

SAVE YOUR CHANGE

Performance Standard (6B/6C/8A).J

Analyze the use of the annuity formula and compare it to the two compound interest formulas accordingly. It is assumed students have worked with and are familiar with the annuity formula and compound interest formulas:

- *Mathematical knowledge*: know how to use the compound periodic and continuous interest formulas; know the differences and similarities between different forms of growth formulas.
- *Strategic knowledge*: use appropriate strategies to solve the problem.
- *Explanation*: explain completely and clearly what was done and why it was done.

Procedures

1. ***In order to investigate, represent and solve problems using number facts, operations and their properties, algorithms and relationships (6B); compute and estimate using mental mathematics, paper-and-pencil methods, calculators and computers (6C); and describe numerical relationships using variables and patterns (8A)***, provide students with sufficient learning opportunities to develop the following skills:
 - Identify, represent and solve problems with numbers expressed in exponential, logarithmic and scientific notation using technology.
 - Develop fluency in operations with real numbers, vectors and matrices using mental computation or paper-and-pencil calculations for simple cases and technology for more-complicated cases.
 - Use the correct number of digits in computation to achieve an appropriate unit or level of accuracy when solving problems.
 - Explain the differences and similarities between different forms of growth formulas.Students will benefit throughout life by understanding the concept of saving and the impact that compounding interest has on the value of the savings. The ability to calculate compound interest either manually or through the use of technology is an important skill to possess as it allows individuals to compare scenarios in which various rates of interest and differing terms of saving would change the amount of earnings. This aligns with the National Standards for Family and Consumer Sciences Education – Standard 2.6 (Demonstrate management of financial resources to meet the goals of individuals and families across the life span.).
2. Provide each student a copy of the "Save Your Change" task sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Ask students to solve the following problem and show their work and explain their reasoning. They should be monitored by the teacher but encouraged to do their own thinking.

Use an annual interest of 9% and the following formula to solve the problems: $S = R \frac{(1+i)^n - 1}{i}$ where R is

the amount of the payment, i is the interest rate per payment period (as a decimal), n is the total number of payments and S is the total amount.

- (1) Use the formula and logarithms and/or technology (available software) to determine how many years of home exercise would amount to \$44,572. Use the formula and/or technology (available software) again to determine how many years of investing \$12 a month would amount to \$22,134. Do your answers for #1 and #2 agree (within 1 year)?
 - a) If so, how old does the author believe the reader to be?
 - b) If not, how much do they differ, and what might be the reason?
- (2) Use the compound interest formula and/or technology (available software) to find how much money would have to be invested today in a lump sum and left to accumulate interest compounded quarterly for 40 years at 8% interest to equal the \$56,092 from the cappuccino example.
- (3) How much less would you have to invest if continuously compounded at 8% for 40 years to accumulate the same \$56,092?

4. Evaluate each student's work using all three dimensions of the rubric and its guide to determine the performance level. Use the standard rubric, giving a score for each category for each question. Minor computational errors might include rounding errors. Use of the incorrect formulas or using the wrong interest amount per payment period should result in no more than a 2 in mathematical knowledge. A 4 in mathematical knowledge would require correct answers as follows:
- 30.9 years, 30.08 years, about 30 years old (retire at 60)
 - \$2359.79
 - \$73.36 (\$2,359.79-\$2,286.43)
- A 4 in strategy would require using the correct formulas and converting annual rates to periodic rates, and months to years.

Examples of Student Work

- [Meets](#)
- [Exceeds](#)

Time Requirements

- 30 minutes

Resources

- Copies of the "Save Your Change" task sheet and work sheet
- Calculator
- Mathematics computer software
- Mathematics Rubric

NAME _____ DATE _____

**SAVE YOUR CHANGE . . .
IT COULD GROW INTO THOUSANDS OF DOLLARS”**

Student Task Sheet

That was the headline for the Personal Finance column of the USA Weekend Magazine, May 29-31, 1998. The article claimed the following:

"Save more!... The first ever "National Pay Yourself Day" created by Fidelity Investments and supported by 300 corporations, was May 7. How to save more?

- Exercising at home instead of joining a gym saves \$ 300 a year. Value at retirement: \$44,572.
- Renting a video once a month instead of going to the movie (and eating popcorn) saves \$12 a month. Value at retirement: \$22,134.
- Having a cappuccino every other day instead of daily saves \$7 a week. Value at retirement: \$ 56,092."

The rate of interest used was 9% annually. The formula used was as follows:

$$S = R \frac{(1+i)^n - 1}{i}$$

where R is the amount of the payment, i is the interest rate per payment period (as a decimal), n is the total number of payments and S is the total amount.

Show all work and write in words what you did and why you did each step.

1. Use the formula and logarithms and/or technology (available software) to determine how many years of home exercise would amount to \$ 44,572.

Use the formula and/or technology (available software) again to determine how many years of investing \$12 a month would amount to \$ 22,134.

Do your answers for #1 and #2 agree (within 1 year)?

- a) If so, how old does the author believe the reader to be?
 - b) If not, how much do they differ, and what might be the reason?
2. Use the compound interest formula and/or technology (available software) to find how much money would have to be invested today in a lump sum and left to accumulate interest compounded quarterly for 40 years at 8% interest to equal the \$ 56,092 from the cappuccino example.
 3. How much less would you have to invest if continuously compounded at 8% for 40 years to accumulate the same \$ 56,092?

Adapted from Personal Finance, Chatzky, J., USA Weekend Magazine, May 29-31, 1998

NAME _____ DATE _____

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Student Work Sheet

MATHEMATICS RUBRIC

NAME _____ DATE _____

- Exceeds standard (must receive a 4 in each area)
- Meets standard (must receive all 3's or a combination of 3's and 4's)
- Approaches standard (must receive all 2's or any combination which may include a 3 or a 4)
- Begins standard (has no 3's or 4's but not all 1's)
- Absent (has all 1's and 0's)

	Mathematical Knowledge	Strategic Knowledge	Explanation
4	<ul style="list-style-type: none"> • Wrote the right answer. • Used math words correctly to show understanding of how math works. • Worked it out with no mistakes. • Used the right math words and labeled the answers. 	<ul style="list-style-type: none"> • Identified all the important parts of the problem, and knew how they went together. • Showed all the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote what was done and why it was done. • If a drawing was used, all of it was explained in writing.
3	<ul style="list-style-type: none"> • Knew how to do the problem, but made small mistakes. 	<ul style="list-style-type: none"> • Identified most of the important parts of the problem. • Showed most of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote mostly about what was done. • Wrote a little about why it was done. • If a drawing was used most of it was explained in writing.
2	<ul style="list-style-type: none"> • Understood a little, but made a lot of big mistakes. 	<ul style="list-style-type: none"> • Identified some of the important parts of the problem. • Showed some of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote some about what was done or why it was done but not both. • If a drawing was used, some of it was explained in writing.
1	<ul style="list-style-type: none"> • Tried to do the problem, but didn't understand it. 	<ul style="list-style-type: none"> • Identified almost no important parts of the problem. • Showed almost none of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote or drew something that didn't go with the answer. • Wrote an answer that was not clear.
0	<ul style="list-style-type: none"> • No answer attempted. 	<ul style="list-style-type: none"> • No strategy shown. 	<ul style="list-style-type: none"> • No written explanation.
Score			