

HOW TO

Find the amount of change (increase or decrease) from a percent of change

1. Identify the original or beginning amount and the percent or rate of change.
2. Multiply the decimal or fractional equivalent of the rate of change times the original or beginning amount.

$$\text{Amount of change} = \text{percent of change} \times \text{original amount}$$

EXAMPLE 3

Your company has announced that you will receive a 3.2% raise. If your current salary is \$42,560, how much will your raise be?

What You Know

Current salary = \$42,560
Rate of change = 3.2%

What You Are Looking For

Amount of raise

Solution Plan

$$\text{Amount of raise} = \left(\begin{array}{c} \text{percent of} \\ \text{change} \end{array} \right) \left(\begin{array}{c} \text{original} \\ \text{amount} \end{array} \right)$$

Solution

$$\begin{aligned} \text{Amount of raise} &= \text{percent of change} \times \text{original amount} \\ &= 3.2\%(\$42,560) \\ &= 0.032(\$42,560) \\ &= \$1,361.92 \end{aligned}$$

Multiply.

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Conclusion

The raise will be \$1,361.92.

STOP AND CHECK

1. The price of a new Lexus is \$53,444. The previous year's model cost \$51,989. What is the amount of increase?
2. In trading on the New York Stock Exchange, Bank of America fell to \$73.57. The stock had sold for \$81.99. What is the amount of decrease in the stock price per share?

2 Find the new amount directly in percent problems.

Often in increase or decrease problems we are more interested in the new amount than the amount of change. We can find the new amount directly by adding or subtracting percents first. The original or beginning amount is always considered to be our *base* and is represented by 100%.

HOW TO Find the new amount directly in a percent problem

1. Find the rate of the new amount.

For increase: $100\% + \text{rate of increase}$

For decrease: $100\% - \text{rate of decrease}$

2. Find the new amount.

$$P = RB$$

New amount = rate of new amount \times original amount

EXAMPLE 4

Medical assistants are to receive a 9% increase in wages per hour. If they were making \$15.25 an hour, what is the *new wage per hour* to the nearest cent?

$$\begin{aligned}\text{Rate of new amount} &= 100\% + \text{rate of increase} \\ &= 100\% + 9\% \\ &= 109\%\end{aligned}$$

$$\begin{aligned}\text{New amount} &= \text{rate of new amount} \times \text{original amount} \\ &= 109\%(\$15.25) \\ &= 1.09(\$15.25) \\ &= \$16.6225 \\ &= \$16.62\end{aligned}$$

Change % to its decimal equivalent.

Multiply with

New amount

Near cent



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The new hourly wage is \$16.62.

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$$\begin{aligned}
 \text{New amount} &= \text{rate of new amount} \times \text{original amount} \\
 &= 30\%(\$49.99) && \text{Change \% to its decimal equivalent.} \\
 &= 0.3(\$49.99) && \text{Multiply.} \\
 &= \$14.997 && \text{New amount} \\
 &= \$15.00 && \text{Nearest cent}
 \end{aligned}$$

STOP AND CHECK

1. Marilyn Bauer earns \$62,870 and gets a 4.3% raise. How much is her new salary?
2. International Paper reported third-quarter earnings were down 16% from \$145 million. Find the third-quarter earnings.

3 Find the rate or the base in increase or decrease problems.

Many kinds of increase or decrease problems involve finding either the rate or the base.

The rate is the *percent of change* or the *percent of increase or decrease*. The base is still the *original amount*.

HOW TO

Find the rate or the base in increase or decrease problems

1. Identify or find the amount of change (increase or decrease).
2. To find the rate of increase or decrease, use the percentage formula $R = \frac{P}{B}$.

$$R = \frac{\text{amount of change}}{\text{original amount}}$$

3. To find the base or original amount, use the percentage formula $B = \frac{P}{R}$.

$$B = \frac{\text{amount of change}}{\text{rate of change}}$$



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EXAMPLE 6

During the month of May, a graphic artist made a profit of \$1,525. In June she made a profit of \$1,708. What is the percent of increase in profit?

What You Know

Original amount = \$1,525

New amount = \$1,708

What You Are Looking For

Percent of increase in profit

Solution Plan

Amount of increase = new amount - original amount

$$\text{Percent of increase} = \frac{\text{amount of increase}}{\text{original amount}}$$

Solution

$$\begin{aligned}\text{Amount of increase} &= \$1,708 - \$1,525 \\ &= \$183\end{aligned}$$

Subtract.

$$\begin{aligned}\text{Percent of increase} &= \frac{\$183}{\$1,525} \\ &= 0.12 \\ &= 0.12(100\%) \\ &= 12\%\end{aligned}$$

Divide.

Convert to % equivalent.

Conclusion

The percent of increase in profit is 12%.

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EXAMPLE 7

At Best Buy the price of a DVD player dropped by 20% to \$179. What was the original price to the nearest dollar?

What You Know

Reduced price = new amount = \$179
Rate of decrease = 20%

What You Are Looking For

Original price

Solution Plan

Rate of reduced price = $100\% - \text{rate of decrease}$

Use the formula to find base, $B = \frac{P}{R}$

$$\text{Original price} = \frac{\text{reduced price}}{\text{rate of reduced price}}$$

Solution

$$\begin{aligned}\text{Rate of reduced price} &= 100\% - 20\% \\ &= 80\%\end{aligned}$$

$$\text{Original price} = \frac{\$179}{80\%}$$

$$= \frac{179}{0.8}$$

$$= \$223.75$$

$$= \$224$$

Convert % to decimal equivalent.

Divide.

Round to nearest dollar.

Conclusion

The original price of the DVD player was \$224.

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8-1 SINGLE TRADE DISCOUNTS

- 1 Find the trade discount using a single trade discount rate; find the net price using the trade discount.

List prices and discounts apply the percentage formula.

$$\text{Portion (part)} = \text{rate (percent)} \times \text{base (whole)}$$

The portion is the trade discount T , the rate is the single trade discount rate R , and the base is the list price L .

$$P = RB$$

$$T = RL$$

HOW TO

Find the trade discount using a single trade discount rate

1. Identify the single discount rate and the list price.
2. Multiply the list price by the decimal equivalent of the single trade discount rate.

$$\text{Trade discount} = \text{single trade discount rate} \times \text{list price}$$

$$T = RL$$

Because the trade discount is deducted from the list price to get the net price, once you know the trade discount, you can calculate the net price.

HOW TO

Find the net price using the trade discount

1. Identify the list price and the trade discount.
2. Subtract the trade discount from the list price.

$$\begin{aligned}\text{Net price} &= \text{list price} - \text{trade discount} \\ N &= L - T\end{aligned}$$

EXAMPLE 1

The list price of a refrigerator is \$1,200. Young's Appliance Store can buy the refrigerator at the list price less 20%. (a) Find the trade discount. (b) Find the net price of the refrigerator.

(a) Trade discount = single trade discount rate \times list price

$$\begin{aligned}T &= RL \\ T &= 20\%(\$1,200) \\ T &= 0.2(\$1,200) \\ T &= \$240\end{aligned}$$

Discount rate is 20%; list price is \$1,200. Change the percent to a decimal equivalent. Multiply.

The trade discount is \$240.

(b) Net price = list price - trade discount

$$\begin{aligned}N &= L - T \\ N &= \$1,200 - \$240 \\ N &= \$960\end{aligned}$$

List price is \$1,200; trade discount is \$240. Subtract.

The net price is \$960.

STOP AND CHECK

1. The list price of an NSX-T Acura is \$89,765. Shavells Automobiles can buy the car at the list price less 12%.
 - a. Find the trade discount.

2. Find the trade discount and net price of an electric VeloBinder that has a retail price of \$124 and a trade discount of 32%.

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2 Find the net price using the complement of the single trade discount rate.

Another method for calculating the net price uses the *complement* of a percent. The **complement of a percent** is the difference between 100% and the given percent. For example, the complement of 35% is 65%, as $100\% - 35\% = 65\%$. The complement of 20% is 80% because $100\% - 20\% = 80\%$.

The complement of the single trade discount rate can be used to find the net price. Observe the relationships among the rates for the list price, discount, and net price.

List price	Discount (amount off list)	Net price (amount paid)
100%	25% of list price	75% of list price
100%	20% of list price	80% of list price
100%	40% of list price	60% of list price
100%	50% of list price	50% of list price

Because the complement is a percent, it is a rate. The complement of the trade discount rate is the **net price rate**. The single trade discount rate is used to calculate the amount the retailer *does not* pay: the trade discount. The net price rate is used to calculate the amount the retailer *does* pay: the net price.

HOW TO

Find the net price using the complement of the single trade discount rate

1. Find the net price rate: Subtract the single trade discount rate from 100%.
2. Multiply the decimal equivalent of the net price rate by the list price.

Find the net price of a computer that lists for \$3,200 with a trade discount of 35%.

$$100\% - 35\% = 65\%$$

$$\begin{aligned}\text{Net price} &= 0.65(\$3,200) \\ &= \$2,080\end{aligned}$$

$$\text{Net price} = \text{net price rate} \times \text{list price}$$

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or

$$\text{Net price} = (100\% - \text{single trade discount rate}) \times \text{list price}$$



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EXAMPLE 2

Mays' Stationery Store orders 300 pens that list for \$0.30 each, 200 pads that list for \$0.60 each, and 100 boxes of paper clips that list for \$0.90 each. The single trade discount rate for the order is 12%. Find the net price of the order.

$$300(\$0.30) = \$ 90$$

Find the total list price of the pens.

$$200(\$0.60) = \$120$$

Find the total list price of the legal pads.

$$100(\$0.90) = \$ 90$$

Find the total list price of the paper clips.

$$\underline{\$300}$$

Add to find the total list price of the entire order.

$$\text{Net price} = (100\% - \text{single trade discount rate}) \times \text{list price}$$

The single trade discount rate is 12%; the list price is \$300.

$$= (100\% - 12\%)(\$300)$$

The complement of 12% is 88%.

$$= 88\%(\$300)$$

Write 88% as a decimal.

$$= 0.88(\$300)$$

Multiply.

$$= \$264$$

The net price of the order is \$264.

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STOP AND CHECK

1. Find the net price of the PC software SystemWorks that lists for \$70 and has a discount rate of 12%.
2. The InFocus LP 120 projector lists for \$3,200 and has a trade discount rate of 15%. Find the net price.

8-2 TRADE DISCOUNT SERIES

- 1 Find the net price applying a trade discount series and using the net decimal equivalent.

Complements are used to find net prices directly. For the \$400 purchase with discounts of 20/10/5, the net price after the first discount is 80% of \$400 since $100\% - 20\% = 80\%$.

$$0.8(400) = \$320$$

The net price after the second discount is 90% of \$320.

$$0.9(\$320) = \$288$$

The net price after the third discount is 95% of \$288.

$$0.95(\$288) = \$273.60$$

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To condense this process, the decimal equivalents of the complements of the discount rates can be multiplied in a continuous sequence.

$$(0.8)(0.9)(0.95)(\$400) = 0.684(\$400) = \$273.60$$

The product of the decimal equivalents of the complements of the discount rates in a series is the **net decimal equivalent** of the net price rate.

HOW TO

Find net price using the net decimal equivalent of a trade discount series

1. Find the net decimal equivalent: Multiply the decimal form of the complement of each trade discount rate in the series.
2. Multiply the net decimal equivalent by the list price.

Find the net price of a copy machine if the list price is \$1,830 with a series discount of 10/10.

$$0.9(0.9) = 0.81$$

$$\text{Net price} = 0.81(\$1,830)$$

$$\text{Net price} = \$1,482.30$$

$$\text{Net price} = \text{net decimal equivalent} \times \text{list price}$$

EXAMPLE 1

Stone Powell found a set of surround-sound speakers for his bistro that lists for \$600 and a trade discount series of 15/10/5. What is the net price that Stone will pay?

$$100\% - 15\% = 85\% = 0.85$$

$$100\% - 10\% = 90\% = 0.9$$

$$100\% - 5\% = 95\% = 0.95$$

$$0.85(0.9)(0.95) = 0.72675$$

Find the complement of each discount rate and write it as an equivalent decimal.

Multiply the complements to find the net decimal equivalent.

$$\begin{aligned}\text{Net price} &= \text{net decimal equivalent} \times \text{list price} \\ &= 0.72675(\$600) \\ &= \$436.05\end{aligned}$$

The net decimal equivalent is 0.72675; the list price is \$600.

The net price for a \$600 set of surround-sound speakers with a trade discount series of 15/10/5 is \$436.05.

EXAMPLE 2

One manufacturer lists a desk at \$700 with a discount series of 20/10/10. A second manufacturer lists the same desk at \$650 with a discount series of 10/10/10. Which is the better deal?

What You Know

List price for first deal: \$700

Discount series for first deal:
20/10/10

List price for second
deal: \$650

Discount series for second
deal: 10/10/10

What You Are Looking For

Net price for the first deal

Net price for the second deal

Which deal on the desk is
better?

Solution Plan

Net price = net decimal
equivalent \times list price

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Solution

Decimal equivalents of complements of 20%, 10%, and 10% are 0.8, 0.9, and 0.9, respectively.

$$\text{Net decimal equivalent} = 0.8(0.9)(0.9) \quad \text{Deal 1}$$

$$= 0.648$$

$$\text{Net price for first deal} = (0.648)\$700$$

$$= \$453.60$$

Decimal equivalents of complements of 10%, 10%, and 10% are 0.9, 0.9, and 0.9, respectively.

$$\text{Net decimal equivalent} = 0.9(0.9)(0.9) \quad \text{Deal 2}$$

$$= 0.729$$

$$\text{Net price for second deal} = (0.729)\$650$$

$$= \$473.85$$

Conclusion

The net price for the first deal is \$20.25 less than the net price for the second deal ($\$473.85 - \$453.60 = \$20.25$).

The first deal—the \$700 desk with the 20/10/10 discount series—is the better deal.

STOP AND CHECK

1. Find the net price of a piano that has a list price of \$4,800 and a trade discount series of 10/5.
2. The web site www.Mobile-Tronics.com offers a three-deck instrument cart at a retail (list) price of \$535 and a trade discount series of 12/6. What is the net price?

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8-3 CASH DISCOUNTS AND SALES TERMS

1 Find the cash discount and the net amount using ordinary dating terms.

To encourage prompt payment, many manufacturers and wholesalers allow buyers to take a **cash discount**, a reduction of the amount due on an invoice. The cash discount is a specified percentage of the price of the goods. Customers who pay their bills within a certain time receive a cash discount. Many companies use computerized billing systems to compute the exact amount of a cash discount and show it on the invoice, so the customer does not need to calculate the discount and resulting net price. But the customer still determines when the bill must be paid to receive the discount.

Bills are often due within 30 days from the date of the invoice. To determine the exact day of the month the payment is due, you have to know how many days are in the month, 30, 31, 28, or 29 in the case of February. There are two ways to help remember which months have 31 days and which have 30 or fewer days. The first method, shown in Figure 8-1, is called the *knuckle method*. Each knuckle represents a month with 31 days and each space between knuckles represents a month with 30 days (except February, which has 28 days except in a leap year, when it has 29).



FIGURE 8-1

The knuckle months (Jan., Mar., May, July, Aug., Oct., and Dec.) have 31 days. The other months have 30 or fewer days.

Another way to remember which months have 30 days and which months have 31 is the following rhyme:

Thirty days has September,
April, June, and November.
All the rest have 31,
'cept February has 28 alone.
And leap year, that's the time
when February has 29.

HOW TO Find the ending date of an interval of time

1. Add the beginning date and the number of days in the interval.
2. If the sum exceeds the number of days in the month, subtract the number of days in the month from the sum.
3. The result of step 2 will be the ending date in the next month of the interval.

EXAMPLE 1

If Marie Husne has an invoice that is dated March 19, what is the date (a) 10 days later and (b) 15 days later?

(a) $19 + 10 = 29$

Ten days later is March 29.

(b) $19 + 15 = 34$
 $34 - 31 = 3$

March has 31 days.

Fifteen days later is April 3.

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HOW TO

Find the cash discount

1. Identify the cash discount rate and the net price.
2. Multiply the cash discount rate by the net price.

$$\text{Cash discount} = \text{cash discount rate} \times \text{net price}$$

EXAMPLE 2

Tommye Adams received an invoice dated July 27 from Webb Printing Services that shows a net price of \$450 with the terms 2/10, n/30. (a) Find the latest date the cash discount is allowed. (b) Find the cash discount.

- (a) The cash discount is allowed up to and including 10 days from the invoice date, July 27.

27th of July	Invoice date
+ 10 days	Days allowed according to terms 2/10
<hr/>	
“ 37th of July”	If July had 37 days ...
- 31 days in July	July has 31 days.
<hr/>	
6th of August	Latest date allowed

August 6 is the latest date the cash discount is allowed.

- (b) $\text{Cash discount} = \text{Cash discount rate} \times \text{net price}$
 $\text{Cash discount} = 2\%(\$450)$
 $= 0.02(\$450)$
 $= \$9.00$

The cash discount is \$9.00.

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HOW TO

Find the net amount

Using the cash discount:

1. Identify the net price and the cash discount.
2. Subtract the cash discount from the net price.

$$\text{Net amount} = \text{net price} - \text{cash discount}$$

Using the complement of the cash discount rate:

1. Identify the net price and the complement of the cash discount rate.
2. Multiply the complement of the cash discount rate by the net price.

$$\text{Net amount} = \text{complement of cash discount rate} \times \text{net price}$$

EXAMPLE 3

Find the net amount for the invoice in Example 2.

Using the cash discount:

$$\begin{aligned}\text{Net amount} &= \text{net price} - \text{cash discount} \\ &= \$450 - \$9 \\ &= \$441\end{aligned}$$

Using the complement of cash discount rate:

$$\begin{aligned}\text{Net amount} &= \text{complement of cash discount rate} \times \text{net price} \\ &= (100\% - 2\%)(\$450) \\ &= 0.98(\$450) \\ &= \$441\end{aligned}$$

The net amount is \$441.

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EXAMPLE 4

Charming Shoppes received a \$1,248 invoice for computer supplies, dated September 2, with sales terms 2/10, 1/15, n/30. A 5% late fee is charged for payment after 30 days. Find the amount due if the bill is paid (a) on or before September 12; (b) on or between September 13 and September 17; (c) on or between September 18 and October 2; and (d) on or after October 3.

(a) If the bill is paid on or before September 12 (within 10 days), the 2% discount applies:

$$\begin{aligned}\text{Cash discount} &= 2\%(\$1,248) = 0.02(\$1,248) = \$24.96 \\ \text{Net amount} &= \$1,248 - \$24.96 = \$1,223.04\end{aligned}$$

The net amount due on or before September 12 is \$1,223.04.

(b) If the bill is paid on or between September 13 and September 17 (within 15 days), the 1% discount applies:

$$\begin{aligned}\text{Cash discount} &= 1\%(\$1,248) = 0.01(\$1,248) = \$12.48 \\ \text{Net amount} &= \$1,248 - \$12.48 = 1,235.52\end{aligned}$$

The net amount due on or between September 13 and September 17 is \$1,235.52.

(c) If the bill is paid on or between September 18 and October 2, no cash discount applies.

The net price of \$1,248 is due.

(d) If the bill is paid on or after October 3, a 5% late fee is added:

$$\begin{aligned}\text{Late fee} &= 5\%(\$1,248) = 0.05(\$1,248) = \$62.40 \\ \text{Net amount} &= \$1,248 + \$62.40 = \$1,310.40\end{aligned}$$

The net amount due on or after October 3 is \$1,310.40.

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STOP AND CHECK

1. An invoice received by Best Buy and dated March 15 has a net price of \$985 with terms 2/15, n/30. Find the latest date a cash discount is allowed and find the cash discount. Find the net amount.
2. Federated Department Stores received an invoice dated April 18 that shows a billing for \$3,848.96 with terms 2/10, 1/15, n/30. Find the cash discount and net amount if the invoice is paid within 15 days but after 10 days.

9-1 MARKUP BASED ON COST

- 1 Find the cost, markup, or selling price when any two of the three are known.

Visualize the relationships among the cost, markup, and the selling price. The basic relationship can be written as the formula

$$\begin{array}{rcl} \text{Selling price} & = & \text{cost} + \text{markup} \\ S & = & C + M \end{array}$$

Relate this to the concept that two parts add together to get a sum or total. Then we can develop variations of the formula using the concept that the sum or total minus one part gives the other part.

$$\begin{array}{rcl} \text{Cost} & = & \text{selling price} - \text{markup} \\ C & = & S - M \end{array}$$

$$\begin{array}{rcl} \text{Markup} & = & \text{selling price} - \text{cost} \\ M & = & S - C \end{array}$$

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HOW TO

Find the cost, markup, or selling price when any two of the three are known

1. Identify the two known amounts.
2. Identify the missing amount.
3. Select the appropriate formula.
4. Substitute the known amounts into the formula.
5. Evaluate the formula.

EXAMPLE 1

What is the selling price of a media charging station if the cost is \$28.35 and the markup is \$5.64?

What You Know	What You Are Looking For	Solution Plan
Cost = \$28.35 Markup = \$5.64	Selling price	Selling price = cost + markup

Solution

$$S = C + M$$

$$S = \$28.35 + \$5.64$$

$$S = \$33.99$$

Substitute known values.

Add.

Conclusion

The selling price of the media charging station is \$33.99.

EXAMPLE 2

Mapco buys travel mugs for \$2.45 and sells them for \$5.88. What is the markup?

What You Know	What You Are Looking For	Solution Plan
Cost = \$2.45 Selling price = \$5.88	Markup	Markup = selling price - cost

Solution

$$M = S - C$$

$$M = \$5.88 - \$2.45$$

$$M = \$3.43$$

Substitute known values.

Subtract.

Conclusion

The markup is \$3.43.

EXAMPLE 3

Kroger is selling 2-liter Coke at \$1.29. If the markup is \$0.35, what is the cost?

What You Know	What You Are Looking For	Solution Plan
Selling price = \$1.29 Markup = \$0.35	Cost	Cost = selling price - markup

Solution

$$C = S - M$$

$$C = \$1.29 - \$0.35$$

$$C = \$0.94$$

Substitute known values.

Subtract.

Conclusion

The cost of the 2-liter Coke is \$0.94.

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STOP AND CHECK

1. Charlie Cook bought a light fixture that cost \$32 and marked it up \$40. Find the selling price.
2. Margaret Davis sells a key fob for \$12.95 and it costs \$7. Find the markup.

2 Find the cost, markup, selling price, or percent of markup when the percent of markup is based on the cost.

When the markup is based on cost, the cost is the base in the basic percentage formula

$$P = RB$$

We can apply the percentage formula to markup to get the formula

$$\text{Markup} = \text{rate of markup} \times \text{cost} \quad \text{or} \quad M = M\%(C)$$

Then, we can find variations of the formula by solving the equation for each variable.

Solve for $M\%$.

$$M = M\%(C)$$

$$\frac{M}{C} = \frac{M\%(C)}{C}$$

$$\frac{M}{C} = M\%$$

$$M\% = \frac{M}{C}$$

Divide both sides by C .

Reduce.

Write the isolated variable on the left.

Solve for C .

$$M = M\%(C)$$

$$\frac{M}{M\%} = \frac{M\%(C)}{M\%}$$

$$\frac{M}{M\%} = C$$

$$C = \frac{M}{M\%}$$

Divide both sides by $M\%$.

Reduce.

Write the isolated variable on the left.

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HOW TO

Find the rate of markup based on the cost, the cost, or the markup when any two of the three are known

1. Identify the known and unknown amounts.
2. Select the formula variation that has the unknown on the left of the equation.

$$M = M\%(C) \quad \text{Use the decimal equivalent of } M\%.$$

$$M\% = \frac{M}{C}(100\%) \quad \text{Change to a percent by multiplying by } 100\%.$$

$$C = \frac{M}{M\%} \quad \text{Use the decimal equivalent of } M\%.$$

3. Substitute the known amounts into the formula.
4. Solve for the missing amount.

EXAMPLE 4

Duke's Photography pays \$9 for a 5 in.-by-7 in. photograph. If the photograph is sold for \$15, what is the percent of markup based on cost? Round to the nearest tenth of a percent.

What You Know

$$\text{Cost} = \$9$$

$$\text{Cost}\% = 100\%$$

$$\text{Selling price} = \$15$$

What You Are Looking For

Rate of markup

Solution Plan

$$\text{Markup} = \text{selling price} - \text{cost}$$

Solution

Find the amount of markup:

$$M = S - C$$

$$M = \$15 - \$9$$

$$M = \$6$$

Substitute known values into the formula.

Subtract.

Amount of markup

Find the rate of markup:

$$M\% = \frac{M}{C}(100\%)$$

Substitute known values into the formula.

$$M\% = \frac{\$6}{\$9}(100\%)$$

Divide.

$$M\% = 0.667(100\%)$$

Rounded to thousandths. Change to percent equivalent.

$$M\% = 66.7\%$$

Rate or percent of markup

Conclusion

The percent of markup based on cost of the photograph is 66.7%.

EXAMPLE 5

A boutique pays \$5 a pair for handmade earrings and sells them at a 50% markup rate based on cost. Find the selling price of the earrings.

What You Know

$$\text{Cost} = \$5$$

$$\text{Markup \%} = 50\%$$

What You Are Looking For

Amount of markup

Selling price

Solution Plan

$$M = M\%(C)$$

$$S = C + M$$

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Solution

Find the amount of markup.

$$M = M\%(C)$$

$$M = 50\%(\$5)$$

$$M = 0.5(\$5)$$

$$M = \$2.50$$

Substitute known amounts.

Change the percent to its decimal equivalent.

Multiply.

Find the selling price.

$$S = C + M$$

$$S = \$5 + \$2.50$$

$$S = \$7.50$$

Substitute known amounts.

Add.

Conclusion

The selling price of the earrings is \$7.50.

EXAMPLE 6

A DVD movie was marked up \$6.50, which was a 40% markup based on cost. What was the cost of the DVD?

What You Know

$$\text{Markup} = \$6.50$$

$$M\% = 40\%$$

What You Are Looking For

Cost

Solution Plan

$$C = \frac{M}{M\%}$$

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Solution

$$C = \frac{M}{M\%} \quad \text{Substitute known amounts.}$$

$$C = \frac{\$6.50}{40\%} \quad \text{Change percent to its decimal equivalent.}$$

$$C = \frac{\$6.50}{0.4} \quad \text{Divide.}$$

$$C = \$16.25$$

Conclusion

The cost of the DVD movie was \$16.25.

If the markup is based on cost, the cost percent is 100% and the selling price percent is 100% + the markup percent.

HOW TO

Find the cost when the selling price and the percent of markup based on the cost are known

1. Find the rate of selling price.

$$\begin{aligned} \text{Rate of selling price} &= \text{rate of cost} + \text{rate of markup based on cost} \\ S\% &= 100\% + M\% \end{aligned}$$

2. Find the cost using the formula

$$\text{Cost} = \frac{\text{selling price}}{\text{rate of selling price based on cost}} \quad C = \frac{S}{S\%}$$

3. Change the rate of selling price to a numerical equivalent and divide.

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EXAMPLE 7

A camera sells for \$20. The markup rate is 50% of the cost. Find the cost of the camera and the markup.

What You Know	What You Are Looking For	Solution Plan
$S = \$20$ $M\% = 50\%$ $C\% = 100\%$	Cost Markup	$S\% = 100\% + M\%$ $C = \frac{S}{S\%}$ $M = S - C$

Solution

Find the selling price rate:

$$S\% = 100\% + M\%$$

$$S\% = 100\% + 50\%$$

$$S\% = 150\%$$

Substitute known amounts.

Add.

Find the cost:

$$C = \frac{S}{S\%}$$

Substitute known amounts.

$$C = \frac{\$20}{150\%}$$

Change the percent to its decimal equivalent.

$$C = \frac{\$20}{1.5}$$

Divide.

$$C = \$13.33$$

Rounded to the nearest cent

Find the markup:

$$M = S - C$$

Substitute known amounts.

$$M = \$20 - \$13.33$$

Subtract.

$$M = \$6.67$$

Conclusion

The cost of the camera is \$13.33 and the markup is \$6.67.

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STOP AND CHECK

1. Find the percent of markup based on cost for a table that costs \$220 and sells for \$599. Round to the nearest tenth of a percent.
2. A file cabinet costs \$145 and sells for \$197.20. Find the percent of markup based on cost.

9-2 MARKUP BASED ON SELLING PRICE AND MARKUP COMPARISONS

- 1 Find the cost, markup, selling price, or percent of markup when the percent of markup is based on the selling price.

When the markup is based on selling price, the rate of the selling price is known and is 100%. The amount of the selling price is the base in the basic percentage formulas $P = RB$.

We can apply the percentage formula to markup to get the formula

$$\text{Markup} = \text{rate of markup} \times \text{selling price} \quad \text{or} \quad M = M\%(S)$$

Then, we can find variations of the formula by solving the equation for each variable.

Solve for $M\%$.

$$M = M\%(S)$$

$$\frac{M}{S} = \frac{M\%(S)}{S}$$

$$\frac{M}{S} = M\%$$

$$M\% = \frac{M}{S}$$

Divide both sides by S .

Simplify.

Write the isolated variable on the left.

$M\%$ is expressed as a decimal.

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FIGURE 9-2
Markup Based on Selling Price

Solve for S .

$$M = M\%(S)$$

$$\frac{M}{M\%} = \frac{M\%(S)}{M\%}$$

$$\frac{M}{M\%} = S$$

$$S = \frac{M}{M\%}$$

Divide both sides by $M\%$ in decimal form.

Simplify.

Write the isolated variable on the left.

HOW TO

Find the rate of markup based on the selling price, the selling price, or the markup when any two of the three are known.

1. Identify the known and unknown amounts.
2. Select the formula variation that has the unknown on the left side of the equation.

$$M = M\%(S)$$

Use the decimal equivalent of $M\%$.

$$M\% = \frac{M}{S}(100\%)$$

Change to a percent by multiplying by 100%.

$$S = \frac{M}{M\%}$$

Use the decimal equivalent of $M\%$.

3. Substitute the known amounts into the formula.
4. Solve for the missing amount.

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EXAMPLE 1

A calculator costs \$4 and sells for \$10. Find the rate of markup based on the selling price.

What You Know	What You Are Looking For	Solution Plan
Cost = \$4 Selling price = \$10	Amount of markup Rate of markup based on the selling price	Markup = selling price - cost $M\% = \frac{M}{S}(100\%)$

Solution

Find the markup:

$$M = S - C$$

$$M = \$10 - \$4$$

$$M = \$6$$

Substitute known values into the formula.

Subtract.

Amount of markup

Find the rate of markup:

$$M\% = \frac{M}{S}(100\%)$$

Substitute known values into the formula.

$$M\% = \frac{\$6}{\$10}(100\%)$$

Divide.

$$M\% = 0.6(100\%)$$

Change to percent equivalent.

$$M\% = 60\%$$

Rate or percent of markup

Conclusion

The rate of markup for the calculator is 60%.

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EXAMPLE 2

Find the cost and selling price if a handbook is marked up \$5 with a 20% markup rate based on selling price.

What You Know	What You Are Looking For	Solution Plan
Markup = \$5 $M\%$ based on selling price = 20%	Selling price Cost	$S = \frac{M}{M\%}$ $C = S - M$

Solution

Find the selling price:

$$S = \frac{M}{M\%}$$

Substitute known amounts.

$$S = \frac{\$5}{20\%}$$

Change percent to its decimal equivalent.

$$S = \frac{\$5}{0.2}$$

Divide.

$$S = \$25$$

Selling price

Find the cost:

$$C = S - M$$

Substitute known amounts.

$$C = \$25 - \$5$$

Subtract.

$$C = \$20$$

Cost

Conclusion

The selling price of the handbook is \$25 and the cost is \$20.

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STOP AND CHECK

1. A textbook costs \$58 and sells for \$70. Find the rate of markup based on the selling price. Round to the nearest tenth percent.
2. The manufacturer's suggested retail price for a refrigerator is \$1,499 and it costs \$385. What is the rate of markup based on the suggested retail price?

9-3 MARKDOWN, SERIES OF MARKDOWNS, AND PERISHABLES

- 1 Find the amount of markdown, the reduced (new) price, and the percent of markdown.

Markdowns are generally based on the original selling price. That is, the original selling price is the base in the percentage formulas and the rate of the selling price is 100%.

HOW TO

Find the amount of markdown, the reduced (new) price, and the percent of markdown

1. Place the known values into the chart:

	\$	%
Original Selling Price (S)		100%
Markdown (M)		
Reduced (New) Price (N)		

2. Select the appropriate formula based on the known values:

$$\text{Markdown} = \text{original selling price} - \text{reduced price} \quad M = S - N$$

$$\text{Reduced price} = \text{original selling price} - \text{markdown} \quad N = S - M$$

$$\text{Rate of markdown} = \frac{\text{amount of markdown}}{\text{original selling price}} \times 100\% = \frac{M}{S} (100\%)$$

EXAMPLE 1

A lamp originally sold for \$36 and was marked down to sell for \$30. Find the markdown and the rate of markdown (to the nearest hundredth).

What You Know	What You Are Looking For	Solution Plan												
$S = \$36$ $N = \$30$	Markdown Rate of markdown	<table border="1"><thead><tr><th></th><th>\$</th><th>%</th></tr></thead><tbody><tr><td>S</td><td>36</td><td>100%</td></tr><tr><td>M</td><td></td><td></td></tr><tr><td>N</td><td>30</td><td></td></tr></tbody></table> $M = S - N$ $M\% = \frac{M}{S}(100\%)$		\$	%	S	36	100%	M			N	30	
	\$	%												
S	36	100%												
M														
N	30													

Solution

Find the markdown:

$$M = S - N$$

$$M = \$36 - \$30$$

$$M = \$6$$

Substitute known values.

Subtract.

Markdown

Find the rate of markdown:

$$M\% = \frac{M}{S}(100\%)$$

Substitute known values.

$$M\% = \frac{\$6}{\$36}(100\%)$$

Perform calculations.

$$M\% = 0.1666666667(100\%)$$

Rate of markdown

$$M\% = 16.7\%$$

Rounded

Conclusion

The markdown is \$6 and the rate of markdown is 16.7%.

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EXAMPLE 2

A wallet was originally priced at \$12 and was reduced by 25%. Find the markdown and the sale (new) price.

What You Know	What You Are Looking For	Solution Plan												
$S = \$12$ $M\% = 25\%$	Markdown Sale price	<table border="1"><thead><tr><th></th><th>\$</th><th>%</th></tr></thead><tbody><tr><td>S</td><td>12</td><td>100%</td></tr><tr><td>M</td><td></td><td>25%</td></tr><tr><td>N</td><td></td><td></td></tr></tbody></table> $M = M\%(S)$ $N = S - M$		\$	%	S	12	100%	M		25%	N		
	\$	%												
S	12	100%												
M		25%												
N														

Solution

Find the markdown:

$$M = M\% (S)$$

$$M = 25\% (\$12)$$

$$M = 0.25(\$12)$$

$$M = \$3$$

Substitute known values.

Change percent to its decimal equivalent.

Multiply.

Markdown

Find the sale (new) price:

$$N = S - M$$

$$N = \$12 - \$3$$

$$N = \$9$$

Substitute known values.

Subtract.

Sale price

Conclusion

The markdown is \$3 and the sale price is \$9.

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2 Find the final selling price for a series of markups and markdowns.

Prices are in a continuous state of flux in the business world. Markups are made to cover increased costs. Markdowns are made to move merchandise more rapidly, to move dated or perishable merchandise, or to draw customers into a store.

Sometimes prices are marked down several times or marked up between markdowns before the merchandise is sold. In calculating each stage of prices, markups, markdowns, and rates, we use exactly the same markup/markdown formulas and procedures as before. To apply these formulas and procedures, we agree that both the markup and the markdown are based on the *previous selling price* in the series.

HOW TO

Find the final selling price for a series of markups and markdowns

1. Find the first selling price using the given facts and markup procedures in Sections 9-1 and 9-2.
2. For each remaining stage in the series:
 - (a) If the stage requires a *markdown*, identify the previous selling price as the *original selling price* S for this stage. Find the *reduced price* N . This reduced price is the new selling price for this stage.
 - (b) If the stage requires a *markup*, identify the previous selling price as the *cost* C for this stage. Find the *selling price* S . This price is the new selling price for this stage.
3. Identify the selling price for the last stage as the *final selling price*.

EXAMPLE 3

Belinda's China Shop paid a wholesale price of \$800 for a set of imported china. On August 8, Belinda marked up the china 50% based on the cost. On October 1, she marked the china down 25% for a special 10-day promotion. On October 11, she marked the china up 15%. The china was again marked down 30% for a preholiday sale. What was the final selling price of the china?

What You Know	What You Are Looking For	Solution Plan
Cost = \$800 Stage 1: markup of 50% based on cost Stage 2: markdown of 25% based on selling price Stage 3: markup of 15% based on new selling price Stage 4: markdown of 30% based on new selling price	Selling price for stage 1 (S_1) Selling price for stage 2 (N_2) Selling price for stage 3 (S_3) Selling price for stage 4 (N_4)	Find the selling price for each stage using the formulas: $S\% = C\% + M\%$ $N\% = S\% - M\%$ $S = S\%(C)$ $N = N\%(S)$

Solution

Stage 1: August 8

Find the first selling price (S_1), which is a markup, based on cost:

	\$	%
C	800	100
M		50
S	1,200	150

$$\begin{aligned}S_1\% &= C\% + M\% \\S_1\% &= 100\% + 50\% \\S_1\% &= 150\%\end{aligned}$$

$$\begin{aligned}S_1 &= S_1\%(C) \\S_1 &= 150\%(\$800) \\S_1 &= 1.5(\$800) \\S_1 &= \$1,200\end{aligned}$$

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Find the second selling price (N_2), which is a markdown, using S_1 as the original selling price:

	\$	%
S_1	1,200	100
M		25
N_2	900	75

$$N_2\% = S\% - M\%$$

$$N_2\% = 100\% - 25\%$$

$$N_2\% = 75\%$$

$$N_2 = N\%(S_1)$$

$$N_2 = 75\%(\$1,200)$$

$$N_2 = 0.75(\$1,200)$$

$$N_2 = \$900$$

Stage 3: October 11

Find the third selling price (S_3), which is a markup, using N_2 as the cost:

	\$	%
N_2	900	100
M		15
S_3	1,035	115

$$S_3\% = N_2\% + M\%$$

$$S_3\% = 100\% + 15\%$$

$$S_3\% = 115\%$$

$$S_3 = S_3\%(N_2)$$

$$S_3 = 115\%(\$900)$$

$$S_3 = 1.15(\$900)$$

$$S_3 = \$1,035$$

Stage 4: Final markdown

Find the final selling price (N_4), which is a markup, using S_3 as the selling price:

	\$	%
S_3	1,035	100
M		30
N_4	724.50	70

$$N_4\% = S\% - M\%$$

$$N_4\% = 100\% - 30\%$$

$$N_4\% = 70\%$$

$$N_4 = N_4\%(S_3)$$

$$N_4 = 70\%(\$1,035)$$

$$N_4 = 0.7(\$1,035)$$

$$N_4 = \$724.50$$

Conclusion

The final price of the china in the series is \$724.50.

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EXAMPLE 4

Burdines' has various sales racks throughout the store. Chloe Duke finds a coat that she would like to purchase from a rack labeled 40% off. She also has a newspaper coupon that reads "Take an additional 10% off any already reduced price." How much will she pay for a coat (net price) that was originally priced at \$145? What is the total rate of reduction?

What You Know	What You Are Looking For	Solution Plan
Original price = \$145 Discount rates are 40% and 10%.	Final reduced price Total percent of reduction	Find the net decimal equivalent of the rate you pay: Net price = net decimal equivalent \times original price Total rate of reduction = (1 - net decimal equivalent) \times 100%

Solution

Find the net decimal equivalent:

$$0.6(0.9) = 0.54$$

Find the final reduced price:

$$(0.54)(\$145) = \$78.30$$

Find the total rate of reduction:

$$1 - 0.54 = 0.46$$

$$0.46(100\%) = 46\%$$

Multiply the complements of each rate.

Multiply the net decimal equivalent times the original price.

The complement of the net decimal equivalent is the decimal equivalent of the total rate of reduction.

Percent equivalent

Conclusion

The final reduced price is \$78.30 and the total percent of reduction is 46%.

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STOP AND CHECK

1. Find the net price of the PC software SystemWorks that lists for \$70 and has a discount rate of 12%.
2. The InFocus LP 120 projector lists for \$3,200 and has a trade discount rate of 15%. Find the net price.

3 Find the selling price for a desired profit on perishable and seasonal goods.

Most businesses anticipate that some seasonal merchandise will not sell at the original selling price. Stores that sell perishable or strictly seasonal items (fresh fruits, vegetables, swimsuits, or coats, for example) usually know from past experience how much merchandise will be marked down or discarded because of spoilage or merchandise out of date. For example, most retail stores mark down holiday items to 50% of the original price the day after the holiday. Thus, merchants set the original markup of such items to obtain the desired profit level based on the projected number of items sold at “full price” (the original selling price).

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HOW TO

Find the selling price to achieve a desired profit

1. Establish the rate of profit (markup)—based on cost—desired on the sale of the merchandise.
2. Find the total cost of the merchandise by multiplying the unit cost by the quantity of merchandise. Add in additional charges such as shipping.
3. Find the total desired profit (markup) based on cost by multiplying the rate of profit (markup) by the total cost.
4. Find the total selling price by adding the total cost and the total desired profit.
5. Establish the quantity expected to sell.
6. Divide the total selling price (step 4) by the expect-to-sell quantity (step 5).

$$\text{Selling price per item to achieve desired profit (markup)} = \frac{\text{total selling price}}{\text{expect-to-sell quantity}}$$

EXAMPLE 5

Green's Grocery specializes in fresh fruits and vegetables. Merchandise is priced for quick sale and some must be discarded because of spoilage. Hardy Green, the owner, receives 400 pounds of bananas, for which he pays \$0.15 per pound. On the average, 8% of the bananas will spoil. Find the selling price per pound to obtain a 175% markup on cost.

What You Know	What You Are Looking For	Solution Plan
400 lb of bananas at \$0.15 per pound 175% markup on cost (desired profit) 8% expected spoilage	Selling price per pound	Total cost = cost per pound \times number of pounds Markup = $M\%(C)$ Total selling price = $C + M$ Pounds expected to sell = $92\%(400)$ Selling price per pound = $\frac{\text{total selling price}}{\text{pounds expected to sell}}$

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Solution

$$C = \$0.15(400) = \$60$$

$$M = 1.75(\$60) = \$105$$

$$S = C + M = \$60 + \$105 = \$165$$

Find the total cost of the bananas.

$175\% = 1.75$. Find the desired profit (markup).

Find the total selling price.

Hardy must receive \$165 for the bananas he expects to sell. He expects 8% not to sell, or 92% to sell.

$$0.92(400) = 368$$

Establish how many pounds he can expect to sell.

He can expect to sell 368 pounds of bananas.

$$\begin{aligned}\text{Selling price per pound} &= \frac{\text{total selling price}}{\text{pounds expected to sell}} \\ &= \frac{\$165}{368} = \$0.4483695652 \text{ or } \$0.45\end{aligned}$$

Conclusion

Hardy must sell the bananas for \$0.45 per pound to receive the profit he desires. If he sells more than 92% of the bananas, he will receive additional profit.

STOP AND CHECK

1. Drewrey's Market pays \$0.30 per pound for 300 pounds of peaches. On average, 5% of the peaches will spoil before they sell. Find the selling price per pound needed to obtain a 180% markup on cost.
2. Cozort's Produce pays \$0.35 per pound for 500 pounds of apples. On average, 8% of the apples will spoil before they sell. Find the selling price per pound needed to obtain a 175% markup.

GROSS PAY

Employees may be paid according to a salary, an hourly wage, a piecework rate, or a commission rate. Employers are required to withhold taxes from employee paychecks and forward these taxes to federal, state, and local governments.

1 Find the gross pay per paycheck based on salary.

Companies differ in how often they pay salaried employees, which determines how many paychecks an employee receives in a year. If employees are paid **weekly**, they receive 52 paychecks a year; if they are paid **biweekly** (every two weeks), they receive 26 paychecks a year. **Semimonthly** (twice a month) paychecks are issued 24 times a year, and **monthly** paychecks come 12 times a year.

HOW TO

Find the gross pay per paycheck based on annual salary

1. Identify the number of pay periods per year:

Monthly—12 pay periods per year

Semimonthly—24 pay periods per year

Biweekly—26 pay periods per year

Weekly—52 pay periods per year

2. Divide the annual salary by the number of pay periods per year, round to the nearest cent.

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EXAMPLE 1

Charles Demetriou earns a salary of \$60,000 a year.

- (a) If Charles is paid biweekly, how much is his gross pay per pay period before taxes are taken out?
- (b) If Charles is paid semimonthly, how much is his gross pay per pay period?

(a) $\$60,000 \div 26 = \$2,307.69$

Charles earns \$2,307.69 biweekly before deductions.

(b) $\$60,000 \div 24 = \$2,500$

Charles earns \$2,500 semimonthly before deductions.

Biweekly paychecks are issued 26 times a year, so divide Charles's salary by 26.

Semimonthly paychecks are issued 24 times a year, so divide Charles's salary by 24.

STOP AND CHECK

1. Ryan Thomas earns \$42,822 a year. What is his biweekly gross pay?
2. Jaswant Jain earns \$32,928 annually and is paid semimonthly. Find his earnings per pay period.

2 Find the gross pay per weekly paycheck based on hourly wage.

Many jobs pay according to an *hourly wage*. The **hourly rate**, or **hourly wage**, is the amount of money paid for each hour the employee works in a standard 40-hour work week. The Fair Labor Standards Act (FLSA) of 1938 set the standard work week at 40 hours. When hourly employees work more than 40 hours in a week, they earn the hourly wage for the first 40 hours, and they earn an **overtime rate** for the remaining hours. The standard overtime rate is often called **time and a half**. By law, it must be at least 1.5 (one and one-half) times the hourly wage. Earnings based on the hourly wage are called **regular pay**. Earnings based on the overtime rate are called **overtime pay**. An hourly employee's gross pay for a pay period is the sum of his or her regular pay and his or her overtime pay.

HOW TO

Find the gross pay per week based on hourly wages

1. Find the regular pay:
 - (a) If the hours worked in the week are 40 or fewer, multiply the hours worked by the hourly wage.
 - (b) If the hours worked are more than 40, multiply 40 hours by the hourly wage.
2. Find the overtime pay:
 - (a) If the hours worked are 40 or fewer, the overtime pay is \$0.
 - (b) If the hours worked are more than 40, subtract 40 from the hours worked and multiply the difference by the overtime rate.
3. Add the regular pay and the overtime pay.

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When Does the Week Start? Even if an employee is paid biweekly, overtime pay is still based on the 40-hour standard work week. So overtime pay for each week in the pay period must be calculated separately. Also, each employer establishes the formal work week. For example, an employer's work week may begin at 12:01 A.M. Thursday and end at 12:00 midnight on Wednesday of the following week, allowing the payroll department to process payroll checks for distribution on Friday. Another employer may begin the work week at 11:01 P.M. on Sunday evening and end at 11:00 P.M. on Sunday the following week so that the new week coincides with the beginning of the 11 P.M.–7 A.M. shift on Sunday.

EXAMPLE 2

Marcia Scott, whose hourly wage is \$10.25, worked 46 hours last week. Find her gross pay for last week if she earns time and a half for overtime.

$$40(\$10.25) = \$410$$

$$46 - 40 = 6$$

$$\underbrace{6(\$10.25)(1.5)}_{\text{overtime rate}} = \$92.25$$

$$\$410 + \$92.25 = \$502.25$$

Marcia's gross pay is \$502.25.

Find the regular pay for 40 hours of work at the hourly wage.

Find the overtime hours.

Find the overtime pay by multiplying the overtime hours by the overtime rate, which is the hourly wage times 1.5. Round to the nearest cent.

Add the regular pay and the overtime pay to find Marcia's total gross earnings.

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DID YOU KNOW?

Some salaried employees do earn overtime pay for hours worked above 40 hours per week. A common misconception is that salaried employees do not earn overtime. An employee that is *nonexempt* from FLSA is entitled to overtime. To be exempt from FLSA, an employee must meet the test for exempt status as defined by federal and state laws.

If an employee is salaried and nonexempt, the overtime pay rate is calculated by applying the following process:

1. If the salary is defined as a monthly salary, multiply the monthly salary by 12 months to get the annual salary.
2. Divide the annual salary by 52 (weeks) to get a weekly salary.
3. Divide the weekly salary by the maximum number of hours in a regular work week (40) to get the regular hourly pay rate.
4. Multiply the regular hourly pay rate by 1.5 to get the overtime hourly pay rate.

EXAMPLE 3

Ann Glover earns a monthly salary of \$3,600 and is nonexempt from FLSA. Last week she worked 56 hours. What are her overtime earnings for the week?

$\$3,600(12) = \$43,200$	Annual salary
$\$43,200 \div 52 = \830.77	Weekly pay rate
$\$830.77 \div 40 = \20.77	Hourly pay rate
$\$20.77(1.5) = \31.16	Overtime pay rate
$56 - 40 = 16$	Hours of overtime worked
$16(\$31.16) = \498.56	Overtime pay

Ann Glover earned \$498.56 in overtime pay for the week.

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STOP AND CHECK

1. Shekenna Chapman earns \$15.83 per hour and worked 48 hours in a week. Overtime is paid at 1.5 times hourly pay. What is her gross pay?
2. McDonald's pays Kelyn Blackburn 1.5 times her hourly pay for overtime. She worked 52 hours one week and her hourly pay is \$13.56. Find her gross pay for the week.

3 Find the gross pay per paycheck based on piecework wage.

Many employers motivate employees to produce more by paying according to the quantity of acceptable work done. Such **piecework rates** are typically offered in production or manufacturing jobs. Garment makers and some other types of factory workers, agricultural workers, and employees who perform repetitive tasks such as stuffing envelopes or packaging parts may be paid by this method. In the simplest cases, the gross earnings of such workers are calculated by multiplying the number of items produced by the **straight piecework rate**.

Sometimes employees earn wages at a **differential piece rate**, also called an **escalating piece rate**. As the number of items produced by the worker increases, so does the pay per item. This method of paying wages offers employees an even greater incentive to complete more pieces of work in a given period of time.



HOW TO

Find the gross pay per paycheck based on piecework wage

1. If a *straight piecework rate* is used, multiply the number of items completed by the straight piecework rate.
2. If a *differential piecework rate* is used:
 - (a) For each rate category, multiply the number of items produced for the category by the rate for the category.
 - (b) Add the pay for all rate categories.

EXAMPLE 4

A shirt manufacturer pays a worker \$0.47 for each acceptable shirt inspected under the prescribed job description. If the worker had the following work record, find the gross earnings for the week: Monday, 250 shirts; Tuesday, 300 shirts; Wednesday, 178 shirts; Thursday, 326 shirts; Friday, 296 shirts.

$$\begin{aligned}250 + 300 + 178 + 326 + 296 \\= 1,350 \text{ shirts}\end{aligned}$$

Find the total number of shirts inspected.

$$1,350(\$0.47) = \$634.50$$

Multiply the number of shirts by the piecework rate.

The weekly gross earnings are \$634.50.

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EXAMPLE 5

Last week, Jorge Sanchez assembled 317 game boards. Find Jorge's gross earnings for the week if the manufacturer pays at the following differential piece rates:

Boards assembled per week	Pay per board
First 100	\$1.82
Next 200	\$1.92
Over 300	\$2.08

Find how many boards were completed at each pay rate, multiply the number of boards by the rate, and add the amounts.

$$\begin{aligned}\text{First 100 items: } & 100(\$1.82) = \$182.00 \\ \text{Next 200 items: } & 200(\$1.92) = \$384.00 \\ \text{Last 17 items: } & 17(\$2.08) = \underline{\$ 35.36} \\ & \qquad \qquad \qquad \$601.36\end{aligned}$$

Jorge's gross earnings were \$601.36.

STOP AND CHECK

1. JR Tinkler and Co. employs pear and peach pickers on a piecework basis. Paul Larson picks enough pears to fill 12 bins in the 40-hour work week. He is paid at the rate of \$70 per bin. What is his pay for the week?
2. A rubber worker is paid \$5.50 for each finished tire. In a given week, Dennis Swartz completed 21 tires on Monday, 27 tires on Tuesday, 18 tires on Wednesday, 29 tires on Thursday, and 24 tires on Friday. How much were his gross weekly earnings?

4 Find the gross pay per paycheck based on commission.

Many salespeople earn a **commission**, a percentage based on sales. Those whose entire pay is commission are said to work on **straight commission**. Those who receive a salary in addition to a commission are said to work on a **salary-plus-commission** basis. A **commission rate** can be a percent of total sales or a percent of sales greater than a specified **quota** of sales.

HOW TO

Find the gross pay per paycheck based on commission

1. Find the commission:
 - (a) If the commission is *commission based on total sales*, multiply the commission rate by the total sales for the pay period.
 - (b) If the commission is *commission based on quota*, subtract the quota from the total sales and multiply the difference by the commission rate.
2. Find the salary:
 - (a) If the wage is *straight commission*, the salary is \$0.
 - (b) If the wage is *commission-plus-salary*, determine the gross pay based on salary.
3. Add the commission and the salary.