Math 3 – 320: Money Name: _____

You may recall from our introduction to *e* weeks ago that we looked how money grows in bank accounts when it is compounded a certain number of times over the course of a year. The equation for the amount of money in the bank account was

$$A = P(1 + \tfrac{r}{n})^{nt}$$

This follows a certain pattern. Understanding the pattern will help you understand exponential and logarithmic applications.

- *P* in the equation is the principle. This is the **initial amount**. The units will depend on the problem; *P* could be an amount of money, number of people, or anything really.
- $\left(1 + \frac{r}{n}\right)$ is the base. This is the **rate of growth or decay**. Usually you will see this presented as a percentage in the problem. **One big catch**: the percentage given in the problem is not always the base. Sometimes the percentage will need to be added to 1, because the percentage tell you how much the account is increasing. Other times you will need to divide it by another number because the percentage is an annual percentage and your account is compounded multiple times per year. So be careful. Determining the base is usually the hardest part of the question.
- *nt* is the exponent. This is the **number of times your value has been increased or decreased**. Again, this is not always automatically just the number of years. Sometimes the value will be compounded multiple times per year.

Different parts of money questions:

- Initial and final amounts: Hopefully you can determine these from the question. The initial amount is *P* and the final amount is *A*.
- Annual interest/depreciation rate: This is equivalent to *r* in the equation above. It should always be expressed as a decimal. Notice that *r* is not the base in money questions. This is because *r* is really just the percentage your money increases or decreases each period. 100% (or just 1 in decimal form) is the baseline. If your money doesn't increase or decrease, you keep 100% of your money. Remember if the account compounds (or something grows) **continuously, the base is *e*.**
- Compounding: Sometimes your money gets compounded more frequently than once per year (annually). In this case, *n* stands for the number of compounds per year, and you can see it affects two different parts of the equation. The first part is the base. Interest rates (*r*) are usually presented as annual rates, so that annual rate needs to be divided evenly each time the money gets compounded. That is why *r* is divided by *n*. The number of compounds also affects the exponent. The exponent tells you the number of times the money has been increased or decreased, so multiplying *n* by *t* will tell you the total number of compounds over *t* years.

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Calculating A:

1. Jordan invested $2700 into a bank account with 4% interest that compounds quarterly. What is Jordan's balance after 5 years?

Solving for r:

2. Tony invested $1500 into a bank account. The account compounds twice per year and after 8 years Tony had $6300 in the account. What is the annual interest rate of the account?

3. Ashley invested $2200 into a bank account. The account compounds monthly and after 7 years Ashley had $5400 in the account. What is the annual interest rate of the account?

Solving for t:

4. Sachi invested $1200 in a bank account. The account compounds three times per year and has an interest rate of 4%. When Sachi checked her account balance today, she had $3700. How long has the money been in the account?

5. Juan invested $5200 in a bank account. The account compounds six times per year and has an interest rate of 3.5%. When Juan checked his account balance today, he had $12000. How long has the money been in the account?

General Practice:

6. Brice invested $200 into a bank account. The account compounds annually and after 11 years Brice had $3400 in the account. What is the annual interest rate of the account?
7. Jonelle invested $1700 into a bank account with 5.5% interest that compounds monthly. What is Jonelle's balance after 15 years?
8. Hannah invested $8200 in a bank account. The account compounds twice per year and has an interest rate of 4%. When Hannah checked her account balance today, she had $8300. How long has the money been in the account?
9. Kevin invested $700 into a bank account with 7.5% interest that compounds continuously. What is Kevin's balance after 10 years?
10. Sabrina invested $3200 in a bank account. The account compounds continuously and has an interest rate of 4%. When Sabrina checked her account balance today, she had $9300. How long has the money been in the account?
11. Sierra invested $50 into a bank account. The account compounds continuously and after 3 years Sierra had $8000 in the account. What is the annual interest rate of the account?