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etty goes to high school with Alex. She knows that Alex is trying to decide whether getting a part-time job is worth the effort and time involved. She and Alex were dating before Alex met Alice. In fact, Betty was with Alex when he was shopping around for his van.

Alex and his parents seemed to know a lot about car salespeople when they were picking out the van. At one of the lots they visited, a saleswoman kept trying to push Alex's father and mother into choosing a gorgeous, current-year model. Betty noticed that the saleswoman kept saying that it was "loaded." It had not only a very powerful engine but all the extras: "power this" and "power that," a really plush interior, and all kinds of built-in storage space. Of course, it had a "powerful" price tag also.

Betty guessed that it cost more than Alex's parents wanted to spend. After all, Alex just needed transportation to and from school.

As they left the car lot and drove toward another lot, where Alex would eventually buy his van, Betty asked why the saleswoman had seemed so eager to sell the most expensive van they had. Alex's father explained, "Oh, she works on commission, Betty. You see, the more money we spend, the more she makes! Perhaps she has not stopped to realize that if she does not sell us what we want, she will not make anything from us!"

Betty was not sure she understood how a person's earnings could be affected by the price of a van. She decided to find out.

- OBJECTIVES:** In this lesson, we will help Betty to:
- Determine how much a salesperson earns when his or her pay is based on a commission.
 - Determine how much a person earns when his or her pay is based on a piece rate, or item rate.
 - Understand that the earnings of a person who works on commission or piece rate can vary from month to month.

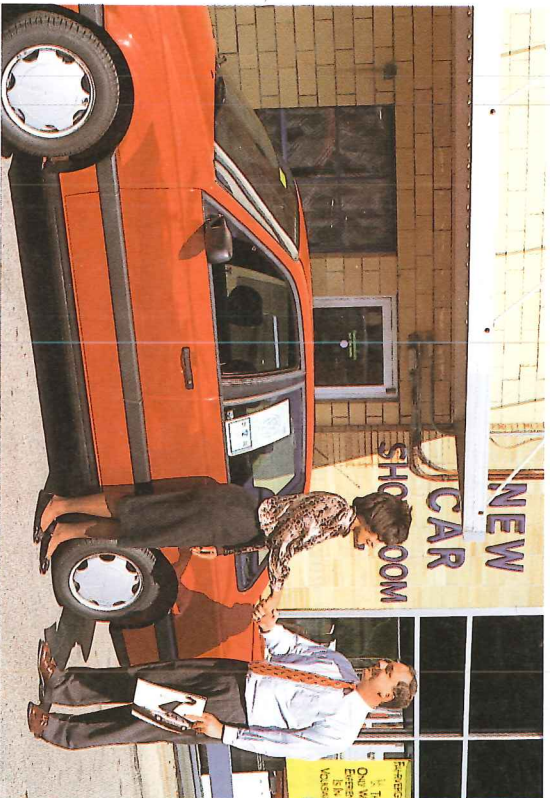
EARNING COMMISSIONS

People whose salaries depend on how much they sell in a given period of time are said to be paid on **commission**. These salespeople receive a percent of each amount that they bring in. For example, Jason, who works at a used-car lot, earns a 15% commission on every car he sells. Today, Jason sold a car for \$6000. His earnings are 15% of \$6000.

$$6000 \cdot 0.15 = 900$$

Jason earned \$900. The more cars Jason sells, the more money he makes. If he sells no cars on a particular day, he earns no money that day.

Some salespeople earn a regular salary plus a commission, as illustrated in the ad below. If the headline is to be believed, the salesperson could earn \$50,000 in a year, but he or she would probably have to make a lot of sales to earn that much.



Auto

\$50,000+ POTENTIAL

We are seeking 2 aggressive self-motivated people to add to our highly successful team. Previous auto-sales experience helpful. We are especially interested in those with **HEAVY RETAIL SALES EXP.** We have an intensive in-house training program to launch you onto a successful sales career. We offer:

- Weekly salary & Comm.
- New demo
- Top medical ins. program
- Heavy advertising
- Excellent service dept. to keep your customers happy

Suppose that the weekly salary is \$300. For 52 weeks the salary will be \$15,600 ($300 \cdot 52$ weeks). If the salesperson earns 10% commission on all sales and sells \$344,000 worth of cars during the year, the total earnings will be

$$\begin{array}{r} \$15,600 \\ + 34,400 \\ \hline \$50,000 \end{array}$$

$\$300 \cdot 52 = \text{regular salary}$
 $\$344,000 \cdot 0.10 = \text{commission}$
Total earnings for the year

If these are new cars, then between 25 and 40 of them are probably being sold a year. If the commission is less than 10%, the salesperson will have to sell more cars to make the same amount of money.

Some companies also encourage their salespeople to sell more by offering them a **graduated commission**. If they sell up to a specified amount, their commission rate will be a certain percent. If they sell more than that amount, the percent will increase.

PIECE RATE

Instead of receiving a salary for working a certain amount of time, some people are paid a **piece rate**, or **item rate** for the number of items that they produce or sell. If you work fast or work on your own schedule, being paid a piece rate may be advantageous to you. Like commission, a piece rate is sometimes combined with a **base salary**, which you would receive regardless of how many items you produced or sold.

PUSH MONEY

Consumers are easily influenced when they lack adequate information about products that they buy. Unfortunately, in many stores, salespeople are not informed enough about a product to provide adequate information to customers. They are trained just to take a customer's order.

Another problem is the salesperson who is paid **push money**, a cash incentive provided by a *manufacturer* for selling the manufacturer's products. Push money is not the same as a commission, which is money paid by the *store* to salespeople to sell *all* the products in the store. If you notice a salesperson aggressively pushing a certain product, that salesperson may be receiving push money. Let the buyer beware!

ALGEBRA REVIEW

Solve for x or a .

- $14x - 8 = 20$
- $3.5 + 2.5a = 18$
- $(3.5 + 2.5)a = 18$
- $26x = 78$
- $\frac{1}{26}x = 78$
- $300 + 0.10x = 50,000$

Simplify.

Example

$$\begin{aligned} 2m + 3.5m - 2.7p + 8 \\ = (2 + 3.5)m - 5.5p + 8 \\ = 5.5m - 5.5p + 8 \end{aligned}$$

- $9x + 3.5x$
- $0.05x - 0.03x + 7$
- $(2.1 + 3.9)b + 4b$
- $1y + 14y$
- $0y + 14y + 1 \cdot 5$
- $y + 14y + 0 \cdot 5$

CLASSIFIED ADS

As Betty was seeking information about salespeople whose earnings depend on commissions, she discovered the following classified ads in the employment section of her Sunday newspaper. The jobs seemed very attractive. But Betty thought that there was more to the matter than she could see from the ads.

<p>Sales</p> <p>ONE-CALL CLOSERS</p> <p>If you are willing to learn and want to earn</p> <p>\$650–\$1200 (weekly commission)</p> <ul style="list-style-type: none"> • CASH PAID DAILY • NO INVESTMENT • DAYTIME SALES • COMPLETE TRAINING • AUTO REQUIRED • MANAGEMENT OPTTY. <p>CALL MONDAY ONLY</p>	<p>TIRED OF FALSE PROMISES? (I was)</p> <ul style="list-style-type: none"> • Join one of the fastest growing industries in the country. • Enjoy success as hundreds of our representatives do. • Earn over \$100,000 per year. • FRESH FREE LEADS • NO SATURDAYS • 10% OF BACK-END PAID/MO. 	<p>CAREER SALES OPPORTUNITY</p> <p>Would You Believe \$144/day?</p> <p>General Research is expanding its headquarters to the suburbs. We are hiring 2-3 people of legal age for marketing and management training program. Minimum \$1500/month guaranteed commissions and bonuses to start. All fringe benefits including hospitalization, medical and life insurance. Must have dependable auto. Call today.</p>
<p>SALES/GOLF</p> <p>Earn more than you require. \$40-\$120,000 per year commissions. Self-starting closer.</p>	<p>ADVENTURE INN BIG MONEY</p> <p>Direct sales experience required. Seminar sales. Sell vacation club. Prospects furnished. Work evenings and weekends. 5-day work week required. Straight commission. Earn up to \$1600 a week. Closed Monday.</p>	

Betty remembered talking with a friend who sells cars. She found out that if a rebate or discount is given, that fact affects how much commission is earned. Suppose that a car is priced at \$6000 and a \$420 discount is offered to make the customer want to buy the car. The salesperson receives a commission on only \$5580 (that is, on 6000 – 420). Because of details such as this, Betty realizes that finding a job requires a lot of research. She cannot just read the ads.

Ask Yourself

1. How can people earn the high pay offered in ads such as those shown?
2. How does a graduated commission work?
3. What is push money?
4. How is push money different from a commission?

SHARPEN YOUR SKILLS

SKILL 1

You can use a formula to find the commission C when you are given the rate of commission r , the price p , and the number of items n sold. Remember to round commission to the nearest cent.

Commission = price • commission rate • number sold

Commission Formula

$C = prn$ where p = price of one item

r = commission rate

n = number of items sold

EXAMPLE 1 Betty's friend Rosalie is a salesperson at a department store. She receives a 7% commission for selling small appliances and housewares. Among the many items that she sells is a fancy ceramic mug. Rosalie would like to know how many mugs she needs to sell to earn at least \$50.

COMPUTER MUG of glazed earthenware with terminal and keyboard as handle. Dishwasher safe. For hot or cold beverages, pencils, and more. Holds 14 oz. #45678 mug \$12.95

QUESTION How can Rosalie use her graphing calculator to find out how many mugs she needs to sell to earn \$50?

SOLUTION

Rosalie uses the commission formula.

$$C = prn$$

$$C = 12.95 \cdot 0.07 \cdot n$$

$$C = 0.9065n$$

$$p = 12.95, r = 7\% = 0.07$$

To use her graphing calculator to graph this equation, Rosalie has to change the variable C to y and the variable n to x :

$$y = 0.9065x$$

Rosalie enters the equation into her graphing calculator. She sets the range as shown and graphs the equation.

$$X_{\min}: 0$$

$$Y_{\min}: -10$$

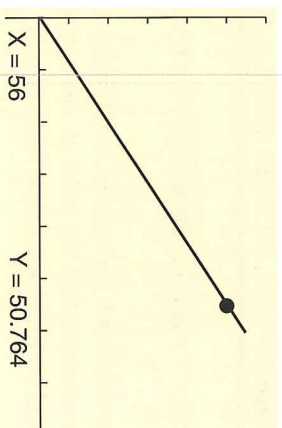
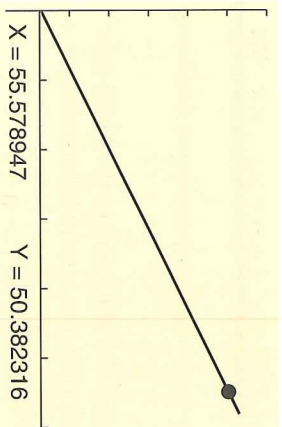
$$X_{\max}: 60$$

$$Y_{\max}: 60$$

$$X_{\text{scl}}: 10$$

$$Y_{\text{scl}}: 10$$





The graph is a line as shown at the left above. Rosalie uses the TRACE function to move the cursor along the line until the y value is close to \$50. She concludes that she can earn over \$50 in commissions by selling 56 mugs.

She would like x values to be integers, so she uses the INTEGER function of her graphing calculator or sets the range to a “friendly window” and redraws the graph as shown at the right above.

To confirm the calculator results, Rosalie substitutes $n = 56$ into the commission equation.

$$C = 0.9065n$$

$$C = 0.9065 \cdot 56$$

$$C = 50.764$$

$$n = 56$$

The equation method confirms the results of the graphing calculator. Rosalie’s commission is \$50.76 for selling 56 mugs.

SKILL 2

You can use a formula to find the earnings E when you are given the monthly salary s , the commission rate r , and the total sales t .

Earnings with Commission Formula

$$E = s + rt$$

where s = monthly salary

r = commission rate

t = total sales for the month

EXAMPLE 2 William earns a salary of \$1000 per month selling cars plus a commission of 6% on each car that he sells. In his first month on the job, he sold 3 cars for a total of \$29,500 in car sales.

QUESTION How much did William earn in all?

SOLUTION

$$E = s + rt$$

$$E = 1000 + 0.06(29,500)$$

$$E = 2770$$

Use the earnings formula.

$$s = 1000, r = 6\% = 0.06, t = 29,500$$

$$E = 2770$$



You can enter the calculation in your graphing calculator as written, since the calculator will multiply before adding.

William earned \$2770 in salary and commissions during the month.

EXAMPLE 3 Yvette is a real-estate salesperson. Her earnings are based on a *graduated commission*. She receives 4% of any sale up to \$100,000. For any amount over \$100,000 she receives a 6% commission. Last Sunday she sold the house described below.

MIINT CONDITION!! \$109,000

You'll appreciate the love and care that went into this stunning 3-bdrm, 2-bath home. Vaulted ceilings, custom drapes, mst. bath w/whirlpool/double vanity.

QUESTION How much did she make selling the home?

SOLUTION

Commission = price • rate

Find the commission C_1 (read “C sub one”) on \$100,000. Then find the commission C_2 (read “C sub two”) on the amount over \$100,000.

$$C_1 = 100,000 \cdot 0.04 = 4000$$

$$C_2 = 9000 \cdot 0.06 = 540$$

$$109,000 - 100,000 = 9000$$

$$\text{Total commission} = C_1 + C_2$$

$$\text{Total commission} = 4000 + 540 = 4540$$

Yvette's commission is \$4540.

SKILL 3

To solve problems involving piece rate, use the following formula.

Piece Rate Formula

$E = rn$ where r = the piece or item rate

n = the number of items

EXAMPLE 4 Carole decorates wedding cakes at Sloane's Bakery. Mrs. Sloane pays her \$16.00 for each cake that she decorates.

QUESTION How much money did Carole earn in a week in which she decorated 5 wedding cakes?

SOLUTION

Substitute in the formula for piece work.

$$E = m$$

$$E = 16,00 \cdot 5$$

$$E = 80$$

Carole earned \$80 for 5 wedding cakes.

EXAMPLE 5

Mrs. Sloane needs Carole to help her with customers when she is not busy decorating cakes. She has offered Carole a choice of one of two payment plans.

Plan 1: Salary of \$120 for a 20-hour week and \$12 for each cake

Plan 2: Salary of \$105 for a 20-hour week and \$14.50 for each cake

QUESTION Which plan should Carole choose?

SOLUTION

Carole is not sure which plan is better for her. She thinks that she can decorate at least 7 cakes a week. Carole writes two equations, one for each plan.

Plan 1: $E = 120 + 12n$

Plan 2: $E = 105 + 14.50n$

$$\text{Earnings} = \text{salary} + \text{piece-rate pay}$$

Carole wants to know the least value of n that will make the same money with either plan. She solves the *system of equations* by setting the two earnings equal to each other.

$$120 + 12n = 105 + 14.5n$$



When solving an equation, you may subtract the same quantity from each side of the equation. Carole decides to subtract $12n$ to obtain a simpler equation.

$$\begin{aligned}120 + 12n &= 105 + 14.5n \\120 + 12n - 12n &= 105 + 14.5n - 12n \\120 &= 105 + 2.5n\end{aligned}$$

Subtract $12n$ from both sides.

Combine similar terms: $12n - 12n = 0$; $14.5n - 12n = 2.5n$

Subtract 105 from both sides.

$$\begin{aligned}120 - 105 &= 105 + 2.5n - 105 \\15 &= 2.5n\end{aligned}$$

$$\frac{15}{2.5} = \frac{2.5n}{2.5}$$

Divide both sides by 2.5.

$$6 = n$$

Simplify.

Carole will earn the same money under both plans if she decorates 6 cakes.

$$\text{Plan 1: } E = 120 + 12n = 120 + 12(6) = 192$$

$$n = 6$$

$$\text{Plan 2: } E = 105 + 14.50n = 105 + 14.50(6) = 192$$

$$n = 6$$

She also calculates her earnings under both plans if she decorates 7 cakes.

$$\text{Plan 1: } E = 120 + 12(7) = 204$$

$$n = 7$$

$$\text{Plan 2: } E = 105 + 14.5(7) = 206.50$$

$$n = 7$$

Plan 2 is better for her when $n = 7$. Carole concludes that she earns more money under Plan 2 if $n > 6$ (n is *greater than* 6) and more money under Plan 1 if $n < 6$ (n is *less than* 6).

TRY YOUR SKILLS

The commission rate, the price of each item, and the number of items sold are given for each salesperson.

- Calculate the commission earned by selling the first number of items sold (for example, 10 items in Exercise 1).
- Write an equation to show the commission y earned by selling x number of items.
- Graph the equation on your graphing calculator. Then use the TRACE function to find the commissions for all four amounts. Remember to use an integer function or a “friendly window.”

	Person	Price	Rate	Number Sold
1.	Carole	\$16.75	9%	10; 18; 24; 32
2.	José	21.90	8.5%	8; 16; 22; 28
3.	Gabe	21.95	7.5%	5; 12; 15; 18

Tracey and several of her friends have jobs working for a monthly salary plus commission. Find the month's earnings for each person. Monthly salary, commission rate, and the amount of sales are shown. Use a computer spreadsheet.

Name	Monthly Salary	Commission Rate	Total Sales	Commission Earned	Total Earnings
4. Tracey	\$ 350	12%	\$6125		
5. Isabel	475	11.5%	6250		
6. Damien	1000	8.5%	7100		

- Tom assembles radios and tape recorders in a factory. He receives \$9 for each radio and \$12 for each tape recorder. How much did he earn in a week in which he assembled 26 radios and 38 tape recorders?
- Alice has her own barber shop. She charges \$9 for a regular haircut and \$16 for a personalized haircut. Last week, 26 of her customers had a regular haircut, and 8 customers had the personalized haircut. What were her earnings for the week?
- Patrick sells annual memberships in a health club. His boss has offered him a choice between Plan 1, no salary but a straight \$30 for each membership sold, and Plan 2, a weekly base salary of \$300 plus \$15 for each membership he sells. How many memberships would Patrick have to sell to make the same amount of money under either plan?

EXERCISE YOUR SKILLS

- If you are earning a commission, why is it to your advantage to sell a relatively expensive item?
- A person working on commission cannot predict exactly what next month's income is going to be. What is a good way to handle money so that there is enough to pay the bills?
- Imagine that you work on commission in a large department store and that during the month before Christmas and Hanukkah, your department has a high volume of sales. As a result, your salary is three times what it was the previous month. Would you assume that next month's salary will be equally high and so be tempted to spend most of your earnings? Why or why not?
- Reread each ad that Betty read in this lesson. Decide what is positive and what is negative about each position being advertised. Make a list of questions that you would ask if you went for an interview for each job. Which jobs appeal to you the most? Which jobs appeal the least?

KEY TERMS

base salary
commission
graduated
commission
item rate
piece rate
push money

The commission rate, the price of each item, and the number of items sold are given for each salesperson.

- Calculate the commission earned by selling the first number of items sold (for example, 18 items in exercise 5).
- Write an equation to show the commission y earned by selling x number of items.
- Graph the equation on your graphing calculator. Then use the TRACE function to find the commissions for all four amounts. Remember to use an integer function or a “friendly window.”

Person	Price	Rate	Number Sold
5. Ellen	\$ 3.75	10%	18; 28; 38; 48
6. Ivy	22.80	8.2%	6; 10; 14; 18
7. Peter	7.99	9.5%	15; 25; 35; 45

8. Jenny earns a base monthly salary of \$2150 plus a commission of $7\frac{1}{2}\%$ on her sales. In July her sales were \$7350. How much did she earn in July?

9. Samantha sells used cars. Her earnings are based on a graduated commission. She receives 3% of her total sales up to \$20,000 and $4\frac{1}{4}\%$ of all sales over \$20,000. Find Samantha’s total earnings for a week in which she sold cars priced at \$6,399, \$2,495, \$7,450, and \$10,188.

Eduardo is a real-estate salesperson who specializes in selling houses. His earnings are based on a graduated commission. He receives 2% on each sale up to \$100,000 and 3% of the amount above \$100,000. How much would Eduardo earn for selling each of these houses?

10. **BEAUTY & SPACE**

\$199,900 5 bedrooms, 3 1/2 baths, formal living and dining. Study. Master bedroom. Lots of storage. Jacuzzi.

11. **LOCATION PLUS**

\$149,900 4 bedrooms, 2 1/2 baths, formal living and dining. Family room, game room.

The salespeople below are offered a choice of two monthly payment plans.

Plan 1: Base salary + commission

Plan 2: A higher rate of commission and no base salary

Let t represent the amount of sales and E represent the earnings. Write an equation for each payment plan. By solving the equations together, find the amount of sales needed to make the same earnings with either plan.

12. Eric

Plan 1: 9% of sales + \$900

Plan 2: 12% of sales

13. Wanda

Plan 1: 7% of sales + \$2400

Plan 2: 10% of sales

- Boris repairs TV and VCR remote-control units at \$7.50 an hour in an electronic equipment repair store. He also gets \$4.00 for each unit that he repairs. He works a 40-hour week.
- How many units does he have to repair to earn at least \$500 per week?
 - It takes Boris an average of $\frac{1}{2}$ hour to repair a unit. What is the most money that he can earn in one week?
 - How many units does Boris have to repair to earn \$700 in one week? Explain your answer.

MIXED REVIEW

Determine the total weekly earnings for each employee described in each classified ad below. Use an equation of the form $E = rh + t$, where r represents the regular hourly rate, h represents the number of hours worked, and t represents the tips or bonus, if any.

- | | |
|-----------------------|--|
| Health Care | 2. |
| LAB TECHNICIAN \$10/h | Manicurist |
| 45 hours/week | English and Spanish speaking. Guaranteed pay \$6.50/h to start. Tips can be up to \$90 for a 35-hour week! |

For each company fringe benefits policy described below, find

- the amount that the company must pay for extra taxes, retirement, health and life insurance, and other fringe benefits.
- how much salary is paid for the number of nonworking days in a total of 260 operating days.

EMPLOYEE	SALARY	FRINGE BENEFITS POLICY
3. Bookkeeper	\$40,000	7.65% of gross for FICA taxes 3% of gross for retirement
4. Cashier	\$18,500	26 nonworking days 7.65% of gross for FICA taxes \$50/month for health insurance
5. Bank manager	\$55,000	8 holidays, 4 sick days, 10 vacation days 7.65% of gross for FICA taxes \$120/month for life and health insurance \$200/month expense allowance 18 nonworking days