

Calculate business and personal investments	= Write functions or sequences that model relationships between two quantities
<p>Program Task: Calculate business and personal investments.</p> <p>Program Associated Vocabulary: RATE, INTEREST RATE, PRINCIPLE, INTEREST, EARNINGS</p> <p>Program Formulas and Procedures: Making investment choices is an important skill for everyone to understand and apply in their daily lives. A person in the field of Marketing and Business will be able to apply the principles of investment for both personal and business use.</p> <p>Example: Shaequawn wants to save money for college. He is working a variety of jobs in his neighborhood to save money. At the end of summer vacation, he has earned a total of \$6500. The local bank is offering a certificate of deposit that has an interest rate of 4.7% for 4 years. What will Shaequawn's total investment be at the end of the four year time period?</p> $y = c(1 + r)^t$ $y = \$6500(1 + .047)^4$ $y = \$6500 (1.047)^4$ $y = \$7810.88$ <p>Shaequawn will have \$7,810.88 in the account after 4 years.</p>	<p>PA Core Standard: CC.2.2.HS.C.3</p> <p>Description: Write functions or sequences that model relationships between two quantities.</p> <p>Math Associated Vocabulary: RATE, CONSTANT, VARIABLE, EXPONENTIAL GROWTH, EXPONENTIAL DECAY, LINEAR</p> <p>Math Formulas and Procedures: Exponential growth: $y = c(1 + r)^t$ Where c is the initial amount, (1 + r) is the growth factor and t is the number of times the exponent is compounded.</p> <p>Exponential decay: $y = c(1 - r)^t$ Where c is the initial amount, (1 - r) is the decay factor and t is the number of times the exponent is compounded.</p> <p>Example: You invest \$3000 into a special program that will offer you 4% annual interest. You will invest the money for 6 years. How much money will you have in the account after the 6 years?</p> <p>Using the exponential growth formula:</p> $y = c(1 + r)^t$ $y = 3000(1 + .04)^6$ $y \approx \$3,795.96$ <p>You will have \$3,795.96 in the account after 6 years.</p>

Instructor's Script – Comparing and Contrasting

Compound interest is a form of exponential growth. Understanding how investments (or debts) can grow when interest compounds monthly or annually is an important skill.

Common Mistakes Made By Students

A common mistake is using the wrong formula or confusion about where to start or what formula to use. When using the exponential growth or exponential decay formulas students sometimes forget that they need to take the sum or difference of one and the percent and not just the percent. The percent **MUST** be written as a decimal. When you are using the formula for exponential growth, the base of the exponent should be greater than one; when you are using the exponential decay formula, the base of the exponent should be between 0 and 1.

Example 1:

A credit card company charges 20% monthly interest on all balances that are not paid at the end of the month. It charges a \$39 late fee and an annual fee of \$50. You have decided to get the card. During the first three months that you have the card, you pay the full balance each month. You need to get your car repaired and the bill is \$1500. You pay with your credit card. At the end of the month you can only pay \$500 towards the bill. If you carry the balance of the bill on your credit card for six months, what are you paying in interest?

$$y = C(1 + r)^t$$

$$y = \$1000(1 + .20)^6$$

$$y = \$2985.98$$

$$\$2985.98 - \$1000 = \$1985.98$$

You would pay \$1,985.98 in interest.

Example 2:

How would this change if it 20% were an annual interest rate?

Interest rates are typically given as an amount per year. Remember, in the formula, $y = C(1 + r)^t$, the exponent "t" represents the number of times the interest is compounded. If the percent was 20% *per year*, and you wanted to calculate the interest *for 6 months*, then the formula would be:

$$y = 1000(1 + (.20/12))^6$$

$$y = 1000(1 + (1.1066...))^6$$

$$y \approx 1,103.83$$

$$\$1,103.83 \text{ (total amount paid)} - \$1,000 = \$103.83 \text{ (interest paid for the 6 month period)}$$

When you are applying for a credit card it is important to understand the fees you will be paying, and it is also important to get in the habit of paying the credit card's full balance every month.

CTE Instructor's Extended Discussion

The concept of rate and time is essential in the field of Marketing and Business. It can impact personal investments for college and retirement investments. In business, it can impact decisions made concerning investing pension benefits for employees, investments to help grow the company's capital, and measuring different finance options for equipment.

Having a strong understanding of this concept will help a young person develop a strong understanding of the importance of investing for their personal and business portfolios.

Sales, Distribution, and Marketing Operations (52.1801) T-Chart

Problems	Career and Technical Math Concepts	Solutions
1. Cathleen just received \$100.00 from her uncle. She just learned about investing in class and wants to look at the options for the money she has just received. The local bank is offering depositors 3% on their investments for one year. How much will Cathleen earn on her investment if she puts the money she received in the bank and leaves it there for 5 years?		
2. Taylor is 3 years old; her Aunt Sissy would like to put some money away for her for college. It is estimated that Taylor will start college when she is 18 years old. Sissy has \$15,000.00 that she is going to place into a high yield savings account—8.5% interest for 15 years. How much money will be in Taylor’s college fund account when she turns 18? Create an equation for this problem. Solve the equation.		
3. Juan is thinking about retirement, and would like to retire in 20 years with \$2,000,000. He found a great medium risk investment opportunity guaranteeing to a 9% return on his investment. Calculate Juan’s initial investment amount.		
Problems	Related, Generic Math Concepts	Solutions
4. What interest would you earn on an investment of \$5000 that earned 5% annual interest for 10 years?		
5. How long would it take to lose 44 pounds if you lose at a constant rate of 1½ pounds per week?		
6. You drink a beverage with 150 mg. of caffeine. Each hour, the caffeine in your system decreases by about 15%. How much caffeine will be in your system after 6 hours?		
Problems	PA Core Math Look	Solutions
7. How much money would you have in an account if you invested \$2000 for 6 months at an interest of 8% per year?		
8. Bacteria can multiply at an alarming rate when each bacteria splits into two new cells, thus doubling. If we start with only one bacterium which can double every hour, how many bacteria will we have by the end of one day?		
9. A once booming town had a population of 30,000 in 1990. The population has been decreasing at a rate of 2.5% per year. What will be the population in 2020?		

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Problems	Career and Technical Math Concepts	Solutions
1. Cathleen just received \$100.00 from her uncle. She just learned about investing in class and wants to look at the options for the money she has just received. The local bank is offering depositors 3% on their investments for one year. How much will Cathleen earn on her investment if she puts the money she received in the bank and leaves it there for 5 years?	$y = C(1 + r)^t$ $y = 100(1 + 0.03)^5$ $y = 100(1.03)^5$ $y = 115.93$	$\$115.93 - \$100 = \$15.93$ So if Cathleen invested \$100 dollars for 5 years at a rate of 3% per year, she would have earned \$15.93.
2. Taylor is 3 years old; her Aunt Sissy would like to put some money away for her for college. It is estimated that Taylor will start college when she is 18 years old. Sissy has \$15,000.00 that she is going to place into a high yield savings account—8.5% interest for 15 years. How much money will be in Taylor’s college fund account when she turns 18? Create an equation for this problem. Solve the equation.	$y = C(1 + r)^t$ $y = 15,000(1 + .085)^{15}$ $y = 15,000 (1.085)^{15}$ $y = 15,000 (3.40)$ $y \approx \$51,000.00$	
3. Juan is thinking about retirement, and would like to retire in 20 years with \$2,000,000. He found a great medium risk investment opportunity guaranteeing to a 9% return on his investment. Calculate Juan’s initial investment amount.	$2,000,000 = P (1 + 0.09)^{20}$ $2,000,000 = P (1.09)^{20}$ $\frac{2,000,000}{(1.09)^{20}} = P$ $P = \$356,861.78$	
Problems	Related, Generic Math Concepts	Solutions
4. What interest would you earn on an investment of \$5000 that earned 5% annual interest for 10 years?	$y = C(1 + r)^t$ $y = \$5000(1 + .05)^{10}$ $y = \$8144.473$ $\$8144.47 - \$5000 = \$3144.47$ You would earn \$3144.47 in interest.	
5. How long would it take to lose 44 pounds if you lose at a constant rate of 1½ pounds per week?	$y = mx$ $44 = 1\frac{1}{2}x$ $x = 29\frac{1}{3}$ It would take between 29 and 30 weeks to lose the weight. At the rate of 1 ½ pounds per week.	
6. You drink a beverage with 150 mg. of caffeine. Each hour, the caffeine in your system decreases by about 15%. How much caffeine will be in your system after 6 hours?	$y = C(1 + r)^t$ $y = 150(1 - 0.15)^6$ $y = 150(.85)^6$ $y = 56.6$ mg.	
Problems	PA Core Math Look	Solutions
7. How much money would you have in an account if you invested \$2000 for 6 months at an interest of 8% per year?	$y = 2000(1 + 0.08)^{\frac{1}{2}}$ $y = 2000(1.08)^{\frac{1}{2}}$ $y = \$2078.46$	
8. Bacteria can multiply at an alarming rate when each bacteria splits into two new cells, thus doubling. If we start with only one bacterium which can double every hour, how many bacteria will we have by the end of one day?	$y = C(1 + r)^t$ $y = 1(2)^{24}$ $y = 16,777,216$	
9. A once booming town had a population of 30,000 in 1990. The population has been decreasing at a rate of 2.5% per year. What will be the population in 2020?	$y = C(1 - r)^t$ $y = 30,000(1 - 0.0242)^{30}$ $y = 14,475$	