

EFFECTS OF COMPOUNDING INTEREST RATES ON BUSINESS DECISIONS

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.

Business and accounting students need to understand how interest rates affect costs of goods. By changing interest rates and number of years to complete a payment, dramatic changes can occur. These changes are fundamental to the purchase of cars, homes and businesses. All students would benefit by being familiar with the interest rate formulas. This assessment aligns with Workplace Skills H4 (Solving Problems and Critical Thinking/Employ reasoning skills) and H5 (Solving Problems and Critical Thinking/Evaluate options).

2. Provide each student a copy of the "Business Decisions" 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, show their work and explain their reasoning. They should be monitored by the teacher but encouraged to do their own thinking.

Acme Corporation has a need for additional office space. This will require Acme Corporation to obtain an additional building and its lot. They have located a potential building and lot, and the current owner is willing to either rent the property to them for \$5000 a month or sell the property for \$1,000,000. The board of directors must decide if they should buy or rent additional space. Use appropriate technology to help you make any necessary calculations, but clearly explain any formulas the technology may be using and why that is appropriate.

- (1) To buy the building and lot, Acme needs \$100,000 down with a \$900,000 mortgage. The interest rate on the mortgage is 8% APR.
 - a. What would be the monthly payments?
 - b. If the term is 30 years, how much would ACME have actually paid for the property (and interest) by the time the loan is repaid?
- (2) If Acme rents, the rent is \$5,000 per month.
 - a. How many years does it take before Acme has paid the owner the asking price of \$1,000,000?
 - b. How much will Acme have paid in rent if they continue to rent the building for 30 years?
 - c. How many years can Acme rent the building for the same price they will pay out during the duration of the loan?
- (3) If Acme invests the difference between the rent payment and the purchase payment, as well as the \$100,000 down payment amount over the next 30 years, at an average APR of 5%, what amount will the company have invested at the end of that time period?
- (4) Acme plans to be in business for at least the next 50 years, and current analyst predictions suggest that their space needs will not decrease during that time. What would you recommend to Acme? Should they rent the building or purchase it? Why?

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:

(1) a. \$6603.88 per month b. \$2,377.397.22 in payments, plus \$100,000 down payment.

(2) a. 200 months b. \$1.8 million c. more than 495 months

(3) \$1603.88 monthly invested at 5% APR for 30 years, plus the initial deposit of \$100,000 would yield \$1,781,617.41 at the end of 30 years.

(4) The students' answers may vary, but they should provide a reasonable rationale for their decision, based on the data and sound business practices.

A 4 in strategy would require using the correct formulas and converting annual rates to periodic rates and months to years.

A 4 in communication will clearly describe the exponential relationships involved in the interest and payment calculations. It must include identification of the formulas used and the manner in which the calculator or computer handles these calculations.

Examples of Student Work

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

Time Requirements

- 45 minutes

Resources

- Copies of the "Business Decisions" task sheet and work page
- Calculator or Spreadsheet program
- Mathematics Rubric

NAME _____ DATE _____

BUSINESS DECISIONS

Student Task Sheet

Acme Corporation has a need for additional office space. This will require Acme Corporation to obtain an additional building and its lot. They have located a potential building and lot, and the current owner is willing to either rent the property to them for \$5000 a month or sell the property for \$1,000,000. The board of directors must decide if they should buy or rent additional space. Use appropriate technology to help you make any necessary calculations, but clearly explain any formulas the technology may be using and why that is appropriate.

1. To buy the building and lot, Acme needs \$100,000 down with a \$900,000 mortgage. The interest rate on the mortgage is 8% APR.
 - a. What would be the monthly payments?
 - b. If the term is 30 years, how much would ACME have actually paid for the property (and interest) by the time the loan is repaid?

2. If Acme rents, the rent is \$5,000 per month.
 - a. How many years does it take before Acme has paid the owner the asking price of \$1,000,000?
 - b. How much will Acme have paid in rent if they continue to rent the building for 30 years?
 - c. How many years can Acme rent the building for the same price they will pay out during the duration of the loan?

3. If Acme invests the difference between the rent payment and the purchase payment, as well as the \$100,000 down payment amount over the next 30 years, at an average APR of 5%, what amount will the company have invested at the end of that time period?

4. Acme plans to be in business for at least the next 50 years, and current analyst predictions suggest that their need for space needs will not decrease during that time. What would you recommend to Acme? Should they rent the building or purchase it? Why?

NAME _____ DATE _____

BUSINESS DECISIONS

Student Work Page

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			