cost, and the tax rate plays the role of percent markup. This means all the strategies developed for markups apply to this situation, with the changes indicated.

EXAMPLE 6.22**Sales Tax in Kankakee Illinois**

The sales tax in Kankakee, Illinois, is 8.25%. Find the sales tax and total price of items based on the purchase price listed.

1. Purchase price = \$428.99
2. Purchase price = \$34.88

 **Solution**

1. The sales tax is found using $\text{sales tax} = \text{purchase price} \times \text{tax rate}$. The purchase price is \$428.99 and the tax rate is 8.25%. Substituting and calculating, the sales tax is $\text{sales tax} = \$428.99 \times 0.0825 = \35.391675 . The sales tax needs to be rounded off. Since the third decimal place (fraction of a penny) is 1, we round down and the sales tax is \$35.39. The total price is the sales tax plus the purchase price, so is $\$428.99 + \$35.88 = \$464.87$.
2. The sales tax on the item is found using $\text{sales tax} = \text{purchase price} \times \text{tax rate}$. The purchase price is \$34.88 and the tax rate is 8.25%. Substituting and calculating, the sales tax is $\text{sales tax} = \$34.88 \times 0.0825 = \2.8776 . The sales tax needs to be rounded off. Since the third decimal place (fraction of a penny) is 7, we round up and the sales tax is \$2.88. The total price of the item is the sales tax plus the purchase price, so is $\$34.88 + \$2.88 = \$37.76$.

 **YOUR TURN 6.22**

The sales tax in Union County, Oregon, is 7%. Find the sales tax and total price of items based on the purchase price listed.

1. Purchase price = \$1,499.00
2. Purchase price = \$26.89

As before, the information available might be different than only the purchase price and the sales tax rate. In these cases, use either $\text{sales tax} = \text{purchase price} \times \text{tax rate}$ or $\text{Total price} = \text{purchase price} \times (1 + \text{tax rate})$ and solve for the indicated tax, price, or rate. These problems mirror those for percent markup.

Be aware, almost all sales tax rates are structured as full percentages, or half percent, or one-quarter percent, or three-quarter percent. This means the decimal value of the sales tax rate, written as a percent, will be either 0, as in 5.0%, 5 as in 7.5%, 25 as in 3.25%, or 75 as in 4.75%. When rounding for the sales tax percentage, be sure to use this guideline.

EXAMPLE 6.23**Calculating the Sales Tax from the Purchase Price and the Total Price**

Find the sales tax rate for the indicated purchase price and total price. Round using the guideline for sales tax percentages.

1. Purchase price = \$329.50; total price = \$354.21
2. Purchase Price = \$13.77; total price = \$14.39

✓ **Solution**

1. **Step 1.** Find the sales tax paid. First, the amount of sales tax must be found. Subtracting the purchase price from the total price, the amount of sales tax is \$24.71.

Step 2. Find the sales tax rate. Using the purchase price, the sales tax, and the formula $\text{sales tax} = \text{purchase price} \times \text{tax rate}$, the sales tax rate can be found. Substituting and solving yields

$$\text{Sales Tax} = \text{purchase price} \times \text{tax rate}$$

$$\$24.71 = \$329.50 \times \text{tax rate}$$

$$\frac{\$24.71}{\$329.50} = \text{tax rate}$$

$$0.07499 = \text{tax rate}$$

Keeping in mind the guideline for rounding sales tax rate, the sales tax rate is 7.5%.

2. **Step 1.** Find the sales tax paid. First, the amount of sales tax must be found. Subtracting the purchase price from the total price, the amount of sales tax is \$0.62.

Step 2. Find the sales tax rate. Using the purchase price, the sales tax, and the formula $\text{sales tax} = \text{purchase price} \times \text{tax rate}$, the sales tax rate can be found. Substituting and solving yields

$$\text{sales tax} = \text{purchase price} \times \text{tax rate}$$

$$\$0.62 = \$13.77 \times \text{tax rate}$$

$$\frac{\$0.62}{\$13.77} = \text{tax rate}$$

$$0.04503 = \text{tax rate}$$

Keeping in mind the guideline for rounding sales tax rate, the sales tax rate is 4.5%.

> **YOUR TURN 6.23**

Find the sales tax rate for the indicated purchase price and total price. Round using the guideline for sales tax percentages.

1. Purchase price = \$83.90; total price = \$88.30
2. Purchase price = \$477.00; total price = \$509.20

EXAMPLE 6.24

Calculating the Purchase Price from the Sales Tax and Total Price

Find the purchase price for the indicated sales tax rate and total price.

1. Sales tax rate = 5.75%; total price = \$36.56
2. Sales tax rate = 4.25%; total price = \$97.17

✓ **Solution**

1. When the sales tax rate and the total price are known, the formula $\text{total price} = \text{purchase price} \times (1 + \text{tax rate})$ can be used to find the purchase price. Substituting the tax rate and total price into the formula and solving, we find

$$\text{Total price} = \text{purchase price} \times (1 + \text{tax rate})$$

$$\$36.56 = \text{purchase price} \times (1 + 0.0575)$$

$$\frac{\$36.56}{1.0575} = \text{purchase price}$$

$$\$34.57 = \text{purchase price}$$

The purchase price, the price before tax, was \$34.57.

2. When the sales tax rate and the total price are known, the formula $\text{total price} = \text{purchase price} \times (1 + \text{tax rate})$ can be used to find the purchase price. Substituting the tax rate and total price into the formula and solving, we find

$$\begin{aligned} \text{Total price} &= \text{purchase price} \times (1 + \text{tax rate}) \\ \$97.17 &= \text{purchase price} \times (1 + 0.0425) \\ \frac{\$97.17}{1.0425} &= \text{purchase price} \\ \$93.21 &= \text{purchase price} \end{aligned}$$

The purchase price, the price before tax, was \$93.21.

> YOUR TURN 6.24

Find the purchase price for the indicated sales tax rate and total price.

1. Sales tax rate = 8.25%; total price = \$157.81
2. Sales tax rate = 6.75%; total price = \$522.01

Solve Application Problems Involving Sales Tax

Solving problems involving sales tax follows the same ideas and steps as solving problems for markups. But here we will use the following formula:

$$\text{total price} = \text{purchase price} + \text{sales tax}$$

We can also use the formula:

$$\text{total price} = \text{purchase price} \times (1 + \text{sales tax rate}),$$

This can be seen in the following examples.

EXAMPLE 6.25

Compute Sales Tax for Denver, Colorado

The sales tax rate in Denver Colorado is 8.81%. Keven buys a TV in Denver, and the purchase price (before taxes) is \$499.00. How much will Keven pay in sales tax and what will be the total amount he spends when he buys the TV?

✓ Solution

The sales tax rate in Denver is 8.81%. To find the sales tax Keven will pay, find 8.81% of the purchase price. In decimal form, that sales tax rate is 0.0881. Using the formula and substituting 499.00 for purchase price, we find that Keven will pay purchase price \times tax rate = $\$499 \times 0.0881 = \43.96 in sales tax for the TV.

The total price that Keven will pay is the purchase price plus the sales tax, or $\$499.00 + \$43.96 = \$542.96$.

> YOUR TURN 6.25

1. Daryl decides to buy a new scooter in St. Louis, Missouri, where the sales tax is 9.68%. The scooter he chooses has a purchase price of \$1,149. How much will Daryl pay in sales tax and what is the total price he spends on the scooter?

EXAMPLE 6.26

Compute Sales Tax for Austin, Texas

Jillian visits Austin, Texas, and purchases a new set of weights for her home. She spends, including sales tax, \$467.64. The sales tax rate in Austin Texas is 8.25%. How much of the total price is sales tax?

✓ Solution

The sales tax paid for this purchase is the difference in the total price and the purchase price. We know the total price is \$467.64. We also know the sales tax rate, which is 8.25%. In decimal form, this is 0.0825. Using these values and the

formula total price = purchase price \times (1 + tax rate) to find the purchase price.

$$\text{total price} = \text{purchase price} \times (1 + \text{tax rate})$$

$$\$467.64 = \text{purchase price} \times (1 + 0.0825)$$

$$\$467.64 = \text{purchase price} \times (1.0825)$$

$$\$432 = \text{purchase price}$$

Knowing both the total price and the now the purchase price, we can find the difference, which is the sales tax.

The total price was \$467.64. The purchase price was \$432. The difference of the total price and the purchase price, or the sales tax, is then $\$467.64 - \432.00 , which is \$35.64. Jillian pays \$35.64 in sales tax.

YOUR TURN 6.26

1. Elizabeth decides to buy new running shoes in her hometown of Springfield, Illinois, where the sales tax rate is 6.25%. If her total bill comes to \$153, how much of the total price is sales tax?

VIDEO

[Finding Sales Tax Percentage \(https://openstax.org/r/Finding_Sales_Tax\)](https://openstax.org/r/Finding_Sales_Tax)

WHO KNEW?

West Virginia was the first state to impose a sales tax. This happened on May 3, 1921.

Look up your locality on [this website that lists standard state-level sales tax rates \(https://openstax.org/r/resources_rates\)](https://openstax.org/r/resources_rates) and compare the sales tax structure in your state to two nearby states (for the lower 48) and for any two states (Alaska and Hawaii).

Check Your Understanding

7. What is a discount?
8. What is a markup?
9. An item has a retail price of \$45.00. What is the sale price after a 32% discount?
10. A retailer buys an item for \$311.00. What is the retail price if their markup is 60%?
11. Does sales tax have the same formula as markup?
12. If the sales tax is 6.8%, what is the total price for an item that has a purchase price of \$39.95?



SECTION 6.2 EXERCISES

For the following exercises, use the given values to find the indicated value. Round percent results to 2 decimal places. Round money results to the penny (2 decimal places).

1. Retail price = \$399.00, percent discount = 30%, find the sale price.
2. Retail Price = \$75.00, percent discount = 65%, find the sale price.
3. Retail price = \$125.00, sale price = \$90.00, find the percent discount.
4. Retail price = \$47.00, sale price = \$41.50, find the percent discount.
5. Sale price = \$145.70, percent discount = 20%, find the retail price.
6. Sale price = \$1,208.43, percent discount = 13%, find the retail price.
7. Retail price = \$26,790.00, percent discount = 8%, find the sale price.
8. Sale price = \$314.06, percent discount = 33%, find the retail price.
9. Retail price = \$145.50, sale price = \$117.90, find the percent discount.
10. Retail price = \$28.90, percent discount = 18%, find the sale price.
11. Sale price = \$17.59, percent discount = 12%, find the retail price.

12. Retail price = \$57.50, sale price = \$46.00, find the percent discount.
13. Cost = \$130.00, percent markup = 34%, find the retail price.
14. Cost = \$2.27, percent markup = 42%, find the retail price.
15. Cost = \$68.45, retail price = \$109.90, find the percent markup.
16. Cost = \$466.16, retail price = \$699.00, find the percent markup.
17. Retail price = \$98.99, percent markup = 25%, find the cost.
18. Retail price = \$799.00, percent markup = 55%, find the cost.

In the following exercises, find the sales tax and total paid.

19. Retail price = \$17.99; sales tax = 7.5%
20. Retail price = \$799.00; sales tax = 8.5%
21. Retail price = \$176.83; sales tax = 6.25%
22. Retail price = \$223.93; sales tax = 4.5%

In the following exercises, find the sales tax rate.

23. Purchase price = \$257.45; total price = \$273.54
24. Purchase price = \$14.99; total price = \$15.74
25. Purchase price = \$26.83; total price = \$28.84
26. Purchase price = \$2,399.90; total price = \$2,609.89

In the following exercises, find the purchase price.

27. Sales tax rate = 4.75%; total price = \$50.15
 28. Sales tax rate = 8%; total price = \$1,069.20
 29. Sales tax rate = 9.5%; total price = \$51.45
 30. Sales tax rate = 5.75%; total price = \$3,065.69
31. Harris has a coupon for 20% off for any purchase. She finds a new tennis racket for \$278.00. How much is the price after the coupon is applied?
 32. After the employee discount, Mariam will pay \$46.55. What is her employee discount rate if the retail price was \$53.50? Round to nearest full percent.
 33. Resa purchased a new game for her cousin. After sales tax, she paid \$41.13. Find the sales tax rate she paid if the purchase price of the game was \$38.99.
 34. Larissa opens a new secondhand bookstore. She buys a book for \$2.75. What is her percent markup if she sells the book for \$8.50. Round to the nearest percent.
 35. Doug opens a used auto parts store. He pays \$30 for a car door. How much will he charge if his percent markup is 60%?
 36. Gaia and Seth live in Osceola County in Florida, where the sales tax rate is 7.5%. They purchased some new camping gear. The price before taxes came to \$784.62. How much do they pay after the sales tax is applied?
 37. Theresa decides to purchase a new phone, which has a retail price of \$799.00. Her discount is 20% through a friends and family plan. The sales tax in her county is 6.75%. How much will she pay after the discount? How much will she pay after the tax is applied?
 38. Sakari manages a retail outlet. They receive a shipment of shirts. She sees on the shipping list that each shirt cost 24.50 to the store. The store marks up the shirts by 45%. The county in which she lives charges sales tax of 6.5%. What is the retail price of one of the shirts? After sales tax, how much will a customer pay for the shirt?