Math 1
Exponential Growth and Decay #2

Name: KEY
Date: _____

MCC9-12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear ~~and quadratic functions, and simple rational~~ and exponential functions.

Compound interest: $y = p\left(1+\frac{r}{n}\right)^{nt}$ Compound interest (continuous): $y = pe^{rt}$

1) You deposit $2000 in an account that earns 5% annual interest. Find the balance after five years if the interest is compounded

a. annually

$y = 2000\left(1+\frac{.05}{1}\right)^{1(5)} = 2000(1.05)^5 = 2000(1.276281563)$
$= 2552.563125 = \$2552.56$

b. quarterly

$y = 2000\left(1+\frac{.05}{4}\right)^{4(5)} = 2000(1+0.0125)^{20} = 2000(1.0125)^{20}$
$= 2000(1.282037232) = 2564.074463 = \$2564.07$

c. monthly

$y = 2000\left(1+\frac{.05}{12}\right)^{12(5)} = 2000(1+.004166666)^{60} = 2000(1.283358701)$
$= 2000(1.004166666)^{60} = 2566.717408 = \$2566.72$

d. continuously

$y = pe^{rt} = 2000e^{.05(5)} = 2000e^{.25} = 2000(1.284025417) = 2568.050834 = \$2568.05$

2) A customer purchases a television set for $800 using a credit card. The interest is charged on any unpaid balance at the rate of 18% per year compounded monthly. If the customer makes no payment for one year, how much is owed at the end of the year?

$y = 800\left(1+\frac{.18}{12}\right)^{12(1)} = 800(1+0.015)^{12} = 800(1.015)^{12}$
$= 800(1.195618171) = 956.4945372$

The customer will owe $956.49 at the end of the year.

3) If you deposited $1000 into a savings account earning 6% annual interest compounded quarterly, how much money do you have at the end of 3 years? What if it was compounded continuously?

$y = 1000\left(1+\frac{.06}{4}\right)^{4(3)}$
$y = 1000(1+.015)^{12}$
$y = 1000(1.015)^{12}$
$y = 1000(1.195618171)$
$y = 1195.618171$

You'll have $1195.62 after 3 years.

$y = pe^{rt}$
$y = 1000e^{.06(3)}$
$y = 1000e^{.18}$
$y = 1000(1.197217363)$
$y = 1197.217363$

You'll have $1197.22 after 3 years.

4) The M.A.T.H. Company has a savings plan for their employees. If an employee makes an initial contribution of $2500 and the company pays 7.5% interest compounded daily, how much will the employee have after 10 years?

$y = 2500\left(1 + \frac{.075}{365}\right)^{365(10)}$

$y = 2500\left(1 + .000205479452\right)^{3650}$

$y = 2500\left(1.000205479452\right)^{3650}$

$y = 2500\left(2.116836921\right)$

$= 5292.092301$

The employee will have $5292.09 after 10 years.

5) A local bank advertises two special savings accounts. You have $500 and you want to decide which offer is the best investment.

a. One account offers 4.9% compounded daily. Write a formula that gives the balance of this account at the end of one year.

$y = 500\left(1 + \frac{.049}{365}\right)^{365}$

$y = 500\left(1.000134247\right)^{365}$

b. The other account offers 5% compounded quarterly. Write a formula that gives the balance of this account at the end of one year.

$y = 500\left(1 + \frac{.05}{4}\right)^{4}$

$y = 500\left(1.0125\right)^{4}$

c. Determine the balance of the account using the formula from part (a).

$y = 500(1.000134247)^{365}$

$y = 500(1.050217706)$

$y = 525.1085298$

The balance after one year will be $525.11.

d. Determine the balance of the account using the formula from part (b).

$y = 500(1.0125)^{4}$

$y = 500(1.050945337)$

$y = 525.4726685$

The balance after one year will be $525.47.

e. Explain which account is the ~~best~~ better investment and whether the interest rate or compounding period is of more importance.

The second account is the better investment. The compounding period is of more importance because it is an exponential model. Refer to problem one. The interest rate was held constant and the compounding period was increased. The gain was greater, especially more so than the changes in rate demonstrated in this problem.