Name:

Common Core Algebra II

Unit 6

Modeling Exponential Functions

Mr. Schlansky

2025

Lesson 1: I can create and solve simple exponential functions using $A = P(1 \pm r)^t$.

Basic Exponential Growth/Decay Formula: $A = P(1 \pm r)^t$ where A is the current amount, P is the initial amount, r is the rate as a decimal (divide by 100), and t is time.

Lesson 2: I can find the exponential rate using $A = P(1 \pm r)^t$ and rooting both sides.

To find exponential rate:

1) Substitute values into $A = P(1 \pm r)^t$
2) Isolate the parenthesis
3) Root both sides to get rid of the constant exponent
4) Solve for r (divide by -1 if decay)
5) Multiply by 100 to find the percent

Lesson 3: I can find an equivalent exponential form by absorbing the exponent or setting the two expressions equal to each other.

Equivalent Exponential Forms

To get t by itself in the exponent, absorb whatever is in the exponent into the parenthesis. For example:

$A = 100(1.045)^{12t}$ becomes $A = 100\left(1.045^{12}\right)^t$

$A = 100(1.045)^{\frac{t}{2}}$ becomes $A = 100\left(1.045^{\frac{1}{2}}\right)^t$

If converting to continuous form, set $P(1 \pm r)^t = Pe^{rt}$ and solve. The left hand side is whatever appropriate variation of the formula is involved in the problem.

Lesson 4: I can interpret the meaning of the components of an exponential equation using $A = P(1 \pm r)^t$.

Given an exponential function: What is in front of the parenthesis is the INITIAL amount, what is inside the parenthesis is 1 + the rate or 1 – the rate.

Example: $A = 500(1.2)^t$: 500 is initial amount, rate is .2 or 20% growth (1 + .2)

$A = 500(0.8)^t$: 500 is initial amount, rate is .2 or 20% decay (1 - .2)

Lesson 5: I can convert rates by raising to the $\frac{1}{n}$ power.

To convert from an annual rate to a monthly rate or other:

Start with $A = P\left(1 \pm r\right)^t$

$A = P\left((1 \pm r)^{\frac{1}{n}}\right)^{nt}$ if t is years or $A = P\left((1 \pm r)^{\frac{1}{n}}\right)^{m}$ if m is the rate unit. n is number of new units in old units. For example: yearly to monthly: $n = 12$, weekly to daily: $n = 7$.

How many times per year do you get the monthly rate? 12t

How many times per month do you get the monthly rate? m

Lesson 6: I can calculate compound interest using $A = P\left(1 \pm \frac{r}{n}\right)^{nt}$ and $A = Pe^{rt}$.

COMPOUNDING Interest: $A = P\left(1 \pm \frac{r}{n}\right)^{nt}$, where A is the current amount, P is the initial amount, r is the rate as a decimal (divide by 100), n is the number of times compounded (yearly =1, semiannually = 2, quarterly = 4, monthly = 12, weekly = 52, daily = 365) and t is time.

COMPOUNDING CONTINUOUSLY: $A = Pe^{rt}$

Lesson 7: I can calculate irregular time (half life) using $A = P\left(1 \pm r\right)^{\frac{t}{h}}$.

Half Life

$A = P\left(\frac{1}{2}\right)^{\frac{t}{h}}$ where h is the amount of time for the half life

Double Time:

$A = P\left(2\right)^{\frac{t}{h}}$ where h is the amount of time it takes to double

Irregular Time:

$A = P\left(1 \pm r\right)^{\frac{t}{h}}$ where h is the amount of time it takes for the rate to be applied.

For example, if the rate increases by 15% every 5 years, r = .15 and h = 5.

Lesson 8: I can find A by choosing the appropriate exponential model and substituting in.

$A = P(1 \pm r)^t$	Nothing Below!
$A = P\left(1+\frac{r}{n}\right)^{nt}$	Compounding (Not Continuous)
$A = Pe^{rt}$	Compounding Continuously
$A = P\left(\frac{1}{2}\right)^{\frac{t}{h}}$	Half Life
$A = P(1 \pm r)^{\frac{t}{h}}$	Irregular Time

		n
A = after amount	Annually	1
P = principal (initial/starting) amount	Quarterly	4
r = rate (as a decimal)	Monthly	12
n = number of times compounded per year	Weekly	52
t = time (that is passing)	Daily	365
h = half life or time it takes for the percent to be applied		

Lesson 9: I can find t in exponential equations by choosing the appropriate exponential model and solving the exponential equation by taking the log of both sides.
Same notes as Lesson 8!
When solving for t, solve the exponential equation:
1) Isolate the base (divide)
2) Take the log of both sides
3) Bring the exponent to the front
4) Divide to isolate the variable (multiply by the LCD if fraction in exponent)

Lesson 10: I can write an exponential regression equation using stat, calc, expreg.
Exponential Regression Equations

1) Stat, Edit
2) Stat, Calc, 0: ExpReg

READ AND ROUND CAREFULLY!
WRITE THE EQUATION WITH Y AND X BEFORE YOU SUBSTITUTE IN FOR THE FOLLOW UP QUESTION!
If given x, type expression into calculator and you are done.
If given y, solve the exponential equation (Same notes from Lesson 9)

Lesson 11: I can prepare for my modeling exponential functions test by practicing!

Name ____________ Date ___________

Mr. Schlansky

Rounding

Round 104.9437 to the nearest:

1. Unit: 2. Tenth: 3. Hundredth: 4. Thousandth:

Round 28.3518 to the nearest:

5. Degree: 6. Tenth: 7. Hundredth: 8. Thousandth:

Round 54.8561 to the nearest:

9. Meter: 10. Tenth: 11. Hundredth: 12. Thousandth:

13. Round 59.61 to the nearest inch

14. Round 124.95 to the nearest tenth

15. Round 91.8995 to the nearest hundredth

16. Round 2.1999 to the nearest thousandth

Round the following numbers to the nearest unit

17. 12.92 18. 102.4 19. 47.251 20. 49.75

Round the following numbers to the nearest tenth

21. 15.718 22. 105.519 23. 89.253 24. 235.983

Round the following numbers to the nearest hundredth

25. 29.6901 26. 328.297 27. 181.406 28. 2.4951

Round the following numbers to the nearest thousandth

29. 209.6749 30. 0.57813 31. 111.1142 32. 3.1499

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Mr. Schlansky Algebra II

Creating and Solving Simple Exponential Functions

1. Cassandra bought an antique dresser for $500. If the value of her dresser increases 6% annually, what will be the value of Cassandra's dresser at the end of 3 years to the *nearest dollar*?

2. A certain car depreciates at a rate of 15% each year. If the car was initially worth $8125, what is the value of the car, rounded to the nearest cent, 11 years later?

3. Cameron invests $1,227 in stocks and her money increases by 9% each year. What will be the value of her investment 18 years later?

4. Kathy plans to purchase a car that depreciates (loses value) at a rate of 14% per year. The initial cost of the car is $21,000. What is the value of the car after 3 years rounded to the nearest cent?

5. Marissa deposits $2000 into a bank account with pays an annual interest rate of 4.6%. How much money, to the nearest cent, will she have in the account after 8 years?

6. A bank is advertising that new customers can open a savings account with a 3.75% interest rate compounded annually. Robert invests $5,000 in an account at this rate. If he makes no additional deposits or withdrawals on his account, find the amount of money he will have, to the *nearest cent*, after three years.

7. The value of a truck bought new for $28,000 decreases 9.5% each year. Write an exponential function to represent this function and predict the value of the truck to the nearest cent after 10 years.

8. A car worth $20,000 depreciates at a rate of 8.75% each year. Find the value of the car after 11 years to the nearest cent?

9. Jeff deposits $8750 into a bank account with pays an annual interest rate of 1.5%. How much money, to the nearest cent, will he have in the account after 12 years?

10. A car worth $41,235 depreciates at a rate of 11.5% each year. Find the value of the car after 7 years to the nearest cent?

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Mr. Schlansky Algebra II

Finding Exponential Rate

1. A bank account opened up 3 years ago with an initial balance of \$12000 now has a balance of \$12824. Find the annual growth rate, to the *nearest tenth of a percent*.

2. Jack bought a new car in 2010 for \$16100. In 2018, the car is now worth \$6125. What is the annual rate of decrease to the *nearest percent*?

3. A collectible toy was bought 15 years ago for \$5 and is now worth \$42. Find the annual growth rate to the *nearest tenth of a percent*.

4. A colony of 120 timberwolves increased to 245 over a 6 year span. Assuming exponential growth, what was the annual growth rate to the *nearest percent*?

5. The principal value of a loan is $424,100. If there is $110,000 remaining on the loan after 19 years, what was the annual rate of decrease to the *nearest tenth of a percent*?

6. An endangered species has dropped from 937 animals to 375 animals over the past 8 years. What is the annual rate of decrease rounded to the *nearest percent*?

7. A house purchased 5 years ago for $100,000 was just sold for $135,000. Assuming exponential growth, approximate the annual growth rate, to the *nearest percent*.

8. Over the past 4 years, the value of a stock increased from $1200 to $2300. What is the *monthly* growth rate, rounded to the *nearest tenth of a percent*?

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Equivalent Exponents Forms

Express each of the following functions with an exponent of *t*. Round values to the nearest thousandth.

1. $A = 12,000(1.025)^{12t}$

2. $A = 25,000(1.125)^{13.2t}$

3. $A = 37,000(.986)^{10t}$

4. $A = 17,000(.889)^{9.4t}$

5. $A = 9,175(1.885)^{\frac{1}{2}t}$

6. $A = 9,325(1.762)^{\frac{2}{5}t}$

7. $A = 11,185(.764)^{\frac{t}{12}}$

8. $A = 125,000(.785)^{\frac{t}{4}}$

9. lridium-192 is an isotope of iridium and has a half-life of 73.83 days. If a laboratory experiment begins with 100 grams of Iridium-192, the number of grams, *A*, of Iridium-192 present after *t* days would be $A = 100\left(\frac{1}{2}\right)^{\frac{t}{73.83}}$. Which equation approximates the amount of Iridium-192 present after *t* days?

1) $A = 100\left(\frac{73.83}{2}\right)^t$

2) $A = 100\left(\frac{1}{147.66}\right)^t$

3) $A = 100(0.990656)^t$

4) $A = 100(0.116381)^t$

10. The population, $p(t)$, of a small county in Western New York has grown according to the formula $p(t)=6000(1.392)^{1.2t}$ after t years. When re-written in the form $p(t)=6000e^{rt}$, what is the value of r rounded to the nearest thousandth?

11. The value of an investment account, $v(t)$, can be modeled by the formula $v(t)=10000(.875)^{1.04t}$ after t years. When written in its equivalent form, $v(t)=10000e^{rt}$, what would be the value of r rounded to the nearest tenth of a percent? Interpret the meaning of this value in the context of the problem.

12. The half-life of iodine-131 is 8 days. The percent of the isotope left in the body d days after being introduced is $I=100\left(\frac{1}{2}\right)^{\frac{d}{8}}$. When this equation is written in terms of the number e, the base of the natural logarithm, it is equivalent to $I=100e^{kd}$. What is the approximate value of the constant, k?

1) -0.087	3) -11.542
2) 0.087	4) 11.542

13. According to a pricing website, Indroid phones lose 58% of their cash value over 1.5 years. Which expression can be used to estimate the value of a $300 Indroid phone in 1.5 years?

1) $300e^{-0.87}$
2) $300e^{-0.63}$
3) $300e^{-0.58}$
4) $300e^{-0.42}$

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Interpreting Exponential Functions

1. The function $A = 3,600(1.025)^t$ represents the value of a bank account after *t* years. Which of the following statements is *false*?
1) The initial investment of the bank account was $3,600.
2) The annual interest rate of the bank account is 2.5%.
3) The value of the account after 5 years is $4073.07.
4) It will take 12 years for the value of the account to double.

2. The function $v(t) = 10,000(1.112)^t$ represents the value of a stock investment after *t* years. Which of the following statements is *false*?
1) The stock is increasing by 11.2% each year.
2) The value of the stock after 3 years is $13,750.37
3) The value of the stock increased by $1245.44 between year 1 and year 2.
4) The initial stock investment was $11,120.

3. The function $v(t) = 40,000(0.887)^t$ represents the value of a 2020 Subaru Ascent after *t* years. Which of the following statements is *false*?
1) The initial value of the car was $40,000.
2) The value of the car is decreasing by 11.3% each year.
3) The car is worth $15,324.18 after 5 years.
4) The decreased $3,556.20 from years 2 to 3.

4. A certain pain reliever is taken in 220 mg dosages and has a half-life of 12 hours. The function $A = 220\left(\frac{1}{2}\right)^{\frac{t}{12}}$ can be used to model this situation, where A is the amount of pain reliever in milligrams remaining in the body after t hours. According to this function, which statement is true?

1) Every hour, the amount of pain reliever remaining is cut in half.
2) In 12 hours, there is no pain reliever remaining in the body.
3) In 24 hours, there is no pain reliever remaining in the body.
4) In 12 hours, 110 mg of pain reliever is remaining.

5. An equation to represent the value of a car after t months of ownership is $v = 32,000(0.81)^{\frac{t}{12}}$. Which statement is *not* correct?

1) The car lost approximately 19% of its value each month.
2) The car maintained approximately 98% of its value each month.
3) The value of the car when it was purchased was $32,000.
4) The value of the car 1 year after it was purchased was $25,920.

6. The value of an investment account, $v(t)$, can be modeled by the equation $v(t) = 500(1.15)^{3.2t}$ after t years. Which of the following statements must be true?

1) The account is increasing approximately 15% each year.
2) The account is increasing approximately 56% each year
3) There will be $1216.80 in the account after two years
4) It will take 3.68 years for the account to double

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Converting Rates

Round all coefficients to 6 decimal places

1. Gerard took out a $72000 loan for college that has a 12.7% interest rate. An equation to represent this situation is given as $A(t) = 72000(1.127)^t$.

Write an equation to find the monthly growth rate after *t* years.

Write an equation to find the monthly growth rate after *m* months.

What is the monthly growth rate rounded to the nearest thousandth of a percent?

Write an equation to find the weekly growth rate after *t* years.

Write an equation to find the weekly growth rate after *w* weeks.

What is the weekly growth rate to the nearest thousandth of a percent?

Write an equation to find the daily growth rate after *t* years.

Write an equation to find the daily growth rate after *d* days.

What is the daily growth rate to the nearest thousandth of a percent?

2. The population of a small neighborhood in Brooklyn, NY is 452,000 and is growing by a rate of 11.6% each year. An equation to represent this situation is given as $A(t) = 452000(1.116)^t$.

Write an equation to find the monthly growth rate after *t* years.

Write an equation to find the monthly growth rate after *m* months.

What is the monthly growth rate to the nearest thousandth of a percent?

Write an equation to find the weekly growth rate after *t* years.

Write an equation to find the weekly growth rate after *w* weeks.

What is the weekly growth rate to the nearest thousandth of a percent?

Write an equation to find the daily growth rate after *t* years.

Write an equation to find the daily growth rate after *d* days.

What is the daily growth rate to the nearest thousandth of a percent?

3. Stephanie found that the number of white-winged cross bills in an area can be represented by the formula $C = 550(1.08)^t$, where t represents the number of years since 2010. Which equation correctly represents the number of white-winged cross bills in terms of the monthly rate of population growth?

1) $C = 550(1.00643)^t$
2) $C = 550(1.00643)^{12t}$
3) $C = 550(1.00643)^{\frac{t}{12}}$
4) $C = 550(1.00643)^{t+12}$

4. The value of a stock after t years can be modeled by the function $V = 2500(1.14)^t$ after t years. Which function would represent the weekly rate of increase after w weeks?

1) $V = 2500(1.14)^w$
2) $V = 2500(1.14)^{52w}$
3) $V = 2500(1.0025)^w$
4) $V = 2500(1.0025)^{52w}$

5. The value of a home after t years can be modeled by the function $A = 525000(1.36)^t$ after t years. Which function would represent the monthly rate of increase after m months?

2) $A = 525000(1.36)^m$
2) $A = 525000(1.36)^{12m}$
3) $A = 525000(1.026)^m$
4) $A = 525000(1.026)^{12m}$

6. A study of the annual population of the red-winged blackbird in Ft. Mill, South Carolina, shows the population, $B(t)$, can be represented by the function $B(t) = 750(1.16)^t$, where the t represents the number of years since the study began. In terms of the monthly rate of growth, the population of red-winged blackbirds can be best approximated by the function

1) $B(t) = 750(1.012)^t$
2) $B(t) = 750(1.16)^{12t}$
3) $B(t) = 750(1.012)^{12t}$
4) $B(t) = 750(1.16)^{\frac{t}{12}}$

7. Mia has a student loan that is in deferment, meaning that she does not need to make payments right now. The balance of her loan account during her deferment can be represented by the function $f(x) = 35,000(1.0325)^x$, where x is the number of years since the deferment began. If the bank decides to calculate her balance showing a monthly growth rate, an approximately equivalent function would be

1) $f(x) = 35,000(1.0027)^{12x}$
2) $f(x) = 35,000(1.0027)^{\frac{x}{12}}$
3) $f(x) = 35,000(1.0325)^{12x}$
4) $f(x) = 35,000(1.0325)^{\frac{x}{12}}$

8. The population of Schlansky, Utah is increasing according to the formula $p(t) = 10421(1.23)^t$ after t years. Which expression can represent the weekly growth rate, after w weeks?

1) $10421(1.23)^{52w}$
2) $10421(1.004)^{52w}$
3) $10421(1.23)^{w}$
4) $10421(1.004)^{w}$

9. On average, college seniors graduating in 2012 could compute their growing student loan debt using the function $D(t) = 29,400(1.068)^t$, where t is time in years. Which expression is equivalent to $29,400(1.068)^t$ and could be used by students to identify an approximate daily interest rate on their loans?

1) $29,400\left(1.068^{\frac{1}{365}}\right)^t$
2) $29,400\left(\frac{1.068}{365}\right)^{365t}$
3) $29,400\left(1+\frac{0.068}{365}\right)^t$
4) $29,400\left(1.068^{\frac{1}{365}}\right)^{365t}$

10. A student studying public policy created a model for the population of Detroit, where the population decreased 25% over a decade. He used the model $P = 714(0.75)^d$, where P is the population, in thousands, d decades after 2010. Another student, Suzanne, wants to use a model that would predict the population after y years. Suzanne's model is best represented by

1) $P = 714(0.6500)^y$
2) $P = 714(0.8500)^y$
3) $P = 714(0.9716)^y$
4) $P = 714(0.9750)^y$

11. Each year, the amount of students in Eastbury High School increases by 7.15%. Which of the following expressions could be used to find the *weekly* rate of increase of Eastbury High School after w weeks?

1) $(1.0715)^w$
2) $(1.0715)^{52w}$
3) $(1.0013)^{52w}$
4) $(1.0013)^w$

12. Each year, the amount of students in Eastbury High School increases by 7.15%. Which of the following expressions could be used to find the *weekly* rate of increase of Eastbury High School after t years?

1) $(1.0013)^t$
2) $(1.0013)^{52t}$
3) $(1.0715)^{52t}$
4) $(1.0715)^t$

13. Last year, the total revenue for Home Style, a national restaurant chain, increased 5.25% over the previous year. If this trend were to continue, which expression could the company's chief financial officer use to approximate their monthly percent increase in revenue? [Let *m* represent months.]

1) $(1.0525)^{m}$ 3) $(1.00427)^{m}$

2) $(1.0525)^{\frac{12}{m}}$ 4) $(1.00427)^{\frac{m}{12}}$

14. Rasmus invested \$65,000 in the stock market and makes an average of 9.2% each year on his investments. Which equation could be used to find his monthly percent increase after *t* years?

1) $v = 65000(1.092)^{t}$ 3) $v = 65000(1.0074)^{t}$

2) $v = 65000(1.0074)^{12t}$ 4) $v = 65000(1.092)^{12t}$

15. Blake's currently has 240 Pokemon cards and is increasing by 12.4% each year. Which expression represents her *weekly* rate after *w* weeks?

1) $240(1.124)^{52w}$ 3) $240(1.002)^{52w}$

2) $240(1.124)^{w}$ 4) $240(1.002)^{w}$

16. Cameron's YouTube video currently has 1200 views and the views are increasing by 23% each week. Which expression represents her *daily* rate after *t* weeks?

1) $1200(1.23)^{52t}$ 3) $1200(1.03)^{t}$

2) $1200(1.23)^{7t}$ 4) $1200(1.03)^{7t}$

17. Over the past several years, the value of a stock has increased by 3.2% each year. The value of the stock is now \$87.24. Which of the following equations does not represent the value of the stock after *t* years or *m* months?

1) $a(t) = 87.24(1.032)^{t}$ 3) $a(m) = 87.24(1.0026)^{12m}$

2) $a(t) = 87.24(1.0026)^{12t}$ 4) $a(m) = 87.24(1.0026)^{m}$

18. According to the USGS, an agency within the Department of Interior of the United States, the frog population in the U.S. is decreasing at the rate of 3.79% per year. A student created a model, $P = 12,150(0.962)^{t}$, to estimate the population in a pond after *t* years. The student then created a model that would predict the population after *d* decades. This model is best represented by

1) $P = 12,150(0.461)^{d}$ 3) $P = 12,150(0.996)^{d}$

2) $P = 12,150(0.679)^{d}$ 4) $P = 12,150(0.998)^{d}$

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Compound Interest

1. A bank account is opened with $3000 and interest is compounded monthly at an interest rate of 4.2%. How much money is in the account after 8 years?

2. If a bank account is opened with $4000 and is compounded at a rate of 5.2% continuously, how much money will be in the account after 3 years?

3. Sal has a savings account. He opened the account 6 years ago by putting in $3000. If the interest is compounded daily at a rate of 5.6%, how much money is in the account now?

4. How much money is in a bank account opened 7.5 years ago with $3125.67 that is compounded weekly with an interest rate of 5.26%?

5. Moe opened a bank account with $3100 4 years ago at an interest rate of 6.1% that is compounded continuously. How much money is in Moe's bank account now?

6. Max opens a bank account with $2100. If interest is compounded quarterly at an interest rate of 7%, how much interest will Max have earned after 3 years?

7. Dan opened a savings account with $3300. If 4 years has passed, and interest is compounded monthly at a rate of 4.6%, how much *interest* has Dan made?

8. Tyler invests $7,000 in an account with 6.38% interest rate compounded continuously. Alyssa invests $7,000 in an account with a 6.46% interest rate compounded weekly. After 4 years, who will have more money in their account and by how much?

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Mr. Schlansky Algebra II

Irregular Time (Half Life)

1. The half-life of mendelevium-258 is 51.5 days. To the *nearest hundredth of a gram*, how much of a 4000 gram mendelevium-258 sample will remain after 12 days?

2. The amount of ants in a colony doubles every 8 days. If there are initially 275 ants, how many ants, to the nearest ant, will be in the colony after 30 days?

3. Phil is trying to get himself back into shape and wants to ease his way back into distance running. He will start by running 2 miles each day but every four days, he will increase his distance by 60%. How many miles will Phil be running after 10 days rounded to the *nearest tenth of a mile*?

4. Jay borrowed $50,000 from Aaron and they came to an agreement regarding how the interest will be paid. Every 5 days, the loan will accumulate 2% interest. If Jay repays the loan after 21 days, how much money will he have to repay Aaron rounded to the *nearest cent*?

5. The half life of an element is 27 hours. If there were initially 4.2 kg of the substance, how much will remain after 2 days? Round your answer to the *nearest hundredth* of a kg.

6. Jabba went to the movies on Friday night and bought a large popcorn. Every 20 minutes, Jabba eats 40% of the remaining amount of popcorn in his bucket. If there were 967 pieces of popcorn initially in Jabba's bucket, how many pieces of popcorn, to the *nearest piece of popcorn*, will be left an hour and a half into the movie?

7. The amount of views of a YouTube video triples every 5 days. If it currently has 1120 views, how many full views will the video have two weeks from now?

8. A payday loan company makes loans between \$100 and \$1000 available to customers. Every 14 days, customers are charged 30% interest with compounding. In 2013, Remi took out a \$300 payday loan. Which expression can be used to calculate the amount she would owe, in dollars, after one year if she did not make payments?

1) $300(.30)^{\frac{14}{365}}$ 2) $300(1.30)^{\frac{14}{365}}$ 3) $300(.30)^{\frac{365}{14}}$ 4) $300(1.30)^{\frac{365}{14}}$

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Modeling Exponential Functions Practice

$A = P(1 \pm r)^t$	Nothing Below!
$A = P\left(1+\frac{r}{n}\right)^{nt}$	Compounding (Not Continuous)
$A = Pe^{rt}$	Compounding Continuously
$A = P\left(\frac{1}{2}\right)^{\frac{t}{h}}$	Half Life
$A = P(1 \pm r)^{\frac{t}{h}}$	Irregular Time

A = after amount

P = principal (initial/starting) amount

r = rate (as a decimal)

n = number of times compounded per year

t = time (that is passing)

h = half life or time it takes for the percent to be applied

	n
Annually	1
Quarterly	4
Monthly	12
Weekly	52
Daily	365

1. Jackie deposits \$26,000 into a savings account with interest compounded monthly at a rate of 4.6% each year. Write an equation for $A(t)$, the value of her account after t years. Use your equation to determine how much money will be in her account after 4 years?

2. The population of Schlansky, Arizona increases by 18% every 3.2 years. If the population is currently 2750, write an equation for $p(t)$, the population after t years. Using your equation, what will be the population, to the *nearest person*, 12 years from now?

3. A bank account is opened with \$2700 and interest is compounded continuously at a rate of 3.76% per year. Write an equation for $b(t)$, the balance of the account after t years. Using your equation, what will be the balance of the account after 8.1 years?

4. A certain car depreciates at a rate of 14% each year. If the car was initially worth \$22,500, write an equation for $v(t)$, the value of the account after t years. Using your equation, what is the value of the car, rounded to the *nearest cent*, 12 years later?

5. The half life of an element is 73 minutes. If there were initially 7.4 kg of the substance, write an equation for $a(t)$, the amount of the substance remaining after t minutes. Using your equation, to the *nearest hundredth of a kg*, how much will remain after 110 minutes?

6. Skylar bought an antique mirror for \$800. If the value of her mirror increases 6% annually, write an equation for $v(t)$, the value of her mirror after t years. Using your equation, determine the value of Skylar's mirror at the end of 4 years to the *nearest dollar*?

7. A bank account is opened with \$1500 and interest is compounded quarterly at an interest rate of 3.1%. Write an equation for $b(t)$, the balance of the account after t years. Using your equation, how much money will be in the account after 7 years?

8. The amount of insects in a colony doubles every 6 days. If there are initially 50 insects, write an equation for $P(t)$, the amount of insects in the colony after t days. Using your equation, how many insects, to the *nearest insect*, will be in the colony after 11 days?

9. A bank account is opened with $9200 and is compounded at a rate of 4.7% continuously. Write an equation for $A(t)$, the amount of money in the account after t years. Using your equation, how much money will be in the account after 5 years?

10. The half-life of an element Schlanskium is 4.1 days. If there is a 9000 gram sample, write an equation for $p(t)$, the amount of Schlanskium remaining after t days. To the *nearest hundredth of a gram*, how much Schlanskium will remain after 7 days?

11. Emma opens a bank account with an initial balance of $90,210. If interest is compounded quarterly at 4.25% each year, write an equation for $b(t)$, the balance of the account after t years. Using your equation, how much money will be in the account after 14 years?

12. Sophia is beginning to lift weights to get buff for the summer. She starts by working out 30 minutes and every five days, she will increase the time of her workouts by 25%. Write an equation to represent $d(t)$, the duration of her workout after t days. Using your equation, how many minutes will Sophia be working out after 30 days rounded to the *nearest tenth of a minute*?

Name ____________ Date ________

Mr. Schlansky Algebra II

Exponential Modeling Finding t

1. Megan opens a savings account with $5,000 in it. If interest is compounded weekly at a rate of 4.3%, write an equation for $b(t)$, the balance of her account after t years. Using your equation, how long will it take, to the *nearest tenth of a year*, for Megan's money to reach $8,000?

2. One of the medical uses of Iodine–131 (I–131), a radioactive isotope of iodine, is to enhance x-ray images. The half-life of I–131 is approximately 8.02 days. A patient is injected with 20 milligrams of I–131. Create an equation for $a(t)$, the amount of Iodine-131 remaining after t days. Determine, to the *nearest day*, the amount of time needed before the amount of I–131 in the patient's body is approximately 7 milligrams.

3. Tyler opens a bank account with $5,450 with an annual interest rate of 5.3% compounded continuously. Write an equation for $b(t)$, the balance of Tyler's account after t years. Using your equation, to the *nearest hundredth of a year*, how long will it take for Tyler's account to triple?

4. Jessica deposits \$2000 into a bank account where 4% interest is given every 2.4 years. Write an equation for $v(t)$, the value of Jessica's account after t years. Using your equation, to the *nearest tenth of a year*, how long will it take for Jessica's investment to reach \$5000?

5. Manny opens a savings account with \$6,400.00 with a 5.2% interest rate that is compounded quarterly. Write an equation for $b(t)$, the balance of the account after t years. Using your equation, to the nearest *tenth of a year,* how long will it take for Manny's balance to double?

6. Christopher is preparing for the Nassau County Spelling Bee. Currently, Christopher knows 1200 words and will learn 20% more words every 4 days. Write an equation, $A(t)$, to represent how many words Christopher will be able to spell after t days. After how many days, to the *nearest day,* will Christopher be able to spell 5000 words?

7. If a bank account was opened with \$3000 and interest is compounded continuously at 5.2%. Write an equation for $v(t)$, the value of the account after t years. To the *nearest hundredth of a year*, how long will it take for the value of the account to reach \$4000?

8. Danielle bought a basketball card for \$2125 its value is increasing by 4.1% each year. Create an equation for $v(t)$, the value of the basketball card after t years. Using your equation, how long, to the *nearest year*, will it take for the value of the basketball card to reach \$10000?

9. Miguel opened a bank account with \$1000 and interest is compounded monthly at a rate of 8.1%. Write an equation to represent $b(t)$, the balance of Miguel's account after t years. Using your equation, how much time, to the *nearest year*, will it take for Miguel's money to triple?

10. Melanie bought a car for $52,000 and the car depreciates at a rate of 10% each year. Write an equation to represent the value of the car, $v(t)$, after t years. Using your equation, to the *nearest tenth of a year*, how long will it take until the value of her car reaches $22,000?

11. Jennifer initially invested $4800 in a bank account compounded continuously at a rate of 5.8%. Write an equation for $C(t)$, the value of her account after t years. After how much time, to the *nearest tenth of a year*, will it take for Jennifer's money to double?

12. The half-life of carbon-15 is 2.449 seconds. If Jackie has 17500 grams of carbon-15, write an equation for $j(t)$, the amount of grams of carbon-15 remaining after t seconds. After how much time will there be 500 grams of carbon-15 remaining? Round your answer to the *nearest tenth of a second*.

Name ___________________ Date ________________
Mr. Schlansky Algebra I

Exponential Regression Equations

1. The accompanying table shows the number of bacteria present in a certain culture over a 5-hour period, where x is the time, in hours, and y is the number of bacteria.

Write an exponential regression equation for this set of data, rounding all values to *four decimal places*. Using this equation, determine the number of whole bacteria present after 6.5 hours.

x	*y*
0	1,000
1	1,049
2	1,100
3	1,157
4	1,212
5	1,271

2. The accompanying table shows the amount of water vapor, y, that will saturate 1 cubic meter of air at different temperatures, x.

Write an exponential regression equation for this set of data, rounding all values to the *nearest thousandth*. Using this equation, predict the amount of water vapor that will saturate 1 cubic meter of air at a temperature of 50°C, and round your answer to the *nearest tenth of a gram*.

Amount of Water Vapor That Will Saturate 1 Cubic Meter of Air at Different Temperatures

Air Temperature (*x*) (°C)	Water Vapor (*y*) (g)
–20	1
–10	2
0	5
10	9
20	17
30	29
40	50

3. Jean invested \$380 in stocks. Over the next 5 years, the value of her investment grew, as shown in the accompanying table.

Years Since Investment (*x*)	Value of Stock, in Dollars (*y*)
0	380
1	395
2	411
3	427
4	445
5	462

Write the exponential regression equation for this set of data, rounding all values to *two decimal places*. Using this equation, find the value of her stock, to the *nearest dollar*, 10 years after her initial purchase.

4. The following table represents the amount of student loan debt Dr. Ross has x years after 2010. Write an exponential regression equation to represent the amount of debt Ross will have left have left after x years. Round all coefficients to the *nearest thousandth*.
Assuming the pattern continues, in what year will Ross have $10,000 left in debt?

Years after 2010	Debt in Dollars
0	120,000
1	112,541
3	88,897
4	76,441
6	53,289

5. Consider the data in the table below.
State an exponential regression equation to model these data, rounding all values to the *nearest thousandth*. Use your equation to find x when y is 100, rounding to the *nearest tenth*.

x	1	2	3	4	5	6
y	3.9	6	11	18.1	28	40.3

6. A runner is using a nine-week training app to prepare for a "fun run." The table below represents the amount of the program completed, *A*, and the distance covered in a session, *D*, in miles.

Based on these data, write an exponential regression equation, rounded to the *nearest thousandth*, to model the distance the runner is able to complete in a session as she continues through the nine-week program. After how much of the program is completed will the runner complete 2.5 miles? Round your answer to the *nearest hundredth*.

A	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{6}{9}$	$\frac{8}{9}$	1
D	2	2	2.25	3	3.25

Name _____________ Date _________________
Mr. Schlansky Algebra II

Modeling Exponential Functions Review Sheet

If t represents years, find the yearly rate of increase/decrease for the following functions. Round to the nearest tenth of a percent.

1. $A = 38,000(.987)^{12t}$

2. $A = 16,000(.887)^{8.4t}$

3. $A = 9,200(1.985)^{\frac{t}{2}}$

4. $A = 9,324(1.562)^{\frac{t}{5}}$

5. A study of black bears in the Adirondacks reveals that their population can be represented by the function $P(t) = 3500(1.025)^t$, where t is the number of years since the study began. Which function is correctly rewritten to reveal the monthly growth rate of the black bear population?

1) $P(t) = 3500(1.00206)^{12t}$
2) $P(t) = 3500(1.00206)^{\frac{t}{12}}$
3) $P(t) = 3500(1.34489)^{12t}$
4) $P(t) = 3500(1.34489)^{\frac{t}{12}}$

6. Driven by conservation efforts in Asia, the global population of tigers in the wild has shown a significant increase in the past few years. In 2010 there were estimated to be 3,200 tigers in the wild and that number has grown by approximately 3.3% per year since. Which formula can be used to determine, T, the number of wild tigers, d days since 2010?

1) $T(t) = 3,200(1.00009)^d$
2) $T(t) = 3,200(1.00009)^{365d}$
3) $T(t) = 3,200(1.033)^{\frac{365}{d}}$
4) $T(t) = 3,200(1.033)^d$

7. The function $A = 3,600(1.025)^t$ represents the value of a bank account after t years. Which of the following statements is *false*?

1) The initial investment of the bank account was $3,600.
2) The annual interest rate of the bank account is 2.5%.
3) The value of the account after 5 years is $4073.07.
4) It will take 12 years for the value of the account to double.

8. The function $v(t)=40,000(0.887)^t$ represents the value of a 2020 Subaru Ascent after t years. Which of the following statements is *false*?

1) The initial value of the car was $40,000.
2) The value of the car is decreasing by 11.3% each year.
3) The car is worth $15,324.18 after 5 years.
4) The decreased $3,556.20 from years 2 to 3.

9. A bank account opened up 3 years ago with an initial balance of $12000 now has a balance of $12824. Find the annual growth rate, to the *nearest tenth of a percent*.

10. The principal value of a loan is $424,100. If there is $110,000 remaining on the loan after 19 years, what was the annual rate of decrease to the *nearest tenth of a percent*?

11. Joe Manana just opened a bank account with a $5000 initial balance with interest compounded quarterly at a rate of 2.8%. Write an equation to represent $b(t)$, the balance of his account after t years. Using your equation, how long will it take for his money to double? Round your answer to the *nearest tenth of a year*.

12. The half-life of substance X is 12.4 minutes. Write an equation for $p(t)$, the amount of a 300 mg sample remaining after t minutes. Using your equation, how much of substance X remain after 30 minutes to the *nearest milligram*?

13. A bank account is opened with \$2500 and is compounded continuously with an interest rate of 5.16%. Write an equation for $A(t)$, the amount in the account after t years. Using your equation, how much money will be in his account after 6.5 years rounded to the *nearest cent*?

14. Jay borrowed \$15,000 from Aaron and they came to an agreement regarding how the interest will be paid. Every five days, the loan will accumulate 2.5% interest. Write an equation for $f(t)$, the amount owed after t days. Using your equation, to the *nearest day*, after how many days will Jay owe \$25,000?

15. Using a microscope, a researcher observed and recorded the number of bacteria spores on a large sample of uniformly sized pieces of meat kept at room temperature. A summary of the data she recorded is shown in the table below.

Using these data, write an exponential regression equation, rounding all values to the *nearest thousandth*. The researcher knows that people are likely to suffer from food-borne illness if the number of spores exceeds 100. Using the exponential regression equation, determine the maximum amount of time, to the *nearest hundredth of an hour*, that the meat can be kept at room temperature safely.

Hours (x)	**Average Number of Spores** (y)
0	4
0.5	10
1	15
2	60
3	260
4	1130
6	16,380

16. The table below shows the average yearly balance in a savings account where interest is compounded annually. No money is deposited or withdrawn after the initial amount is deposited.
Write an exponential regression equation to represent this situation. Round all coefficients to the *nearest ten-thousandth*. Use your equation to determine to the *nearest tenth of a year*, how long it will take for the balance to reach $1,000,000.

Year	**Balance, in Dollars**
0	380.00
10	562.49
20	832.63
30	1232.49
40	1824.39
50	2700.54