CHAPTER

9

Planning for Retirement

9-1 Retirement Income from Savings
9-2 Social Security Benefits
9-3 Pensions
9-4 Life Insurance

if we ... accept our generation's responsibility, that's going to mean that we give our children no less retirement security than we inherited

Carol Moseley Braun,
American Politician

What do you think the author meant in her quote?

Most people eventually stop working—they retire—yet they still have all of the expenses you have encountered in this course. Everybody needs to make arrangements to have steady income for their retirement years. Imagine someone who retires at age 65 and lives to age 85. For 20 years after they stopped working, they need income. You need to start planning for retirement early in your working life. If you don't, you may not have enough money to fund your retirement. Retirement planning can actually affect what job you choose to do when you start working in your 20s!

There are many avenues you can take. There are special savings accounts that you can open for retirement income. Some jobs offer pension plans. Social Security provides benefits for retirees. You can't ignore the issue even when retirement seems a "lifetime" away. It is important to become knowledgeable about the pros and cons of each type of retirement income, so you are ready when you retire!

Really?

"A tsunami is building and ready to hit future generations, but this won't be set off by earthquakes or other natural disasters. Instead, it will be a fiscal calamity created by the failure of government and business leaders to deal with the financial drain of millions of retiring baby boomers," said former U.S. Comptroller General, David Walker. Who are these baby boomers that Walker is so worried about? Baby boomers are defined as those people born from 1946 to 1964. This was a time right after World War II when the United States experienced a huge increase in births. Examine these birth statistics.

1940 2,559,000 births per year
1946 3,311,000 births per year
1955 4,097,000 births per year
1957 4,300,000 births per year
1964 4,027,000 births per year
1974 3,160,000 births per year

Look at the rise in birthrates during the "boomer" years. In 2008, the first baby boomers reached the age when they could begin collecting full retirement benefits from the federal government. It is very likely that your grandparents were part of the baby boom generation. It is reported that as these baby boomers age, close to 9,000 Americans will reach the age of 65 each day. With that many baby boomers nearing the time when they leave the workforce, using Social Security benefits, and tapping into retirement savings accounts, it is reasonable to expect that there will be an effect on business, banking, and the economy.

Really!

A whole generation of Americans will retire in poverty instead of prosperity, because they simply are not preparing for retirement now.

Scott Cook, American Businessman

9-1 Retirement Income from Savings

Objectives

- Calculate future values of retirement investments that are both single deposit and periodic.
- Compare the tax savings by making contributions to pre-tax retirement savings accounts.
- Calculate an employer's matching contribution to a retirement account.

Key Terms

- retirement
- semi-retired
- pre-tax dollars
- after-tax investments
- individual retirement account (IRA)
- traditional IRA
- tax-deferred
- Roth IRA
- tax-exempt
- 401k
- Keogh plan
- 403b

How can you save for your retirement?

Retirement is a specific point in a person's life when he or she stops working. People can be partially, or **semi-retired**. That is, they continue to work at a full- or part-time job out of choice or financial necessity. Many people begin planning for their retirement at an early age in order to be financially secure when they are no longer employed. There are many options available that can provide you with some form of income in your retirement. Some retirement accounts are made with **pre-tax dollars**. A pre-tax investment is a deposit made to a retirement account that is taken out of your wages before taxes have been calculated and deducted. Pre-tax investments lower your current taxable income. Other types of accounts are made with **after-tax investments**. This is money that is deducted from your income after taxes have been deducted.

Some retirement plans are sponsored by employers and others are opened by individuals. Here are a few of the most common retirement savings plans.

- An **individual retirement account**, or **IRA**, is an account that is opened by an individual. There are two types of IRAs. A **traditional IRA** is a savings plan in which the income generated by the account is **tax-deferred** until it is withdrawn from that account. If you withdraw money from the account before the age of $59\frac{1}{2}$, then you may have to pay an early withdrawal penalty of 10% on that amount, as well as income tax. The penalty can be waived for certain exceptions such as qualified higher education expenses. The second type of IRA is a **Roth IRA**. All deposits into a Roth IRA are taxable. But, when the

money is withdrawn from the account after having been there for at least 5 years and the saver is at least $59\frac{1}{2}$ years old, the money and the income earned is **tax-exempt**, or free from taxes. There is an income limit for being able to open a Roth IRA or a traditional IRA.

- A **401k** plan is a retirement savings plan that is sponsored by an employer for its employees. Like other retirement plans, there are strict rules as to when the money can be withdrawn without a penalty. There are also contribution limits that change from year to year.
- A **Keogh plan** is a retirement savings plan for a self-employed professional or the owner of a small business. The pre-tax money invested in this type of an account is tax-deferred until it is withdrawn.
- A **403b** plan is a tax-deferred retirement savings program for employees of educational institutions and some non-profit organizations.

Skills and Strategies

In Chapter 3, you learned about present and future values of single and periodic investment accounts. Often, these are retirement accounts.

EXAMPLE 1

Blythe is 40 years old. She is planning on retiring in 25 years. She has opened an IRA with an APR of 3.8% compounded monthly. If she makes monthly deposits of $500 to the account, how much will she have in the account when she is ready to retire?

SOLUTION Recall the formula in Lesson 3-7 for determining the future value of a periodic deposit investment.

$$B = \frac{P\left(\left(1 + \frac{r}{n}\right)^{nt} - 1\right)}{\frac{r}{n}}$$

where B = balance at end of investment period
P = periodic deposit amount
r = annual interest rate expressed as a decimal
n = number of times interest is compounded annually
t = length of investment in years

Use the formula to determine the amount in Blythe's account after 25 years.

$$B = \frac{500\left(\left(1 + \frac{0.038}{12}\right)^{12(25)} - 1\right)}{\frac{0.038}{12}} \approx 249{,}762.8564$$

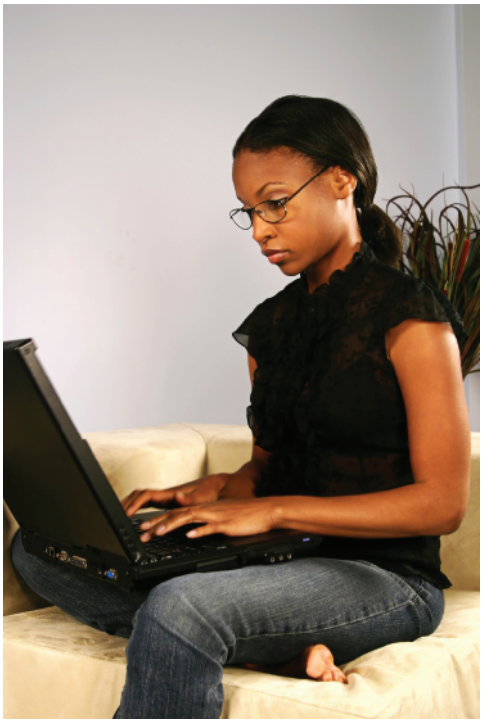
Blythe will have approximately $249,763 in her account after 25 years.

CHECK YOUR UNDERSTANDING

Which would have a greater effect on the final balance in Blythe's account—half the monthly deposit or half the interest rate?

EXAMPLE 2

Suppose that Blythe's annual contribution was pre-tax. How much did she save in taxes in one year if her taxable income for that year was $72,500?



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SOLUTION Blythe's taxable income was $72,500 for the tax year. Using the tax table on the left below, Blythe owes $14,475 in taxes.

Blythe contributed $500 for each of 12 months during the year.

$$12 \times 500 = 6{,}000$$

By using pre-tax dollars for her retirement investments, her income was reduced by $6,000.

Had her retirement deductions not been in pre-tax dollars, her taxable income would be $6,000 higher.

Taxable income plus pre-tax dollars $\quad 72{,}500 + 6{,}000 = 78{,}500$

Suppose Blythe's income was $78,500. Using the tax table on the right below, her tax would have been $15,975.

If line 43 (taxable income) is—		
At least	But less than	Single
72,000		
72,000	72,050	14,350
72,050	72,100	14,363
72,100	72,150	14,375
72,150	72,200	14,388
72,200	72,250	14,400
72,250	72,300	14,413
72,300	72,350	14,425
72,350	72,400	14,438
72,400	72,450	14,450
72,450	72,500	14,463
72,500	72,550	14,475
72,550	72,600	14,488
72,600	72,650	14,500
72,650	72,700	14,513
72,700	72,750	14,525
72,750	72,800	14,538
72,800	72,850	14,550
72,850	72,900	14,563
72,900	72,950	14,575
72,950	73,000	14,588

If line 43 (taxable income) is—		
At least	But less than	Single
78,000		
78,000	78,050	15,850
78,050	78,100	15,863
78,100	78,150	15,875
78,150	78,200	15,888
78,200	78,250	15,900
78,250	78,300	15,913
78,300	78,350	15,925
78,350	78,400	15,938
78,400	78,450	15,950
78,450	78,500	15,963
78,500	78,550	15,975
78,550	78,600	15,988
78,600	78,650	16,000
78,650	78,700	16,013
78,700	78,750	16,025
78,750	78,800	16,038
78,800	78,850	16,050
78,850	78,900	16,063
78,900	78,950	16,077
78,950	79,000	16,091

To find how much Blythe saved, subtract the tax without the reduction from the tax with the reduction.

$$15{,}975 - 14{,}475 = 1{,}500$$

By opening up an account in which her retirement savings were tax deferred, Blythe saved $1,500 in taxes.

CHECK YOUR UNDERSTANDING

Suppose Jacob invested D dollars in an after-tax retirement account. His taxable income for the year was A dollars. Represent his taxable income had he invested that same amount in a pre-tax account.

EXAMPLE 3

Chelsea is 45 years old. She plans to open a retirement account. She wants to have $300,000 in the account when she retires at age 62. How much must she deposit each month into an account with an APR of 2.25% to reach her goal?

SOLUTION Recall the formula in Lesson 3-8 for determining present value of a periodic deposit investment.

$$P = \frac{B\left(\frac{r}{n}\right)}{\left(1 + \frac{r}{n}\right)^{nt} - 1}$$

where B = ending balance
P = periodic deposit amount
r = annual interest rate expressed as a decimal
n = number of times interest is compounded annually
t = length of investment in years

Chelsea can compute the amount she will need to deposit each month for the next 17 years as follows.

$$P = \frac{30{,}000\left(\frac{0.0225}{12}\right)}{\left(1 + \frac{0.0225}{12}\right)^{12(17)} - 1} \approx 1{,}208.59$$

Chelsea should deposit $1,209 each month to reach her goal.

CHECK YOUR UNDERSTANDING

Which would result in a need for a larger monthly deposit: half the interest rate or half the number of years before the money is withdrawn from the account?

EXAMPLE 4

Zander is a 50-year-old married man who files taxes separately from his wife. He has been making monthly contributions into his traditional IRA for many years. Last year, he entered into a new business partnership and decided to withdraw $50,000 from his IRA to make the initial investment in the partnership. Zander's taxable income for the year, excluding the $50,000 from his IRA, was $97,000. How much extra did he pay in both penalty and taxes because of this withdrawal?

SOLUTION Using the tax table shown, Zander's taxable income of $97,000 would have made his tax $21,539.

Zander's withdrawal will increase his taxable income to $147,000.

$$97{,}000 + 50{,}000 = 147{,}000$$

If line 43 (taxable income) is—		And you are —			
At least	But less than	Single	Married filing jointly *	Married filing separately	Head of a household
		Your tax is —			
97,000					
97,000	**97,050**	21,145	16,944	21,539	19,319
97,050	**97,100**	21,159	16,956	21,553	19,331
97,100	**97,150**	21,173	16,969	21,567	19,344
97,150	**97,200**	21,187	16,981	21,581	19,356
97,200	**97,250**	21,201	16,994	21,595	19,369
97,250	**97,300**	21,215	17,006	21,609	19,381
97,300	**97,350**	21,229	17,019	21,623	19,394
97,350	**97,400**	21,243	17,031	21,637	19,406
97,400	**97,450**	21,257	17,044	21,651	19,419
97,450	**97,500**	21,271	17,056	21,665	19,431
97,500	**97,550**	21,285	17,069	21,679	19,444
97,550	**97,600**	21,299	17,081	21,693	19,456
97,600	**97,650**	21,313	17,094	21,707	19,469
97,650	**97,700**	21,327	17,106	21,721	19,481
97,700	**97,750**	21,341	17,119	21,735	19,494
97,750	**97,800**	21,355	17,131	21,749	19,506
97,800	**97,850**	21,369	17,144	21,763	19,519
97,850	**97,900**	21,383	17,156	21,777	19,531
97,900	**97,950**	21,397	17,169	21,791	19,544
97,950	**98,000**	21,411	17,181	21,805	19,556

Because his taxable income is more than $100,000, he must use the tax computation worksheet to calculate his tax. The portion of the worksheet that pertains to Zander is shown here.

Section C — Use if your filing status is **Married filing separately**. Complete the row below that applies to you.

Taxable income. If line 43 is—	(a) Enter the amount from line 43	(b) Multiplication amount	(c) Multiply (a) by (b)	(d) Subtraction amount	Tax. Subtract (d) from (c) Enter the result here and on Form 1040, line 44
At least $100,000 but not over $100,150	$	× 28% (.28)	$	$ 5,628.00	$
Over $100,150 but not over $178,850	$ 147,000	× 33% (.33)	$ 48,510	$ 10,635.50	$ 37,874.50
Over $178,850	$	× 35% (.35)	$	$ 14,212.00	$

Zander's tax is now $37,874.50, which is $16,335.50 more than if he had not made the early withdrawal from his IRA.

$$37{,}874.50 - 21{,}539 = 16{,}335.50$$

Because Zander made a withdrawal before age $59\frac{1}{2}$ he must pay a penalty of 10% of the withdrawal amount.

$$0.10 \times 50{,}000 = 5{,}000$$

Add the penalty and the amount of additional taxes.

$$16{,}335.50 + 5{,}000 = 21{,}335.50$$

Zander had to pay $21,335.50 in combined taxes and penalty.

CHECK YOUR UNDERSTANDING

Suppose that Rachel's taxable income is D dollars. She withdraws A dollars from her IRA, which brings her taxable income between $100,150 and $178,850. Using the tax computation worksheet above, write an algebraic expression for her tax.

Employer Matching Plans

Some employers offer 401k retirement plans in which they match the employee's contribution up to a fixed amount of the salary made. This is extremely beneficial to the employee and is an excellent employee benefit. The money contributed by both the employer and the employee earns interest and is tax-deferred. Most companies only allow employee contributions to the 401k plan up to a certain percentage of the salary earned, based on government rules. There is also a maximum allowable contribution, which may change each year. The employer matching contribution is not calculated into the 401k yearly contribution limit.

EXAMPLE 5

Leo makes $75,000 per year. His company offers a 401k retirement plan in which they match 50% of his contributions to the 401k up to 6% of his salary. The company allows employees to make contributions to the 401k to a maximum of 15% of their salary. The maximum allowable contribution to any 401k is $16,500. How much should Leo contribute per month in order to maximize his employer's matching contribution?

SOLUTION Determine the maximum that Leo's employer will allow him to contribute this year to the 401k.

$$75{,}000 \times 0.15 = 11{,}250$$

Leo can contribute \$11,250, which is below the 401k limit of \$16,500 for the year.

To find the monthly contribution Leo can make, divide by 12.

$$11{,}250 \div 12 = 937.50$$

Leo can contribute \$937.50 per month and will reach his employer's maximum contribution limit by the end of the year.

Suppose Leo only wants to contribute an amount up to his employer's matching contribution level. He finds 6% of his salary and divides that amount by 12.

$$75{,}000 \times 0.06 = 4{,}500$$

$$4{,}500 \div 12 = 375$$

Leo will make a monthly contribution of \$375 to his 401k account.

His employer will make a matching contribution of 3%.

$$75{,}000 \times 0.03 = 2{,}250$$

$$2{,}250 \div 12 = 187.50$$

Leo's employer will contribute \$187.50 each month, or \$2,250 annually, to match Leo's contribution.

Add the two contributions. $375.00 + 187.50 = 562.50$

Each month \$562.50 will be put into Leo's 401k account. The total annual deposit to his 401k account will be 12×562.50, bringing his total annual deposit to \$6,750.

CHECK YOUR UNDERSTANDING

Robin makes D dollars. Her employer will match her IRA contributions up to P percent of her salary. Write an algebraic expression for Robin's monthly contribution if she only wants the total to match the maximum amount that will be matched by her employer.

Applications

A whole generation of Americans will retire in poverty instead of prosperity, because they simply are not preparing for retirement now.

Scott Cook, American Businessman

1. Explain how the quote can be interpreted.

2. Ricky is 35 years old. He plans to retire when he is 63. He has opened a retirement account that pays 3.2% interest compounded monthly. If he makes monthly deposits of $400, how much will he have in the account by the time he retires?

3. Jay just graduated from college and he has decided to open a retirement account that pays 1.75% interest compounded monthly. If he has direct deposits of $100 per month taken out of his paycheck, how much will he have in the account after 42 years?

4. At the age of 30, Jasmine started a retirement account with $50,000 which compounded interest semi-annually with an APR of 4%. She made no further deposits. After 25 years, she decided to withdraw 50% of what had accumulated in the account so that she could contribute towards her grandchild's college education. She had to pay a 10% penalty on the early withdrawal. What was her penalty?

5. A taxpayer who pays 22% in taxes each year has these two accounts.

Account 1: $10,000 is placed in a tax-deferred account that pays 5% interest compounded annually for 25 years.

Account 2: $10,000 is placed in a taxable account that pays 5% interest compounded annually for 25 years.

a. How much is in Account 1 after the 25-year period?

b. Since the taxpayer pays 22% of all income in taxes, 22% of the interest he makes each year will go towards taxes. Therefore, his annual interest rate in actuality is 22% less than the 5% quoted rate. What is his real annual interest rate?

c. How much will he actually have made after the 25-year period in Account 2 if taxes are taken into consideration?

6. Laura has been contributing to a retirement account that pays 4% interest with pre-tax dollars. This account compounds interest monthly. She has put $500 per month into the account. At the end of 10 years, she needed to pay some medical bills and had to withdraw 15% of the money that was in the account.

a. Rounded to the nearest dollar, how much did she withdraw?

b. Laura pays 23% of her income in taxes. What was her tax on the amount of the withdrawal (rounded to the nearest dollar)?

c. She had to pay a 10% early withdrawal penalty. How much was she required to pay, rounded to the nearest dollar?

7. Fiona opened a retirement account that has an annual yield of 6%. She is planning on retiring in 20 years. How much must she deposit into that account each year so that she can have a total of $600,000 by the time she retires?

8. John is 60 years old. He plans to retire in two years. He now has $400,000 in a savings account that yields 2.9% interest compounded continuously (see Lesson 3-7). He has calculated that his final working year's salary will be $88,000. He has been told by his financial advisor that he should have 60–70% of his final year's annual income available for use each year when he retires.

a. What is the range of income that his financial advisor thinks he must have per year once he retires?

b. Use the continuous compounding formula to determine how much he will have in his account at the ages of 61 and 62.

c. Assume that John is planning on using 65% of his current salary in each of his first 5 years of retirement. What should that annual amount be?

d. John has decided that he will need $20,000 each year from his savings account to help him reach his desired annual income during retirement. Will John be able to make withdrawals of $20,000 from his savings account for 20 years? Explain your reasoning.

9. Bob can afford to deposit $400 a month into a retirement account that compounds interest monthly with an APR of 3.9%. His plan is to have $200,000 saved so that he can then retire. Approximately how long will it take him to reach this goal?

10. Jack contributed $400 per month into his retirement account in pre-tax dollars during the last tax year. His taxable income for the year was $62,350. He files taxes as a single taxpayer.

a. What would his taxable income have been had he contributed to the account in after-tax dollars?

b. Use the tax table below to calculate his tax in both the pre-tax and after-tax contribution situations.

c. How much did Jack save in taxes during that year?

If line 43 (taxable income) is—		And you are —			
At least	But less than	Single	Married filing jointly *	Married filing separately	Head of a household
		Your tax is —			
62,000					
62,000	**62,050**	11,850	8,501	11,850	10,569
62,050	**62,100**	11,863	8,509	11,863	10,581
62,100	**62,150**	11,875	8,516	11,875	10,594
62,150	**62,200**	11,888	8,524	11,888	10,606
62,200	**62,250**	11,900	8,531	11,900	10,619
62,250	**62,300**	11,913	8,539	11,913	10,631
62,300	**62,350**	11,925	8,546	11,925	10,644
62,350	**62,400**	11,938	8,554	11,938	10,656
62,400	**62,450**	11,950	8,561	11,950	10,669
62,450	**62,500**	11,963	8,569	11,963	10,681
62,500	**62,550**	11,975	8,576	11,975	10,694
62,550	**62,600**	11,988	8,584	11,988	10,706
62,600	**62,650**	12,000	8,591	12,000	10,719
62,650	**62,700**	12,013	8,599	12,013	10,731
62,700	**62,750**	12,025	8,606	12,025	10,744
62,750	**62,800**	12,038	8,614	12,038	10,756
62,800	**62,850**	12,050	8,621	12,050	10,769
62,850	**62,900**	12,063	8,629	12,063	10,781
62,900	**62,950**	12,075	8,636	12,075	10,794
62,950	**63,000**	12,088	8,644	12,088	10,806

If line 43 (taxable income) is—		And you are —			
At least	But less than	Single	Married filing jointly *	Married filing separately	Head of a household
		Your tax is —			
67,000					
67,000	**67,050**	13,100	9,444	13,139	11,819
67,050	**67,100**	13,113	9,456	13,153	11,831
67,100	**67,150**	13,125	9,469	13,167	11,844
67,150	**67,200**	13,138	9,481	13,181	11,856
67,200	**67,250**	13,150	9,494	13,195	11,869
67,250	**67,300**	13,163	9,506	13,209	11,881
67,300	**67,350**	13,175	9,519	13,223	11,894
67,350	**67,400**	13,188	9,531	13,237	11,906
67,400	**67,450**	13,200	9,544	13,251	11,919
67,450	**67,500**	13,213	9,556	13,265	11,931
67,500	**67,550**	13,225	9,569	13,279	11,944
67,550	**67,600**	13,238	9,581	13,293	11,956
67,600	**67,650**	13,250	9,594	13,307	11,969
67,650	**67,700**	13,263	9,606	13,321	11,981
67,700	**67,750**	13,275	9,619	13,335	11,994
67,750	**67,800**	13,288	9,631	13,349	12,006
67,800	**67,850**	13,300	9,644	13,363	12,019
67,850	**67,900**	13,313	9,656	13,377	12,031
67,900	**67,950**	13,325	9,669	13,391	12,044
67,950	**68,000**	13,338	9,681	13,405	12,056

11. Mark is an accountant who has been contributing to his retirement account for the last 15 years with pre-tax dollars. The account compounds interest semi-annually at a rate of 5%. He contributes X dollars after each 6-month period, and this has not changed over the life of the account.

a. How much will he have in the account after 20 years of saving? Round numbers to the nearest hundredth.

b. After 20 years of contributions, he needed to withdraw 20% of the money in his account to pay for his children's education. Write an expression for the withdrawal amount.

c. Mark pays T percent of his income in taxes. Write an algebraic expression for the combined total of his tax and the 10% early withdrawal penalty.

12. Jhanvi is a 40-year-old executive for a department store. She files taxes as head of household. She needed to withdraw $45,000 from her tax-deferred retirement account to put a down payment on a new condominium. Jhanvi's taxable income for that year was $110,550, excluding the $45,000 early withdrawal from her retirement account.

a. Use the tax computation worksheet shown below to calculate Jhanvi's tax had she not made the early withdrawal.

Section D — Use if your filing status is **Head of household**. Complete the row below that applies to you.

Taxable income. If line 43 is—	**(a)** Enter the amount from line 43	**(b)** Multiplication amount	**(c)** Multiply (a) by (b)	**(d)** Subtraction amount	**Tax** Subtract (d) from (c). Enter the result here and on Form 1040, line 44
At least $100,000 but not over $112,650	$	× 25% (.25)	$	$ 4,937.50	$
Over $112,650 but not over $182,400	$	× 28% (.28)	$	$ 8,317.00	$
Over $182,400 but not over $357,700	$	× 33% (.33)	$	$ 17,437.00	$
Over $357,700	$	× 35% (.35)	$	$ 24,591.00	$

b. Use the same worksheet to calculate her tax with an increase in her taxable income of $45,000.

c. How much more in taxes did she pay because of the early withdrawal?

d. If Jhanvi paid a 10% early withdrawal fee, what was her early withdrawal penalty?

13. Nelson makes $120,000 per year. His employer offers a 401k plan in which they will match 40% of his contributions up to a maximum of 7% of his annual salary. His employer allows contributions up to a maximum of 15% of Nelson's salary per year. If Nelson contributes $200 out of each biweekly paycheck, how much will his employer contribute to his 401k?

14. Mike makes Y dollars per year. His company offers a matching retirement plan in which they agree to match M percent of his contributions up to P percent of his salary. Write an algebraic expression for the maximum value of the employer's matching contribution.

We can never insure one hundred percent of the population against one hundred percent of the hazards and vicissitudes of life, but we have tried to frame a law which will give some measure of protection to the average citizen and to his family against the loss of a job and against poverty-ridden old age.
President Franklin Delano Roosevelt upon signing Social Security Act, 1935

Social Security Benefits 9-2

Key Terms

- Old-Age, Survivors, and Disability Insurance (OASDI)
- Social Security benefit
- full retirement age
- Social Security statement
- Social Security credit

Objectives

- Understand the benefits paid by Social Security.
- Understand how benefits are computed.
- Compute federal income tax on benefits that are paid under Social Security.

How does the government help me finance my retirement?

There are many expenses involved in maintaining a comfortable, healthy lifestyle when you are not working. Being prepared to meet these challenges requires careful and early planning. In addition to your own savings plans, the government has an insurance program that helps workers in their retirement by providing financial assistance.

After the stock market crash of 1929, the United States entered a period of very harsh economic times. Millions of people were unemployed; banks and businesses failed, and the elderly had trouble paying expenses just to survive. These circumstances led to the Social Security Act of 1935. This act created an insurance program that paid workers benefits after they retired.

In Chapters 6 and 7 you learned about paying Social Security and Medicare taxes. Social Security taxes fund **Old-Age, Survivors, and Disability Insurance (OASDI)**. This insurance pays benefits to retired workers that help them meet their financial obligations. It also provides benefits to families of retired workers and disabled workers under certain conditions. Medicare taxes fund a health insurance program that provides benefits to people over age 65 and to some disabled persons under 65. It helps pay for doctor's costs, hospital costs, and prescription drugs.

Younger employees are usually more concerned with these programs because they are funded through taxes taken out of employee paychecks. There is a maximum amount of earnings subject to Social Security taxes. This maximum holds no matter how many jobs you have—it is a per-person maximum for the year.


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When you get close to retirement age, you will be concerned with the benefits these services provide—benefits that you contributed to over your entire working career. The money that is taken out of your paycheck for Social Security is paying for the benefits of the people who are currently receiving them. Your benefits will be paid by the people who are working when you are receiving the benefits.

Social Security benefits are based on your earnings over your working lifetime. Benefits can start as early as age 62, but are reduced. People born after 1960 must wait to start collecting their full retirement benefit until age 67, their **full retirement age**.

You can keep track of every year's earnings by requesting a Social Security statement each year from the IRS. Compare the entries on the form to your W-2 each year. Be sure keep the copies on file.

Skills and Strategies

Here you will be introduced to some of the details on how Social Security works. When you get close to retirement, you will want to read lots of material on the rules and procedures involved.

EXAMPLE 1

In 2009, Jose had two jobs. He earned $73,440 working at a nursing home the first 8 months. He switched jobs in September and began to work in a hospital, where he earned $42,566. How much Social Security tax did he overpay?

SOLUTION In 2009, the maximum taxable income for Social Security taxes was $106,800. Each of Jose's employers took out the required 6.2% for Social Security. The nursing home took out 6.2% of $73,440.

$$0.062 \times 73{,}440 = 4{,}553.28$$

The hospital took out 6.2% of $42,565.

$$0.062 \times 42{,}565 = 2{,}639.03$$

Jose adds to find the total he paid into Social Security in 2009.

$$4{,}553.28 + 2{,}639.03 = 7{,}192.31$$

The two employers withheld $7,192.31 in Social Security taxes in 2009. This is too much tax. The maximum an individual should have paid in 2009 was 6.2% of $106,800, which equals $6,621.60. Subtract to find out how much Jose overpaid.

$$7{,}192.31 - 6{,}621.60 = 570.71$$

Jose overpaid $570.71 and needs to fill out a line on his Form 1040 to claim a refund of this amount. Notice that this is not a refund of federal income tax. It is a refund of overpaid FICA tax.

CHECK YOUR UNDERSTANDING

Monique had two employers in 2007. Both employers took out 6.2% Social Security tax. The maximum taxable income was $97,500. Monique earned x dollars at one job and y dollars at her second job, and $x + y > 97{,}500$. Express her refund algebraically.

Social Security Credits

Your **Social Security statement** is a record of the money you earned every year. You get a certain number of credits each working year. It includes the number of **Social Security credits** you have earned. You can earn a maximum of four credits for each year. Before 1978, employers reported earnings every three months or quarter. You earned one credit for each quarter in which you earned a specific amount of money. Since 1978, employers report earnings once a year and credits are based on your total wages and self-employment income during the year, no matter when you did the actual work. You might work all year to earn four credits, or you might earn enough for all four in a shorter length of time. The amount of earnings it takes to earn a credit changes each year. In 2009, you must earn $1,090 in covered earnings to get one credit. People born after 1929 need 40 credits in their lifetime to qualify for Social Security benefits.

EXAMPLE 2

Fran requests her annual Social Security statement from the Social Security Administration each year. She wants to check how many Social Security credits she received for 2009. She worked all year and earned $8,102 per month. How many credits did she earn in 2009?

SOLUTION Fran goes to the Social Security website. To earn a credit in 2009, she needed to earn at least $1,090 in a quarter. To earn the maximum 4 credits, Fran needed to earn 4 times the amount for one credit anytime during the year.

$$4 \times 1{,}090 = 4{,}360$$

Fran earned over $8,102 in one month, which is greater than $4,360, so her statement should show that she earned 4 credits for the year. Keep track of your credits carefully.

CHECK YOUR UNDERSTANDING

Beth earned $5,600 working part-time during the first half of the year in 2009. She then left for college and didn't work. How many Social Security credits did she receive?

Social Security Benefit

Your Social Security benefit is based on the 35 highest years of earnings throughout your lifetime. The earnings are adjusted for inflation—earning $5,000 in 1955 is not like earning $5,000 today. The adjusted earnings are used to find the average adjusted monthly earnings. Keep in mind that benefit computations can change, and you must be sure to keep up to date on how your particular benefit will be computed.

EXAMPLE 3

Marissa reached age 62 in 2007. She did not retire until years later. Over her life, she earned an average of $2,300 per month after her earnings were adjusted for inflation. What is her Social Security full retirement benefit?

SOLUTION Marissa was born in 1945 and turned 62 in 2007. For people turning 62 in 2007, the formula for computing Social Security benefits is

- 90% of the first $680 on monthly earnings
- 32% of the monthly earnings between $680 and $4,100
- 15% of the earnings over $4,100

Marissa's monthly earnings were $2,300.

Find 90% of the first $680.	$0.90 \times 680 = 612$
Subtract to find the earnings over $680.	$2{,}300 - 680 = 1{,}620$
Find 32% of $1,620 by multiplying.	$0.32 \times 1{,}620 = 518.40$
Find the sum of $612 and $518.40.	$612 + 518.40 = 1{,}130.40$

Marissa's monthly full retirement benefit at age 67 is $1,130.40.

CHECK YOUR UNDERSTANDING

Ron reached age 62 in 2007. His monthly adjusted earnings were x dollars, where $x > \$4{,}100$. Express his monthly benefit algebraically.

EXAMPLE 4

Marissa from Example 3 retired at age 65. What will her monthly benefit be, since she did not wait until age 67 to receive full retirement benefits?

SOLUTION Age 67 is considered to be full retirement age if you were born in 1945. If you start collecting Social Security before age 67, your full retirement benefit is reduced, according to the following schedule.

- If you start at collecting benefits at 62, the reduction is about 30%.
- If you start at collecting benefits at 63, the reduction is about 25%.
- If you start at collecting benefits at 64, the reduction is about 20%.
- If you start at collecting benefits at 65, the reduction is about 13.3%.
- If you start at collecting benefits at 66, the reduction is about 6.7%.

Marissa's full retirement benefit was $1,130.40. Since she retired at age 65, the benefit will be reduced about 13.3%.

Find 13.3% of $1,130.40, and round to the nearest cent.

$$0.133 \times 1{,}130.40 \approx 150.34$$

Subtract to find the benefit Marissa would receive.

$$1{,}130.40 - 150.34 = 980.06$$

Marissa's benefit would be about $980.06.

CHECK YOUR UNDERSTANDING

Find the difference between Marissa's monthly benefit if she retires at age 62 instead of age 67.

Reporting Social Security Benefits on Form 1040

If your total taxable income (wages, pensions, interest, dividends, and so on) plus any tax-exempt income, plus half of your Social Security benefits exceed $25,000 for singles, $32,000 for married couples filing jointly, or $0 for married couples filing separately, you will pay federal income tax on your benefits.

The taxable portion can range from 50% to 85% of your benefits. The numbers can change from year to year, and the government prints worksheets to help taxpayers compute the part of their Social Security benefit that is taxed.

EXAMPLE 5

Rob is 64 years old, and collected $19,612 in Social Security last year. He is married filing a joint return. On his Form 1040, the total of lines 7, 8a, 9a, 10 through 14, 15b, 16b, 17 through 19, and 21 is $80,433. Line 8b on his Form 1040 shows $519 and lines 23 to 32 on his Form 1040 total $1,239. Line 36 on his Form 1040 does not have an amount. What are Rob's taxable Social Security benefits for the year?

SOLUTION The Social Security Benefits Worksheet is used to determine the taxable benefit amount. It is not a form filed with your taxes. The worksheet is used to help you compute the part of the Social Security benefit that is taxed.

Rob starts filling out Form 1040 and gets to the line for Social Security benefits. He must now fill out the 18-line worksheet.

His Social Security benefit is entered on line 1.

Notice the information on lines 3 and 4 of the worksheet comes directly from the information given about Rob's Form 1040.

Line 6 also requires information from Rob's Form 1040.

Social Security Benefits Worksheet—Lines 20a and 20b

1. Enter the total amount from **box 5** of **all** your **Forms SSA-1099** and **Forms RRB-1099.** Also, enter this amount on Form 1040, line 20a 1. $19,612.00
2. Enter one-half of line 1 . . . . . 2. $9,806.00
3. Enter the total of the amounts from Form 1040, lines 7, 8a, 9a, 10 through 14, 15b, 16b, 17 through 19, and 21 . . . . . 3. $80,433.00
4. Enter the amount, if any, from Form 1040, line 8b 4. $519.00
5. Add lines 2, 3, and 4 . . . . . 5. $90,758.00
6. Enter the total of the amounts from Form 1040, lines 23 through 32, plus any write-in adjustments you entered on the dotted line next to line 36 . . . . . 6. $1,239.00
7. Is the amount on line 6 less than the amount on line 5?
   - ☐ **No.** STOP None of your social security benefits are taxable. Enter -0- on Form 1040, line 20b.
   - ☒ **Yes.** Subtract line 6 from line 5 . . . . . 7. $89,519.00
8. If you are:
   - Married filing jointly, enter $32,000
   - Single, head of household, qualifying widow(er), or married filing separately and you **lived apart** from your spouse for all of 2008, enter $25,000
   - Married filing separately and you lived with your spouse at any time in 2008, skip lines 8 through 15; multiply line 7 by 85% (.85) and enter the result on line 16. Then go to line 17

   . . . . . 8. $32,000.00
9. Is the amount on line 8 less than the amount on line 7?
   - ☐ **No.** STOP None of your social security benefits are taxable. Enter -0- on Form 1040, line 20b. If you are married filing separately and you **lived apart** from your spouse for all of 2008, be sure you entered "D" to the right of the word "benefits" on line 20a.
   - ☒ **Yes.** Subtract line 8 from line 7 . . . . . 9. $57,519.00

The instructions for lines 10–18 use only lines from the worksheet. The instructions for each line guide Rob as he progresses.

10.	Enter: $12,000 if married filing jointly; $9,000 if single, head of household, qualifying widow(er), or married filing separately and you **lived apart** from your spouse for all of 2008	**10.**	$12,000.00
11.	Subtract line 10 from line 9. If zero or less, enter -0-	**11.**	$45,519.00
12.	Enter the **smaller** of line 9 or line 10	**12.**	$12,000.00
13.	Enter one-half of line 12	**13.**	$6,000.00
14.	Enter the **smaller** of line 2 or line 13	**14.**	$6,000.00
15.	Multiply line 11 by 85% (.85). If line 11 is zero, enter -0-	**15.**	$38,691.15
16.	Add lines 14 and 15	**16.**	$44,691.15
17.	Multiply line 1 by 85% (.85)	**17.**	$16,670.20
18.	**Taxable social security benefits.** Enter the **smaller** of line 16 or line 17. Also enter this amount on Form 1040, line 20b	**18.**	$16,670.20

Rob's taxable Social Security benefits are $16,670.20 as shown on line 18. Rob must enter this amount on his Form 1040 and pay taxes on that amount. He received $19,612 in Social Security benefits, but only had to pay income tax on $16,670.20 of that money.

CHECK YOUR UNDERSTANDING

Maria filled out a Social Security benefits worksheet. She received x dollars in Social Security benefits, but had to pay taxes on t dollars of it. Express the fraction of her Social Security income that she had to pay tax on as a percent.

Medicare Benefit

When you apply for Social Security, you may also apply to receive Medicare. Medicare has four parts. Part A is hospital insurance that helps pay for inpatient care in a hospital. Part B is medical insurance and helps pay for doctor's visits. Part C is Medicare advantage and is available in some areas. Part D is prescription drug coverage.

You must pay a monthly premium for Part B. In 2008 the standard premium was $96.40. The premium may be higher if your adjusted gross income is greater than $85,000.

EXAMPLE 6

Ryan has retired and is qualified to receive Medicare. In 2008, he paid the standard monthly premium. How much did he pay for the year?

SOLUTION Ryan paid 12 monthly premiums.

Multiply. $12 \times 96.40 = 1{,}156.80$

Ryan paid $1,156.80 in Medicare premiums for the year.

CHECK YOUR UNDERSTANDING

Claire has retired. She pays a Medicare Part B premium of p dollars per month. Express the total amount she spent on Medicare last year algebraically.

Applications

We can never insure one hundred percent of the population against one hundred percent of the hazards and vicissitudes of life, but we have tried to frame a law which will give some measure of protection to the average citizen and to his family against the loss of a job and against poverty-ridden old age.
President Franklin Delano Roosevelt upon signing Social Security Act, 1935

1. Interpret the quote in the context of what you know about American history and/or challenges facing senior citizens.

2. In 2008, the maximum taxable income for Social Security was $102,000 and the tax rate was 6.2%.
   a. What is the maximum Social Security tax anyone could have paid in the year 2008?
   b. Randy had two jobs in 2008. One employer paid him $67,010 and the other paid him $51,200. Each employer took out 6.2% for Social Security taxes. How much did Randy overpay for Social Security taxes in 2008?

3. In a certain year, the maximum taxable income for Social Security was x dollars and the tax rate was 6.2%.
   a. What is the maximum Social Security tax anyone could have paid in that year?
   b. Paul had two jobs that year. One employer paid him y dollars and the other paid him p dollars. His total income was greater than x. Each employer took out 6.2% for Social Security. Express the amount that Paul overpaid for Social Security taxes in that year algebraically.

4. In 1978, the amount of earnings required to earn one Social Security credit was $250. Thirty years later, in 2008, this amount was $1,050. What was the percent increase in the amount required to earn a credit, over this 30-year span?

5. Go to the Social Security website. What is the amount of earnings needed to earn one Social Security credit for the current year?

6. In 1980, the amount of earnings required to earn one Social Security credit was $290. Back then, Mike earned $55 per week. How many credits did he earn in 1980?

7. Stacy was a stay-at-home mom for most of her adult life. At age 46, she started working outside the home. Each year she earns the maximum number of Social Security credits. Until what age must she work to qualify to receive Social Security benefits when she retires?

8. Rachael turned 62 in 2007.
   a. Compute her Social Security full retirement benefit if her average monthly salary over her 35 highest-paying years was $3,100.
   b. If she starts collecting her benefit at age 66, what will her benefit be? Round to the nearest dollar.

9. Michelle turned 62 in 2007. She earned an average of x dollars per month (adjusted for inflation) over her highest-paying 35 years, where $x > 4{,}100$. Express her Social Security full retirement benefit algebraically.

10. Sascha's Social Security full retirement benefit is x dollars. She started collecting Social Security at age 65, so her benefit is reduced. Express her approximate Social Security benefit algebraically.

11. Dominique is single. She is filling out the Social Security worksheet so she can determine the amount of her Social Security benefits that she will pay federal income tax on. Fill in the following lines which were taken from Dominique's tax information.

- Line 1—she received $28,922 in Social Security benefits.
- Line 3—the total of her other sources of income is $52,888.
- Line 4—the amount from line 8b is $300.
- Line 6—the total to enter is $3,211.

a–n. Fill in the correct entries for the rest of the lines on her Social Security worksheet.

p. How much of Dominique's Social Security benefit must she pay Federal income tax on?

Social Security Benefits Worksheet—Lines 20a and 20b

1.	Enter the total amount from **box 5** of **all** your **Forms SSA-1099** and **Forms RRB-1099.** Also, enter this amount on Form 1040, line 20a	1.	$28,922.00
2.	Enter one-half of line 1	2.	a.
3.	Enter the total of the amounts from Form 1040, lines 7, 8a, 9a, 10 through 14, 15b, 16b, 17 through 19, and 21	3.	$52,888.00
4.	Enter the amount, if any, from Form 1040, line 8b	4.	$300.00
5.	Add lines 2, 3, and 4	5.	b.
6.	Enter the total of the amounts from Form 1040, lines 23 through 32, plus any write-in adjustments you entered on the dotted line next to line 36	6.	$3,211.00
7.	Is the amount on line 6 less than the amount on line 5? ☐ **No.** STOP None of your social security benefits are taxable. Enter -0- on Form 1040, line 20b. ☐ **Yes.** Subtract line 6 from line 5	7.	c.
8.	If you are: • Married filing jointly, enter $32,000 • Single, head of household, qualifying widow(er), or married filing separately and you **lived apart** from your spouse for all of 2008, enter $25,000 • Married filing separately and you lived with your spouse at any time in 2008, skip lines 8 through 15; multiply line 7 by 85% (.85) and enter the result on line 16. Then go to line 17	8.	d.
9.	Is the amount on line 8 less than the amount on line 7? ☐ **No.** STOP None of your social security benefits are taxable. Enter -0- on Form 1040, line 20b. If you are married filing separately and you **lived apart** from your spouse for all of 2008, be sure you entered "D" to the right of the word "benefits" on line 20a. ☐ **Yes.** Subtract line 8 from line 7	9.	e.
10.	Enter: $12,000 if married filing jointly; $9,000 if single, head of household, qualifying widow(er), or married filing separately and you **lived apart** from your spouse for all of 2008	10.	f.
11.	Subtract line 10 from line 9. If zero or less, enter -0-	11.	g.
12.	Enter the **smaller** of line 9 or line 10	12.	h.
13.	Enter one-half of line 12	13.	i.
14.	Enter the **smaller** of line 2 or line 13	14.	j.
15.	Multiply line 11 by 85% (.85). If line 11 is zero, enter -0-	15.	k.
16.	Add lines 14 and 15	16.	l.
17.	Multiply line 1 by 85% (.85)	17.	m.
18.	**Taxable social security benefits.** Enter the **smaller** of line 16 or line 17. Also enter this amount on Form 1040, line 20b	18.	n.

12. Roberta's Social Security full retirement benefit is $2,101. She started collecting Social Security at age 64, and her benefit is reduced since she started collecting before age 67. Find her approximate Social Security benefit.

13. Linda and Rob are married filing a joint Form 1040. Rob is collecting Social Security, but Linda is not. They are filling out the Social Security worksheet (shown in Exercise 11) so they can determine the amount of Rob's Social Security benefits that they will pay federal income tax on. Fill in the following lines which were taken from their tax information:

- Line 1—Rob received $33,191 in Social Security benefits.
- Line 3—the total of their other sources of income is $112,543.
- Line 4—the amount from line 8b is $650.
- Line 6—the total to enter is $5,899.

a–n. Fill in the correct entries for the rest of the lines on their Social Security worksheet.

p. How much of Rob's Social Security benefit must they pay Federal income tax on?

14. If George pays x dollars monthly for Medicare Part B coverage, express his annual cost for Part B coverage algebraically.

15. This year Frank pays m dollars for Medicare Part B coverage. He reads that this cost will go up 12.3% next year. Express next year's cost algebraically.

16. You can receive Social Security payments for being disabled even if you have not retired or reached age 62. You need a certain number of Social Security credits to qualify for this.

- If you become disabled before age 24, you generally need six credits in the three years before you became disabled.
- If you are 24 through 30, you generally need credits for half of the time between age 21 and the time you became disabled, and at least six credits.
- If you are disabled at age 31 or older, you generally need at least 20 credits in the 10 years immediately before you became disabled. The table shows examples of how many credits you would need if you became disabled at various selected ages.

Age at Which You Become Disabled	Credits Needed
31 through 42	20
44	22
46	24
48	26
50	28
52	30
54	32
56	34
58	36
60	38
62 or older	40

a. How many credits would you need to qualify for disability if you became disabled at age 28?

b. How many credits would you need to qualify if you became disabled at age 22?

c. Express algebraically the number of credits you would need to qualify if you became disabled at age a, where $a > 21$ and $a < 30$.

Goodbye tension, hello pension!

Author Unknown

9-3 Pensions

Objectives

- Calculate pension benefits using various formulas.
- Calculate pension benefits during and after vesting periods.

Key Terms

- deferred compensation
- pension
- defined benefit plan
- vested
- single life annuity
- qualified joint and survivor annuity
- lump-sum payment
- Pension Benefit Guaranty Corporation (PBGC)
- Employee Retirement Income Security Act (ERISA)
- Pension Protection Act
- cost of living adjustment (COLA)
- Consumer Price Index (CPI)

What is deferred compensation?

Deferred compensation is money that is given or received at a later date usually in return for services that have been given or received at the present time. A **pension** is a deferred compensation plan. A pension is income given to an employee after retirement that is given at the discretion of an employer. There is no mandate for an employer to fund a pension plan for employees. The compensation from the plan is usually tax-deferred and the contributions that the employer makes for the employees are tax-deductible for the employer.

There are two types of traditional occupational pension plans—the defined benefit plan and the defined contribution plan, such as 401k plans. In a **defined benefit plan**, the employee pension benefits are calculated based upon a formula that may involve the average salary before retirement, the age of the employee at retirement, the length of employment, and some predetermined percentage multiplier. The employer makes all decisions on the investment options for the money in the plan. There is no individual account for any one specific employee but a pooled fund upon which benefits are drawn upon retirement.

In almost every defined benefit plan, the employee must participate in the plan for a certain number of years before being **vested**, or having the right to it. There are two types of vesting. In *cliff vesting* the employee is entitled to a pension after having participated in the plan for a fixed number of years. Suppose you are in a plan with a 5-year cliff vesting formula. If you work for the employer for at least 5 years, you will be entitled to receive a pension even if you leave the company. If you leave before 5 years, you will not be entitled to a pension.

Graded vesting does not set an all or nothing time period. The employee gets a certain percentage of the pension after each set number of years has passed. For example, you might own only 20% of your pension after the first three years of employment and then for every year you work afterwards, your ownership increases by 20% to a maximum of 100%.

When it is time to have your pension benefits paid out to you (usually upon retirement), there are some common options that are available. A **single life annuity** offers the retired employee a fixed monthly amount until death, when all benefits stop. A **qualified joint and survivor annuity** offers the retiree a smaller monthly payment but, upon death, the spouse will continue to receive reduced payments until his or her death. A retiree can sometimes choose to take a **lump-sum payment** in which all of the money owed to you is given in a single payment and no further payments are made to either you or your beneficiaries.

There are different formulas that are used to calculate a pension.

- **Flat-Benefit Formula** Pays a fixed (flat) monthly pension based solely on the years that the retiree has worked for the employer.
- **Career-Average Formula** Pays a pension that is based on a fixed percentage of the average earnings of all of the years the retiree has worked for the employer.
- **Final-Average Formula** Pays a pension that is based on a fixed percentage of the average earnings of the last several years (often 3 to 5) of work with the employer.

Most defined benefit plans are insured under a federal pension insurance program known as the **Pension Benefit Guaranty Corporation (PBGC)**. The PBGC is a federal government agency that insures most defined benefit pension plans. It was created under the **Employee Retirement Income Security Act of 1974 (ERISA)** to protect the pension benefits of retirees. In 2006, the **Pension Protection Act** was passed which amended ERISA and offered legislation to strengthen and protect many types of pensions.

Some benefit plans are fixed throughout the life of the retiree while others can reflect an annual **cost of living adjustment (COLA)**. A cost of living adjustment is a small increase in the retiree's benefits that is based on the **Consumer Price Index (CPI)** or cost-of-living index. The CPI is an indicator of inflation that measures the change in the total cost of a specific list of services and products.

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Skills and Strategies

Here you will learn how to calculate a variety of pension benefits.

EXAMPLE 1

Roberto worked for the Surgical Tools Corporation for 20 years. His employer offers a pension benefit package with a flat benefit formula using the flat amount of $40 for each year of service to calculate his monthly pension. How much will Roberto's monthly pension benefit be?

SOLUTION Roberto's monthly pension benefit is his number of years of service for the company times the flat amount of $40.

$$20 \times 40 = 800$$

Roberto will receive a monthly pension of $800 from Surgical Tools Corporation upon retirement.

CHECK YOUR UNDERSTANDING

Maddy has worked for the same company as Roberto for the last x years. She is considering working for y more years, at which time the flat benefit that Surgical Tools offers will be z dollars for each year of service. Write an algebraic expression that represents Maddy's monthly pension benefit.

EXAMPLE 2

After one year of retirement, Roberto's employer (from Example 1), offered a 2.21% cost of living adjustment to his monthly pension benefit. This year, the employer is offering a 2.35% COLA. Determine Roberto's current monthly pension benefit.

SOLUTION In Example 1, Roberto's monthly pension benefit was $800. Multiply the monthly pension benefit by the first cost of living adjustment, 2.21%.

$$800 \times 0.0221 = 17.68$$

Roberto's cost of living adjustment is $17.68. His new monthly pension benefit after one year is $817.68 ($800 + $17.68).

You can also calculate this by recognizing that Roberto's new monthly pension is 102.21% of his old benefit (100% + 2.21%). The new benefit is

$$800 \times 1.0221 = 817.68$$

To calculate his latest monthly benefit with the 2.35% COLA, multiply

$$817.68 \times 1.0235 = 836.89548$$

Roberto's new monthly pension benefit is $836.90.

CHECK YOUR UNDERSTANDING

Jackie's monthly pension benefit was originally D dollars. Each year for the last 5 years, she has received a 1% COLA. Write an exponential expression that represents Jackie's current monthly pension benefit.

EXAMPLE 3

Alex's employer offers an annual pension benefit calculated by multiplying 1.5% of his career average salary times the number of years employed. Alex has kept a list of his annual salaries in a spreadsheet as shown at the right. Add cells to the spreadsheet to calculate Alex's annual pension benefit.

	A	B
1	**Year**	**Salary**
2	1984	63,000
3	1985	63,000
4	1986	64,300
5	1987	65,000
6	1988	66,000
7	1989	66,300
8	1990	67,000
9	1991	67,000
10	1992	68,500
11	1993	68,500
12	1994	69,190
13	1995	70,300
14	1996	70,300
15	1997	70,799
16	1998	71,250
17	1999	73,000
18	2000	73,000
19	2001	74,190
20	2002	74,190
21	2003	75,000
22	2004	77,230
23	2005	77,230
24	2006	77,230
25	2007	81,002
26	2008	82,156

SOLUTION Alex added labels for the career average salary, percentage multiplier, years of service, and annual pension benefit in column C.

	A	B	C	D
1	**Year**	**Salary**	Career average salary	70,986.68
2	1984	63,000	Percentage multiplier	1.5
3	1985	63,000	Years of service	25
4	1986	64,300	Annual pension benefit	26,620.01

Alex put the formula =average(B2:B26) that calculates the career average salary in cell D1. The calculated amount, 70,986.68, is in cell D1.

Alex entered the percentage multiplier, 1.5 in cell D2.

He entered his years of service, 25, in cell D3.

The annual pension benefit is the product of the career average salary, the percentage multiplier expressed as an equivalent decimal, and the years of service. Alex entered the following formula in cell D4 =(D1*D2/100*D3).

His annual pension benefit, rounded to the nearest penny, is $26,620.01.

CHECK YOUR UNDERSTANDING

Suppose Alex wants to determine his annual pension benefit after any cost of living adjustments. He labels cell C5 as COLA and cell C6 as Adjusted pension. He then enters the COLA percentage in cell D5. Write the formula for cell D6 that will yield the pension with the cost of living adjustment.

EXAMPLE 4

Brian and Marina are married and each is planning on retiring after 30 years of employment. Marina worked the entire 30 years for Santa Fe Corporation. For the last three years she has been making $110,000 per year. Brian has been making the same salary for the last three years at Santa Fe, but has only been working there for 15 years. Prior to his current job, he worked for 15 years at a competitor and had a final average salary of $60,000. Both employers offered a defined benefit plan that calculated the annual pension as the product of the final three year average salary, the number of years of service, and a 2% multiplier. Calculate and compare Marina and Brian's annual pension upon retirement from Santa Fe.

SOLUTION Marina's annual pension can be calculated as follows.

Three-year average salary × Years of service × Percentage multiplier

$$110{,}000 \times 30 \times 0.02 = 66{,}000$$

Marina will receive an annual pension of $66,000.

Although Brian worked a total of 30 years, he received two pensions—one for his first 15 years of service and one for his last 15 years. His annual pension benefit is the sum of these two pension amounts.

Annual benefit from Job 1 = $60{,}000 \times 15 \times 0.02 = \$18{,}000$

Annual benefit from Job 2 = $110{,}000 \times 15 \times 0.02 = \$33{,}000$

Total annual pension benefit = $18{,}000 + 33{,}000 = \$51{,}000$

Although Brian and Marina worked the same number of years and ended their career at the same salary, because Brian's average salary for the first 15 years was lower, his annual pension benefit is $15,000 less than Marina's.

CHECK YOUR UNDERSTANDING

What would Brian's average salary have to have been for his first job so the total of his pensions matches Marina's pension amount?

EXAMPLE 5

Ann's employer offers a pension plan that calculates the annual pension as the product of the final three year average salary, the number of years of service, and a 2% multiplier. Her employer uses a graded 6-year vesting formula as shown. After 5 years, Ann decides to leave her job. Her average salary was $50,000. How much pension will she receive?

Years Employed	Vesting Percentage
0	0%
1	0%
2	20%
3	40%
4	60%
5	80%
6	100%

SOLUTION Ann's annual pension can be calculated as follows.

Average salary × Years of service × Percentage multiplier

$$50{,}000 \times 5 \times 0.02 = 5{,}000$$

Find 80% of the pension amount.

$$0.80 \times 5{,}000 = 4{,}000$$

Ann will receive an annual pension of $4,000.

CHECK YOUR UNDERSTANDING

Use the vesting schedule from Example 5. Ralph is leaving his company after 4 years. Ralph's salary was $38,500 per year. How much pension will Ralph receive?

Applications

Goodbye tension, hello pension!

Author Unknown

1. Explain how that quote can be interpreted in light of what you have learned in this lesson.

2. Pete is retiring after working for 27 years at a major bank. The company offers him a flat monthly retirement benefit of $55 for each year of service. What will his monthly pension be?

3. Janet is retiring after working for a major department store for 20 years. The company offered her a flat retirement benefit of $50 per year for each year of service.

a. What was her monthly income in the first year after retirement?

b. What was her annual income for the first year of retirement?

c. After one year of retirement, she received a 1.54% cost of living adjustment to her monthly pension benefit. What was her new monthly benefit?

4. Integrated Technologies offers employees a flat pension plan in which a predetermined dollar amount (multiplier) is multiplied by the number of years of service to determine the monthly pension benefit using the schedule shown. After working at Integrated Technologies for 22 years, Al has decided to retire. He has been told there will be a 2.2% cost of living adjustment soon after he retires. Which will yield a higher retirement benefit, calculating the COLA on the multiplier or calculating the COLA on the monthly benefit using the chart?

Years Employed	Multiplier
15–19	$40
20–25	$45
30+	$55

5. Martina's employer offers an annual pension benefit calculated by multiplying 2.35% of the career average salary times the number of years employed. Here are Martina's annual salaries over the last 24 years of employment.

28,800	29,300	30,250	31,000	35,500	42,000	45,000	50,000
28,800	29,900	30,350	35,000	35,700	43,000	48,000	52,000
29,210	29,900	30,450	35,000	38,000	43,900	48,800	52,000

a. What is Martina's career average salary?

b. What is Martina's annual pension under this plan?

c. What percentage of her final annual salary will her annual retirement salary be to the nearest percent?

d. What is Martina's monthly pension benefit to the nearest penny?

6. The Morning Sun offers employees 1.65% of the average of their last three years of annual compensation for each year of service. Ramon began working for the Morning Sun in 1988. He retired in 2010. In 2008, he made $76,000 per year. Thereafter, he received a 3% salary increase each year until he retired. How much was his annual retirement benefit?

7. Office Industries uses a final average formula to calculate employees' pension benefits. The calculations use the salary average of the final four years of employment. The retiree will receive an annual benefit that is equivalent to 1.4% of the final average for each year of employment. Charlotte and Krista are both retiring at the end of this year. Calculate their annual retirement pensions.

a. Krista's years of employment: 18
Final four annual salaries: $72,000, $74,780, $74,780, $76,000

b. Charlotte's years of employment: 23
Final four annual salaries: $81,000, $81,000, $81,400, $81,900

8. A certain company offers a 5-year average retirement formula for their employees. The accountant uses a spreadsheet to keep track of employee benefits. The salaries from the last five years of employment are listed in cells B4, B5, B6, B7, B8, and B9. The percentage multiplier is listed in cell B10. The number of years of employment is listed in cell B11. Write the spreadsheet formula that will calculate the annual pension benefit for the employee.

9. Emily's employer offers a pension plan that calculates the annual pension as the product of the final average salary, the number of years of service, and a 2% multiplier. Her employer uses a graded 5-year vesting formula as shown. After 4 years, Emily leaves her job. Her average salary was $65,000. How much pension will she receive?

Years Employed	Vesting Percentage
0	0%
1	0%
2	25%
3	50%
4	75%
5	100%

10. Grant's employer offers a pension plan that calculates the annual pension as the product of the final average salary, the number of years of service, and a 2% multiplier. His employer uses a graded 5-year vesting formula as shown. Grant's starting salary with his company 4 years ago was $80,000. Each year, he received a 2.5% raise. After 4 years, Grant leaves his job. How much pension will he receive?

Years Employed	Vesting Percentage
0	0%
1	10%
2	25%
3	45%
4	70%
5	100%

11. Peterson Products calculates its pension benefits as follows:

Years of service × 1.98% multiplier × Average of last two annual salaries

What is Mary's monthly pension benefit if she worked for Peterson for 28 years and her last two annual salaries were $78,000 and $80,000?

12. Jamal is retiring after working 45 years for the same company. The company pays a monthly retirement benefit of $35 for each year of service less than 20 years. The benefit increases by $\frac{1}{10}$% for each year of service beyond 20 years.

a. What is Jamal's multiplier?

b. What is his monthly income in his retirement?

c. What is his annual income in his retirement?

13. Sunshine Living calculates its pension benefits as follows: Years of service × 2.25% multiplier × Average of last five annual salaries. What is Killian's annual pension benefit if he worked for Sunshine Living for 16 years and his last annual salaries were $38,600, $39,990, $41,000, $41,500, and $55,200?

14. Sara works for the City of Northbeck. The city calculates an employee's pension according to the following formula.

- Determine the average of the highest 3 years of annual earnings.
- Determine the monthly average using the above amount.
- Subtract $600 from that amount.
- Multiply the result by 30%.
- Add $400 to that result.
- For each year of employment over 15 years, add 1% of the average monthly salary, not to exceed $100 for each year.
- The final result is the monthly pension benefit.

Sara's three highest annual salaries are $90,000, $92,598, and $93,000. Calculate Sara's monthly pension benefit to the nearest penny if she retires after 18 years of employment.

Use the following information to answer Exercises 14–17. The Merrick Oaks School District offers their employees the following annual pension benefit.

First 15 Years of Service	Service in Excess of 15 Years
2.12% multiplier	2.25% multiplier
Years of service up to 15	Years of service in excess of 15
Average of final 3 annual salaries	Average of final 3 annual salaries

15. Phil is a custodian who has been working for the Merrick Oaks School District for the last 12 years and has decided to retire. His last three years of annual salaries are $50,000, $50,000, and $52,100. Determine Phil's annual pension.

16. Carmen is a teacher in the district who began working there in 1995 and will retire in 2010 after 15 years of service. In the 2007–08 school year, she made $60,000. She received a 2% cost of living pay increase to her salary for each of the last two years before she retired. Determine her monthly pension.

17. Martha has been a principal in the district for the last 18 years. The average of her last 3 annual salaries is $100,000. Determine Martha's monthly pension if she retires after 18 years.

18. Ralph is a district employee. His final three years of annual salaries were D, E, and F dollars. If he worked for A years (where $A > 15$), write an algebraic expression that represents his annual pension benefit.

Life is what happens to you while you're busy making other plans.

John Lennon, English Songwriter

9-4 Life Insurance

Objectives

- Compute the cost of different types of life insurance.
- Understand advantages and disadvantages of different types of life insurance.

Key Terms

- beneficiary
- premium
- mortality table
- face value
- term life insurance
- group term life insurance
- level term insurance
- decreasing term insurance
- increasing term insurance
- permanent life insurance
- whole life insurance
- cash value
- universal life insurance
- variable life insurance

What are the advantages of purchasing financial protection for your loved ones?

Many people want to provide their families with some financial protection after they die, so they buy life insurance. Life insurance provides cash benefits to **beneficiaries**, people chosen by the policyholder whose names are on the life insurance policy. Life insurance can help pay funeral costs, lawyer's fees, loans, mortgages, and other living expenses that dependents might not be able to afford after the death of the primary income provider.

Life insurance **premiums** are the amount you pay for the policy. Premiums are based on many factors. One is the age of the policyholder. For each age group, the insurance company estimates the number of people expected to die and the number of years that the remainder of the people will live. These facts are used to calculate a death rate for males and females in each age group. The computations are done by an actuary. The death rates are listed in a **mortality table**. The death rate for a person's age group is a key element in determining the premium. People with a higher probability of death pay higher insurance premiums. Insurance premiums are also based on the amount of coverage you purchase and the type of policy you buy. The amount of coverage that a policy provides is called the **face value** of the policy. There are four main types of life insurance policies.

Term life insurance provides protection for the policyholder. Term insurance covers the policyholder for a specified period of time, usually 5, 10, or 20 years. After that time, the policy is no longer in effect, unless it is renewed for another term. If the policyholder dies during the term of the policy, the beneficiaries receive a settlement from the insurance company. Many people get

group term life insurance through their employers. They are covered as long as they work for that employer.

Level term insurance pays the same death benefit over the term of the policy. The premiums you pay usually remain level throughout the term. **Decreasing term insurance** pays a decreasing death benefit over time, and as a result, has a lower premium than other types of term insurance. This is often purchased by parents who feel their children will need less as they get older or by couples looking to cover a declining balance on a mortgage. **Increasing term insurance** pays an increasing death benefit and has increasing premium as the policyholder ages.

Permanent life insurance covers you for your lifetime or to a specified age. Whole life, universal life, and variable life are types of permanent insurance. These polices are very complicated. Be sure to read carefully before investing in this type of policy.

Whole life insurance combines a life insurance policy with an investment feature. Policyholders pay a premium that is divided between the insurance portion and the investment portion. The investment portion has a **cash value**. As the policyholder gets older, more money goes into the insurance component and less into the investment component. If the policyholder wishes to change the death benefit, they must apply for a new policy, which will be based on their current age and health. Policyholders pay premiums to guarantee the death benefit. If the policyholder cancels the insurance before their death, they receive the cash value, and the insurance is no longer in effect.

Universal life insurance is similar to whole life insurance. The cash value can be used to pay the insurance premium if the policyholder doesn't pay it. But if the cash value is not enough to pay the insurance, the policy can lapse. The death benefit can be changed without having to get a new policy.

Variable life insurance combines an insurance part with a variety of investment components. These may include stocks, bonds, and money market funds. Financial advisors often caution clients that this is one of the riskiest insurance policies.

Skills and Strategies

Here you will learn how to solve problems involving life insurance. Life insurance policies must be read carefully—be sure to know exactly what you are paying for.

EXAMPLE 1

Jack is 40 years old. In ten years, his house will be paid off and his daughter will have completed college. He wants to take out a 10-year level term insurance policy with a face value of $750,000. The monthly premium is $76. What will be Jack's total cost over the 10-year period?

SOLUTION There are 120 payments over the 10 years. Multiply to find the total cost.

$$120 \times 76 = 9{,}120$$

The term policy will cost Jack $9,120.

CHECK YOUR UNDERSTANDING

Joanne took out a 15-year term policy with a face value of x dollars. Over the lifetime of the policy, she pays monthly payments of m dollars. She dies after 16 years. How much will her beneficiaries receive from the insurance company?

EXAMPLE 2

Logan purchased a whole life policy with a face value of $100,000 when he was 28 years old. The annual premium was c dollars. He wanted to increase the face value to $250,000, so he had to apply for a new policy. Since his current age was higher, and he had some health issues, the premium increased to x dollars. Express the percent increase algebraically.

SOLUTION The increase is partially due to the increase in face value, but it is substantially affected by the fact that Logan is older and has some health issues. He is a greater risk to the insurance company, so they must charge him more. Subtract to find the monthly premium increase.

$$x - c$$

Divide the increase by the original premium c, and multiply by 100 to change the decimal to an equivalent percent.

$$\frac{x - c}{c}(100)$$

The percent increase can be represented by $\frac{x - c}{c}(100)\%$.

CHECK YOUR UNDERSTANDING

Gabriella's whole life premium increased from $123 to $166 per month when she increased the policy's face value. Find the percent increase to the nearest percent.

EXAMPLE 3

Mario has a universal life insurance policy with a face value of $250,000. The current cash value of the policy is $8,260. If the premium is $97 per month, for how many months can the cash value be used to pay the premium?

SOLUTION With universal life insurance, the premium can be paid by having money taken out of the cash value. Divide to find how many months the current cash value could pay for.

$$8{,}260 \div 97 \approx 85.15464$$

The greatest number of payments the cash value can cover is 85.

In Chapter 8 you were introduced to the greatest integer function, which has its own notation, $[x]$.

The greatest integer less than or equal to 85.15464 is written

$$[85.15464]$$

If a number is not an integer, the greatest integer of that number is the integer to its left on the number line.

$$[85.15464] = 85$$

The current cash value could pay 85 months of premiums.

CHECK YOUR UNDERSTANDING

Zoe pays a monthly premium of m dollars for her universal life policy. Express algebraically the number of years of premiums that could be covered by a cash value of c dollars.

EXAMPLE 4

Joe is an insurance agent. Zach, a 45-year-old man, inquires about a life insurance policy. How can Joe assess the risk his company is taking on when they offer a life insurance policy to Zach?

SOLUTION Joe uses the mortality table for males, which was created by insurance company actuaries. The death probability is the probability that a man of a given age will die before his next birthday. Recall that a probability is a number from 0 to 100%. It can be expressed as a percent, a fraction, or a decimal.

Joe finds a probability of 0.003732 for a 45-year-old male. This means that there is, on average, a 0.37% chance—less than 1%—of a 45-year-old man dying before he reaches age 46.

Zach's rate will be based on this probability, the type of policy he wants, his overall health, where he lives, and how much coverage he wants.

	Mortality Table for Males	
Exact Age	Death Probability	Life Expectancy
41	0.002629	36.36
42	0.002863	35.46
43	0.003127	34.56
44	0.003418	33.67
45	0.003732	32.78
46	0.004967	31.90
47	0.004424	31.03
48	0.004805	30.17
49	0.005208	29.31
50	0.005657	28.46

CHECK YOUR UNDERSTANDING

The mortality rate for a certain female elderly age category is 0.043. A company insures 7,000 people in this category. About how many of them will die before their next birthday?

EXAMPLE 5

The Umbrella State Insurance Company sells a five-year term insurance policy with face value of \$150,000 to a 41-year-old man for an annual premium of \$648. What is the profit the company receives from selling this policy for each age of death?

SOLUTION The company collects \$648 per year for this term policy. If the person dies within the policy period, the company loses a lot of money on the policy. They will have collected much less in premiums than the \$150,000 in benefits they would have to pay out.

If the person dies after a year of payments, the company's revenue for this policy is \$648, and they have to pay out \$150,000. Subtract to find the profit.

$$648 - 150{,}000 = -149{,}352$$

The profit is negative, showing that there was a loss of $149,352.

Profit after 2 years of payments $2 \times 648 - 150{,}000 = -148{,}704$

Profit after 3 years of payments $3 \times 648 - 150{,}000 = -148{,}056$

Profit after 4 years of payments $4 \times 648 - 150{,}000 = -147{,}408$

Profit after 5 years of payments $5 \times 648 - 150{,}000 = -146{,}760$

At an age of death of 46 or greater, the term policy is ended, and the profit is found by multiplying the annual premium by 5 years.

$$5 \times 648 = 3{,}240$$

The company makes a profit of $3,240 if the person does not die during the five-year term.

CHECK YOUR UNDERSTANDING

An insurance company sells a $100,000 five-year term policy to a female. The monthly policy is m dollars. If the person dies 17 months after taking out the policy, express the insurance company's profit algebraically.

EXAMPLE 6

In Example 5, you witnessed how the company takes on a great risk when they sell a policy. The mortality rates and amount of profit are shown in the table. If the company sold 10,000 of the same policies, what would their expected profit be for the 10,000 policies?

Age at death	41	42	43	44	45	Age ≥ 46
Profit at end of each year	−149,352	−148,704	−148,056	−147,408	−146,760	$3,240
Mortality rate	0.0026	0.0029	0.0031	0.0034	0.0037	0.9843

SOLUTION Notice the sum of the probabilities in the table is 1. The *expected value* is the expected profit based on the probabilities. Add the products of each profit and its probability.

$$(-149{,}352)(0.0026) + (-148{,}704)(0.0029) + (-148{,}056)(0.0031) + (-147{,}408)(0.0034) + (-146{,}760)(0.0037) + (3{,}240)(0.9843) = 866.4024$$

The expected profit per policy is about $866.40. This is an average—it cannot occur for one policy. If the company sells 10,000 policies, on average it will earn $866.40 per policy. Multiply to find the profit on 10,000 policies.

$$10{,}000(866.40) = 8{,}664{,}000$$

The expected profit is $8,664,000. The company has made over 8 million dollars on these 10,000 term policies.

CHECK YOUR UNDERSTANDING

Express the expected profit algebraically for the mortality table.

Profit	x	y	p
Probability	0.7	0.1	0.2

Applications

Life is what happens to you while you're busy making other plans.

John Lennon, English Songwriter

1. Interpret the quote in the context of what you have learned throughout your financial algebra course.

2. Premiums for the Sun-Belt Insurance Company are given in the table. Find the annual premiums for $250,000 of the following Sun-Belt life insurance policies.

a. A 10-year life insurance policy purchased by a 30-year-old male.

b. A 20-year term policy for a 40-year-old female.

c. A 10-year term life insurance policy for a 40-year-old male.

d. A 20-year term life insurance policy for a 50-year-old female.

Sun-Belt Life Insurance Company Term Life Premiums

Monthly Premiums for $250,000 Coverage

Age	Male		Female	
	10 year	20 year	10 year	20 year
20	$26	$ 35	$22	$32
30	$36	$ 46	$33	$45
40	$51	$ 67	$48	$60
50	$98	$111	$95	$*x*

3. New City Insurance Company offers a term life insurance policy with a renewable annual premium. The first year premium is $140. Premiums increase 6% each year.

a. What will the premium be in the second year?

b. What will the premium be in the third year?

c. What will the premium be in the fifth year?

d. What will premium be in the *x*th year?

4. Candida purchased an insurance policy with an annual premium of $780. In the first year, 60% of the annual premium is allocated to the insurance component and 40% to the cash value. The investment earns 2.2% interest, compounded annually. How much will Candida have in the investment portion of her policy after the first year?

5. Explain why a ten-year, $200,000 term life insurance policy for a 20-year-old male would have a lower premium than a ten-year, $200,000 insurance policy for a 50-year-old male.

6. Jonathan has a universal life insurance policy with a face value of $500,000. The current cash value of the policy is $11,260. Jonathan wants to stop paying premiums for a few months while he changes jobs. The premium is $134 per month.

a. What will the cash value of the policy be, without adding any interest, if he doesn't pay the premiums for a year?

b. For how many months could Jonathan use the cash value (without interest) to pay for the $134 premiums?

7. Use the mortality table below to answer parts a–f.

Exact Age	Mortality Table for Males		Mortality Table for Females	
	Death Probability	Life Expectancy	Death Probability	Life Expectancy
56	0.008467	23.52	0.005148	26.94
57	0.009121	22.71	0.005627	26.07
58	0.009912	21.92	0.006166	25.22
59	0.010827	21.13	0.006765	24.37
60	0.011858	20.36	0.007445	23.53
61	0.012966	19.60	0.08187	22.71
62	0.014123	18.85	0.08959	21.89
63	0.015312	18.11	0.09747	21.08
64	0.016567	17.38	0.010582	20.29
65	0.017976	16.67	0.011511	19.50
66	0.019564	15.96	0.012572	18.72
67	0.021291	15.27	0.013772	17.95
68	0.023162	14.59	0.015130	17.19
69	0.025217	13.93	0.016651	16.45

a. The life expectancy column gives the number of years a person of that age is expected to live. What is the life expectancy for a 67-year-old female, rounded to the nearest year?
b. To what age is a 56-year-old male expected to live, rounded to the nearest year?
c. If the company insures 20,000 69-year-old females, how many are expected to die before their 70th birthday? Round to the nearest integer.
d. If the company insures 14,000 59-year-old males, how many are expected to die before their 60th birthday? Round to the nearest integer.
e. If the company insures x number of 61-year-old females, how many are expected to die before their 62nd birthday? Express your answer algebraically.
f. Based on the table, what is the probability that a 60-year-old male will live to his 61st birthday?

8. Use the definition of the greatest integer function to evaluate each of the following.

a. $[55.9]$ **b.** $[55.001]$
c. $[0.65]$ **d.** $[-34.11]$
e. $\left[16\frac{3}{14}\right]$ **f.** $[-8.21]$
g. $[19]$ **h.** $[-0.45]$
i. $\left[-8\frac{1}{2}\right]$ **j.** $\left[\frac{2}{3}\right]$

9. Zeke has a universal life insurance policy with a face value of $200,000. The current cash value of the policy is x dollars. The premium is m dollars per month. He is going to use the cash value to pay for premiums for as long as it can. In those months, the cash value will earn y dollars in interest. Express algebraically the number of months the cash value can be used to pay the premium.

10. Johan took out a 10-year term policy with a face value of x dollars. Over the lifetime of the policy, he pays monthly payments of m dollars. He dies after making payments for $3\frac{1}{4}$ years.

a. How many payments did he make?
b. Express the total he paid for the policy algebraically.
c. How much will his beneficiary receive from the insurance company?

11. The Durham Insurance Company sells a five-year term insurance policy with face value of $100,000 to a 47-year-old man for a monthly premium of $63. The mortality table is given below.

Age at Death	47	48	49	50	51	Age ≥ 51
Mortality Rate	0.0032	0.0034	0.0038	0.0043	0.0049	x

a. Find the value of x from the table.
b. A man buys a policy on his 47th birthday. He dies after making 15 payments. What is the sum total of the payments he made?
c. How much do this man's beneficiaries receive upon his death?
d. What is the insurance company's profit on this policy?
e. If 8,000 men aged 47 bought one of these policies, about how many would die at age 50? Round to the nearest integer.
f. What is the annual premium for this policy?
g. Assume a policyholder pays the premium annually. What is the profit of this policy for each year of death?

Age at Death	47	48	49	50	51	Age > 51
Insurance Company Profit ($)	–99,244	–98,488	–97,732	–96,976	–96,220	3,780
Mortality Rate	0.0032	0.0034	0.0038	0.0043	0.0049	0.9804

h. What is the expected profit from selling one of these policies? Round to the nearest cent.
i. What is the expected profit from selling 8,000 of these policies?

12. Life insurance companies take risks much like arcade game owners take risks. Mollie has a booth on a popular beach boardwalk. She charges $2 per game. Winners receive a $5 prize. The probability of winning the game is 0.1.

a. What is the probability of losing the game?
b. What profit does Mollie earn if a person wins the game?
c. What profit does Mollie earn if the person loses the game?
d. Set up a table indicating the profit and the probability of winning and losing.
e. What is Mollie's expected profit per game?
f. If 500 people play this game on a summer weekend, what is Mollie's profit for the weekend?

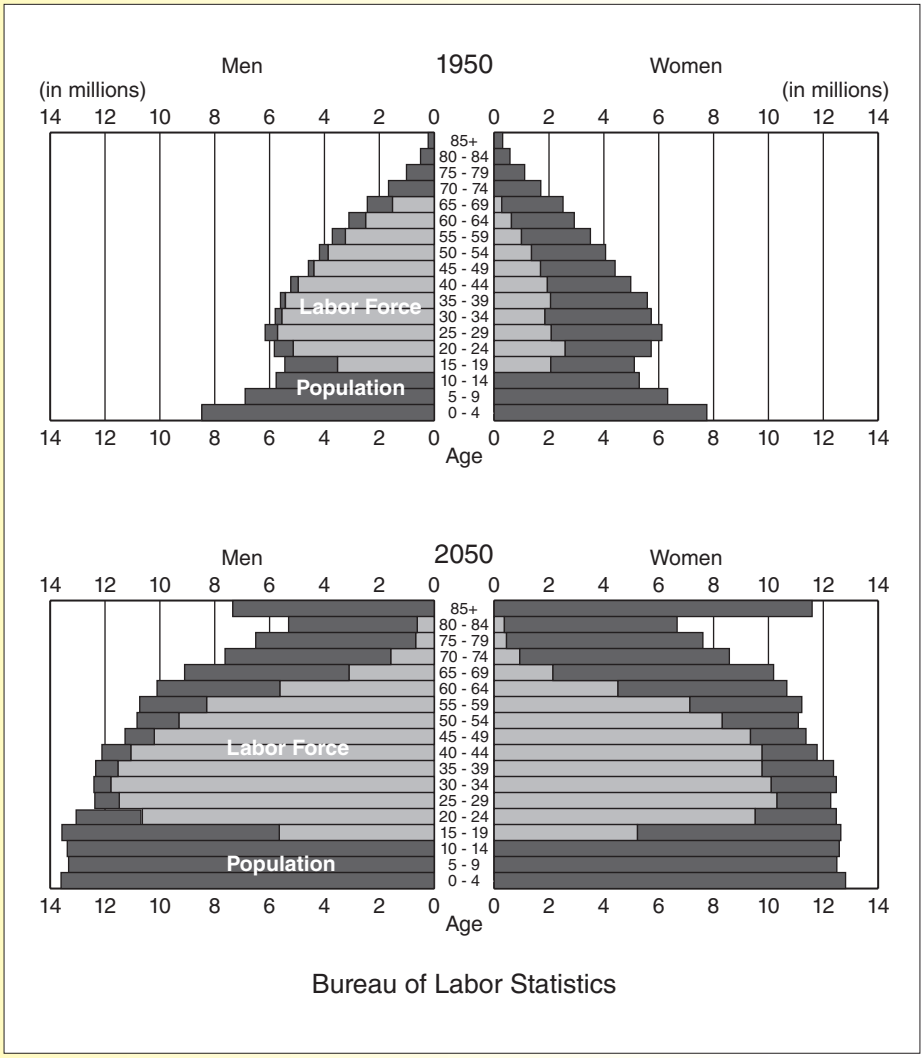
CHAPTER

9 Assessment

Real Numbers

You Write the Story!!

Write a short newspaper-type article centered on this chart below. You can find an electronic copy at www.cengage.com/school/math/financialalgebra. Copy it, and paste it into your article.



Bureau of Labor Statistics

1. Talk to your teacher about inviting a life insurance agent to your classroom. Contact a local life insurance agent and set up a session at your school. Gather questions about life insurance on index cards from your classmates. Ask these questions during the session.
2. Talk to your parents about their retirement plans. See if they have pensions or retirement savings plans. Find out if there are any savings accounts for your college or post–high school plans. Discuss with them their plans for financing their retirement years.
3. Too often, it is not practical to compare funeral costs. Usually, the person planning the funeral is too sad to take time to compare prices. This is an extremely disadvantageous position for a consumer. Funerals can be very expensive, so you should become familiar with funeral costs. Visit a local funeral parlor and discuss the price of a funeral with a representative. Ask questions about prices and different options. Prepare a report on your findings.
4. Go to the Social Security website and download a form to request a copy of your Social Security statement. Have your parent or guardian fill one out and send it in. If you have ever worked, you should fill one out too. When the statement arrives, check to see that it is correct. Be sure to keep it in a safe place.
5. Find a local law office and contact them. See if they would be willing to set up an appointment for you to talk to a lawyer about the costs and other aspects of setting up a will. Do some research online so you are prepared with some knowledge about a will. Make a list of key vocabulary words that a consumer needs to know when making out a will. Define each word. Prepare some questions for your interview. Summarize your findings in a report.
6. Interview your parent/guardian about the health insurance your family has. Find out if it is a benefit from employment or purchased by your family independently. Find out if there are benefits for dentistry, orthodontic care, vision care, and prescription drugs. Find out how much you pay for a visit to the doctor. Do not compile a report since this is private, personal information. Instead, have your parent/guardian write a note to the teacher stating that this interview has taken place.
7. Talk to your teacher about inviting a financial advisor to your classroom. You can find a local financial advisor through your bank. Gather questions about retirement savings plans on index cards from your classmates. Ask these questions during the visit.
8. Log on to the Social Security website. Using what you learned in this chapter, search for frequently asked questions on different aspects of Social Security, including credits and benefits. Select the frequently asked questions and answers that you understand. Paste them into a new document you create for a poster you will present to the class.

9. Visit a local bank and set up an appointment with a bank representative and their in-house financial advisor. Make a list of the savings plans they offer for retirement. Get all information they can give you on these types of savings plans. Find out interest rates, fees, tax advantages, and get sample examples on how much your money can grow. Prepare a poster on your findings to present to the class.

10. Interview your grandparents about their Social Security benefits. Find out how many years each one of them worked in their lifetime and when they started collecting benefits. Ask them about anything they remember about applying for the benefits and when they started collecting Social Security. Do not include this information in a report for your class since it is private. Instead, have a parent or guardian write a note to the teacher stating that the interview did take place.

11. There has been much debate over recent years about the very large number of people in the United States who do not have health insurance because they cannot afford it. Do some Internet research on the current state of this problem. Find out how different politicians plan to address this issue. Look in the newspaper. Research how medical insurance is handled in other countries. Prepare a report on your findings.

12. Go to your local drug store and inquire about interviewing your local pharmacist. Talk to the pharmacist about the difference between generic and brand-name prescription drugs. Get some examples of the different prices of each. Prepare your information on a poster you can present to your class.

13. Log on to the Medicare website. Using what you learned in this chapter, search for frequently asked questions on different aspects of Medicare, including costs and coverage. Select the frequently asked questions and answers that you understand. Paste them into a new document you create for a poster you will present to the class.

Dollars and Sense — Your Financial News Update

Go to www.cengage.com/school/math/financialalgebra where you will find a link to a website containing current issues about retirement. Try one of the activities.

During the baby boomer years, approximately 76 million Americans were born. In 1957, 4.3 million babies were born in the United States. This is more than any year before or since. One of the baby boomers reaches 50 every seven seconds. That is around 11,960 people a day and 4 million a year.

In 2006, the oldest of the baby boomers, the generation born around 1946, turned 60 years old. Among the Americans celebrating their 60th birthday in 2006 were two recent presidents, George W. Bush and Bill Clinton. A host of world famous rock stars and entertainers reached their 60s by 2010.

Nearly 6,000 Americans turn 65 every day. That figure will jump to 9,000 as the baby boomers age. By 2030, there will be over a million centenarians in this country.

1. How many baby boomers reach the age of 50 each day?

2. When 9,000 baby boomers per day reach the age of 65, how many will reach the age of 65 per year?

3. In 1957, how often was a baby born, on average?

4. There is constant concern that the Social Security Trust Fund will run out of money, since so many people are living longer. If, around 2030, there are 1 million people over the age of 100, estimate the total number of years they would have collected Social Security. Explain your answer.

Applications

1. In 2009, the maximum taxable income for Social Security was $106,800. The FICA tax rate was 6.2%.
   a. What is the maximum anyone could have paid into FICA tax in the year 2009?
   b. Bill had two jobs in 2009. One employer paid him $77,090 and the other paid him $31,280. Each employer took out 6.2% for Social Security. How much did Bill overpay in Social Security for 2009?

2. In 1990, the amount of earnings required to earn one Social Security credit was $520. In the tax year 1990, Maggie earned $187 biweekly. How many Social Security credits did she earn in 1990?

3. Anna turned 62 in 2007, and she is computing Social Security benefits. Using the formula from Example 3 in Lesson 9-2, compute her Social Security full retirement benefit if her average monthly salary over her 35 highest-paying years was $3,766.

4. Nick's annual salary is $90,000. His employer matches his 401k contributions at $0.75 for each dollar up to 8% of his annual salary. Nick contributes $350 from each biweekly paycheck to his 401k account. What is the combined total of his annual contribution and his employer's contribution?

5. Juanita's Social Security full monthly retirement benefit is $2,128. She started collecting Social Security at age 65. Her benefit is reduced since she started collecting before age 67. Using the reduction percents from Example 4 in Lesson 9-2, find her approximate monthly Social Security benefit to the nearest dollar.

6. Charleen is single. She is filling out the Social Security worksheet shown on page 451 so she can determine the amount of her Social Security benefits that she will pay federal income tax on. The following lines were taken from her tax information.

- Line 1 She received $38,121 in Social Security benefits.
- Line 3 The total of her other sources of income is $23,907.
- Line 4 The amount from line 8b is $450.
- Line 6 The total to enter is $3,211.

How much of Charleen's Social Security benefit must she pay federal income tax on?

7. Reliable Insurance Company offers a term life insurance policy with a renewable annual premium. The first year premium is $795. Premiums increase by 4.1% each year. What will premiums be in the nth year?

8. Alex took out a 15-year term policy with a face value of f dollars. Over the lifetime of the policy, he pays monthly payments of m dollars. He dies after making payments for $1\frac{1}{2}$ years. Express algebraically the difference between the amount Alex paid in premiums and the amount his beneficiaries received when he died.

9. Paul has a universal life insurance policy with a face value of f dollars. The current cash value of the policy is c dollars. The premium is m dollars per month. He is going to use the cash value to pay for premiums for as long as it can. In those months the cash value will earn i dollars in interest. Express algebraically the number of months the cash value can be used to pay the premium.

10. Use the mortality table to answer parts a and b.

Exact Age	Death Probability	
	Males	Females
62	0.014123	0.08959
63	0.015312	0.09747
64	0.016567	0.010582
65	0.017976	0.011511
66	0.019564	0.012572
67	0.021291	0.013772

a. If the company insures 10,000 63-year-old males, how many are expected to die before their 64th birthday? Round to the nearest integer.

b. Based on the table, what is the probability that a 63-year-old male will live to his 64th birthday?

11. The Lieberman Insurance Company sells a 5-year term insurance policy with face value of $250,000 to a 39-year-old man for an annual premium of $973. The mortality table is given below.

Age at Death	40	41	42	43	44	Age > 44
Mortality Rate	0.0008	0.0009	0.0011	0.0012	0.0013	p

a. Assume the policyholder pays the premium annually. What is the insurance company profit on this policy for each year of death?
b. What is the expected profit from selling one of these policies? Round to the nearest cent.
c. What is the expected profit from selling 5,000 of these policies?

12. Deanna is 62 years old. She plans to retire in 3 years. She has $300,000 in a savings account that yields 2.25% interest compounded daily. She has calculated that her final working year's salary will be $94,000. She has been told by her financial advisor that she should have 65% of her final year annual income available for use each year when she retires.
a. What is the income that her financial advisor feels she must have per year once she retires?
b. Use the compounding formula to determine how much she will have in her account at the ages of 63, 64, and 65.
c. Assume that Deanna is planning on using 60% of her current salary in each of her first 5 years of retirement. What should that annual amount be?
d. Deanna has decided that she will need $20,000 each year from her savings account to help her reach her desired annual income during retirement. Will Deanna be able to make withdrawals of $20,000 from her savings account for 20 years? Explain your reasoning.

13. Mitch opened a retirement account that has an annual yield of 4.2%. He is planning on retiring in 13 years. How much must he deposit into that account each year so that he can have a total of $1,000,000 by the time he retires? Round to the nearest $10,000 dollars.

14. Hillary's employer offers an annual pension benefit, for employees that have worked for the company for more than 10 years. The benefit is calculated by multiplying 5.08% of the career average salary by the number of years that exceeds 10 that the employee has worked for the company. Hillary's salary for the first five years was $26,745. After that she earned the following salaries:

29,000 29,400 30,100 32,500 32,500 33,200 33,400 34,700
35,000 35,000 35,000 35,000 36,700 38,000 39,000 39,500

a. What is Hillary's career average salary?
b. What is Hillary's annual pension under this plan?
c. What percentage of her final annual salary will her annual retirement salary be? Round your answer to the nearest percent.

15. Hannah contributed $300 per month into her retirement account in pre-tax dollars during the last tax year. Her taxable income for the year was $72,000. She files taxes as a single taxpayer.

a. What would her taxable income have been had she contributed to the account in after-tax dollars?

b. Use the tax tables below to calculate her tax in both the pre-tax and after-tax contribution situations.

If line 43 (taxable income) is—		And you are —			
At least	But less than	Single	Married filing jointly *	Married filing separately	Head of a household
		Your tax is —			
72,000					
72,000	**72,050**	14,350	10,694	14,539	13,069
72,050	**72,100**	14,363	10,706	14,553	13,081
72,100	**72,150**	14,375	10,719	14,567	13,094
72,150	**72,200**	14,388	10,731	14,581	13,106
72,200	**72,250**	14,400	10,744	14,595	13,119
72,250	**72,300**	14,413	10,756	14,609	13,131
72,300	**72,350**	14,425	10,769	14,623	13,144
72,350	**72,400**	14,438	10,781	14,637	13,156
72,400	**72,450**	14,450	10,794	14,651	13,169
72,450	**72,500**	14,463	10,806	14,665	13,181
72,500	**72,550**	14,475	10,819	14,679	13,194
72,550	**72,600**	14,488	10,831	14,693	13,206
72,600	**72,650**	14,500	10,844	14,707	13,219
72,650	**72,700**	14,513	10,856	14,721	13,231
72,700	**72,750**	14,525	10,869	14,735	13,244
72,750	**72,800**	14,538	10,881	14,749	13,256
72,800	**72,850**	14,550	10,894	14,763	13,269
72,850	**72,900**	14,563	10,906	14,777	13,281
72,900	**72,950**	14,575	10,919	14,791	13,294
72,950	**73,000**	14,588	10,931	14,805	13,306

If line 43 (taxable income) is—		And you are —			
At least	But less than	Single	Married filing jointly *	Married filing separately	Head of a household
		Your tax is —			
75,000					
75,000	**75,050**	15,100	11,444	15,379	13,819
75,050	**75,100**	15,113	11,456	15,393	13,831
75,100	**75,150**	15,125	11,469	15,407	13,844
75,150	**75,200**	15,138	11,481	15,421	13,856
75,200	**75,250**	15,150	11,494	15,435	13,869
75,250	**75,300**	15,163	11,506	15,449	13,881
75,300	**75,350**	15,175	11,519	15,463	13,894
75,350	**75,400**	15,188	11,531	15,477	13,906
75,400	**75,450**	15,200	11,544	15,491	13,919
75,450	**75,500**	15,213	11,556	15,505	13,931
75,500	**75,550**	15,225	11,569	15,519	13,944
75,550	**75,600**	15,238	11,581	15,533	13,956
75,600	**75,650**	15,250	11,594	15,547	13,969
75,650	**75,700**	15,263	11,606	15,561	13,981
75,700	**75,750**	15,275	11,619	15,575	13,994
75,750	**75,800**	15,288	11,631	15,589	14,006
75,800	**75,850**	15,300	11,644	15,603	14,019
75,850	**75,900**	15,313	11,656	15,617	14,031
75,900	**75,950**	15,325	11,669	15,631	14,044
75,950	**76,000**	15,338	11,681	15,645	14,056

c. How much did Hannah save in taxes during that year?

16. Regina is a 45-year-old supervisor for a communications company. She files taxes as married filing separately. She withdrew $50,000 from her tax-deferred retirement account to pay off her loans. Regina's taxable income for that year was $100,040, excluding the $50,000 early withdrawal from her retirement account.

a. Use the tax computation worksheet shown to calculate Regina's tax had she not made the early withdrawal.

Section C — Use if your filing status is **Married filing separately**. Complete the row below that applies to you.

Taxable income If line 43 is—	**(a)** Enter the amount from line 43	**(b)** Multiplication amount	**(c)** Multiply (a) by (b)	**(d)** Subtraction amount	**Tax** Subtract (d) from (c). Enter the result here and on Form 1040, line 44
At least $100,000 but not over $100,150	$	× 28% (.28)	$	$ 5,628.00	$
Over $100,150 but not over $178,850	$	× 33% (.33)	$	$ 10,635.50	$
Over $178,850	$	× 35% (.35)	$	$ 14,212.50	$

b. Use the same worksheet to calculate her tax with an increase in her taxable income of $50,000.

c. How much more in taxes did she pay because of the early withdrawal?

d. What was her early withdrawal penalty?

17. Circuit Technologies offers their employees a flat pension plan in which a predetermined dollar amount (multiplier) is multiplied by the number of years of service to determine the monthly pension benefit using the schedule shown.

Years Employed	Multiplier
15–19	$52
20–25	$57
30+	$60

After working at Circuit for 23 years, Jane has decided to change careers and leave her current job. She has been told that there will be a 2.05 % cost of living adjustment soon after she retires. Calculate Jane's pension after the COLA.

18. Petra's employer offers an annual pension benefit calculated by multiplying 2.46% of the career average salary times the number of years employed. Here are Petra's annual salaries over the last 16 years of employment:

54,000 54,000 55,100 55,800 55,800 56,200 56,400 57,000
60,000 61,000 61,000 61,000 61,700 62,000 63,000 63,500

a. What is Petra's career average salary?
b. What is Petra's annual pension under this plan?
c. What percentage of her final annual salary will her annual retirement salary be? Round your answer to the nearest percent.
d. What is Petra's monthly pension benefit? Round your answer to the nearest penny.

19. NuEditions Book Company uses a final average salary formula to calculate an employee's pension benefits. The amount used in the calculations is the salary average of the final 3 years of employment. The retiree will receive an annual benefit that is equivalent to 1.75% of the final average for each year of employment. Mike and Rob are both retiring at the end of this year. Calculate their annual retirement pension given the following information:

Mike: Years of employment: 25;

Final three annual salaries: $84,780, $84,900, $85,000

Kristy: Years of employment: 27;

Final three annual salaries: $71,600, $73,400, $78,000

20. Esteban's employer offers a pension plan that calculates the annual pension as the product of the final average salary, the number of years of service, and a 2% multiplier. His employer uses a graded vesting formula according to the schedule shown. Esteban has decided to change jobs after 3 years of service. What percent of his pension will he receive when he retires?

Years Employed	Vesting Percentage
0	0%
1	0%
2	28%
3	45%
4	78%
5	100%