

Applications

TEACH

Exercises 2, 3, 7, and 9

These exercises are related. Have students first identify which are future values of periodic investment and which are present values of periodic investment problems.

Exercise 4

Here, students first have to calculate the future value of a single deposit investment in order to determine the amount from which the withdrawal will be made.

Exercise 5

This is a good guided discovery activity to use during class. Students can work in small groups through each step.

ANSWERS

1. Retirement requires advanced planning and preparation. A retirement savings plan requires years to grow. Mr. Cook warns all of us (young and old) that without advanced planning for retirement, we could face years of poverty rather than a comfortable old age.

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. [See margin.](#)
2. Ricky is 35 years old. He plans to retire when he is 63. He has opened a traditional retirement account that pays 1% interest compounded monthly. If he makes monthly deposits of \$400, how much will he have in the account by the time he retires? **\$155,028.26**
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? **\$74,356.50**
4. At the age of 30, Jasmine started a retirement account with \$50,000, which compounded interest semi-annually with an APR of 1.75%. 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 toward her grandchild's college education. She had to pay a 10% penalty on the early withdrawal. What was her penalty? **\$3864.72**
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 2.1% interest compounded annually for 25 years.
Account 2: \$10,000 is placed in a taxable account that pays 2.1% interest compounded annually for 25 years.
 - a. How much is in Account 1 after the 25-year period? **\$16,812.94**
 - b. Since the taxpayer pays 22% of all income in taxes, 22% of the interest he makes each year will go toward taxes. Therefore, his annual interest rate in actuality is 22% less than the 2.1% quoted rate. What is his real annual interest rate? **1.638%**
 - c. How much will he actually have made after the 25-year period in Account 2 if taxes are taken into consideration? **The account balance will be \$15,010.76. He will have made \$5,010.76 in interest.**
6. Laura has been contributing to a retirement account that pays 1.75% 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? **\$9,828**
 - b. Laura pays 23% of her income in taxes. What was her tax on the amount of the withdrawal (rounded to the nearest dollar)? **\$2,260**
 - c. She had to pay a 10% early withdrawal penalty. How much was she required to pay, rounded to the nearest dollar? **\$983**
7. Fiona opened a retirement account that has an annual rate of 2.2%. 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? **\$24,206.05**

8. John is 60 years old. He plans to retire in 2 years. He now has \$400,000 in a savings account that yields 2.1% interest compounded monthly. 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.
- What is the range of income that his financial advisor thinks he must have per year once he retires? **\$52,800–\$61,600**
 - Determine how much he will have in his account at the ages of 61 and 62. (margin)
 - 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? **\$57,200**
 - John has decided that he will need \$2,000 each month from his savings account to help him reach his desired annual income during retirement. Will John be able to make withdrawals of 2,000 each month from his savings account for 20 years? Explain your reasoning. See margin.
9. Bob can afford to deposit \$400 a month into a retirement account that compounds interest monthly with an APR of 1.8%. 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? **31 years**
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.
- What would his taxable income have been had he contributed to the account in after-tax dollars? **\$67,150**
 - Use the tax table below to calculate his tax in both the pre-tax and after-tax contribution situations. **Pre-tax: 11,388; After-tax: \$12,588**
 - How much did Jack save in taxes during that year? **\$1,200**

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Exercise 8

Before assigning part (d) of this exercise, encourage students to go back to Section 2-10 and review the lesson on systematic withdrawal accounts. There are two ways to view this problem. Use the balance in the account when John is 62 years old from 8b. Then use the systematic withdrawal formula to determine how long it will take for monthly withdrawals of \$2000 to deplete the entire account. You will see that the answer is over 20 years. This method will require the use of logs. The other way to find the answer is to use the same systematic withdrawal formula and replace t with 20. The result will yield the amount that has been withdrawn from the account after 20 years. Since this number is less than the principal, John can be assured that he will have enough in the account to make the withdrawals.

Exercise 9

Since the problem asks for a length of time, and time is an exponent, this problem will require logs in the solution.

ANSWERS

- 8b. \$408,481.32 and \$417,142.48 respectively
- 8d. The amount in the account at retirement age of 62 will last a little over 21.5 years.

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	11,300	8,381	11,300	9,829
62,050	62,100	11,313	8,389	11,313	9,841
62,100	62,150	11,325	8,396	11,325	9,854
62,150	62,200	11,338	8,404	11,338	9,866
62,200	62,250	11,350	8,411	11,350	9,879
62,250	62,300	11,363	8,419	11,363	9,891
62,300	62,350	11,375	8,426	11,375	9,904
62,350	62,400	11,388	8,434	11,388	9,916
62,400	62,450	11,400	8,441	11,400	9,929
62,450	62,500	11,413	8,449	11,413	9,941
62,500	62,550	11,425	8,456	11,425	9,954
62,550	62,600	11,438	8,464	11,438	9,966
62,600	62,650	11,450	8,471	11,450	9,979
62,650	62,700	11,463	8,479	11,463	9,991
62,700	62,750	11,475	8,486	11,475	10,004
62,750	62,800	11,488	8,494	11,488	10,016
62,800	62,850	11,500	8,501	11,500	10,029
62,850	62,900	11,513	8,509	11,513	10,041
62,900	62,950	11,525	8,516	11,525	10,054
62,950	63,000	11,538	8,524	11,538	10,066

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	12,550	9,131	12,550	11,079
67,050	67,100	12,563	9,139	12,563	11,091
67,100	67,150	12,575	9,145	12,575	11,104
67,150	67,200	12,588	9,154	12,588	11,116
67,200	67,250	12,600	9,161	12,600	11,129
67,250	67,300	12,613	9,169	12,613	11,141
67,300	67,350	12,625	9,176	12,625	11,154
67,350	67,400	12,638	9,184	12,638	11,166
67,400	67,450	12,650	9,191	12,650	11,179
67,450	67,500	12,663	9,199	12,663	11,191
67,500	67,550	12,675	9,206	12,675	11,204
67,550	67,600	12,688	9,214	12,688	11,216
67,600	67,650	12,700	9,221	12,700	11,229
67,650	67,700	12,713	9,229	12,713	11,241
67,700	67,750	12,725	9,236	12,725	11,254
67,750	67,800	12,738	9,244	12,738	11,266
67,800	67,850	12,750	9,251	12,750	11,279
67,850	67,900	12,763	9,259	12,763	11,291
67,900	67,950	12,775	9,266	12,775	11,304
67,950	68,000	12,788	9,274	12,788	11,316

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Exercise 11

If you anticipate some students experiencing difficulty with the algebraic expressions in this exercise, give them a similar problem with numbers first. Once completed, ask them to do Exercise 11 using the numerical problem as a guide.

Exercises 13 and 14

Be sure to assign (and possibly review) Exercise 13 before having students work on Exercise 14. They are related.

ANSWERS

Exercise 11c. $\frac{10.03xt}{100} + 1.003x$

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 2.25%. He contributes x dollars after each 6-month period, and this has not changed over the life of the account.
- How much will he have in the account after 20 years of saving? Round numbers to the nearest hundredth. $50.17x$
 - 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. $10.03x$
 - 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.
- Use the tax computation worksheet shown below to calculate Jhanvi's tax had she not made the early withdrawal. $\$21,960$

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 \$129,600	\$	x 25% (0.25)	\$	\$5,677.50	\$
Over \$129,600 but not over \$209,850	\$	x 28% (0.28)	\$	\$9,565.50	\$
Over \$209,850 but not over \$411,500	\$	x 33% (0.33)	\$	\$20,058.00	\$
Over \$411,500 but not over \$439,000	\$	x 35% (0.35)	\$	\$28,288.00	\$
Over \$439,000	\$	x 39.6% (0.396)	\$	\$48,482.00	\$

- Use the same worksheet to calculate her tax with an increase in her taxable income of \$45,000, which represents the early withdrawal. $\$33,988.50$
 - How much more in taxes did she pay because of the early withdrawal? $\$12,020.50$
 - If Jhanvi paid a 10% early withdrawal fee, how much was her early withdrawal penalty? $\$4,500$
13. Nelson makes \$120,000 per year. His employer offers a 401(k) 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 401(k)? $\$2,080$
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. $\frac{(YMP)}{10000}$