Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Exponential Growth, Decay and Interest Models**

***Growth:*** $y=a\left(1+r\right)^{t}$ ***Decay:*** $y=a\left(1-r\right)^{t}$ ***Compound Interest:*** $y=P\left(1+\frac{r}{n}\right)^{nt}$

***Continuously Compounded Interest:*** $y=Pe^{rt}$

1) Charity put $4,900 into a savings account that earned a fixed interest rate of 4.5% compounded monthly. How much will be in her account in 5 years?

2) Jake bought a car for $29,560 in 2008. The value of the car depreciates 7.2% each year. How much was the car worth in 2016 when he tried to sell it?

3) Monica was studying a bacteria culture in a lab. Initially there were 268 bacteria on the first day. The bacteria increased by 9.4% each day. How many bacteria were there 14 days later?

4) Zoe has $12,219 in a retirement fund that earns interest quarterly at a rate of 3.9%. How much will be in her retirement fund in 10 years’ time?

5) Louis has $5000 in a savings account that earns a 4% interest rate compounded continuously. How much money will be in his account in 6 years?

6) A farm that grew corn began to realize that they were losing one quarter of their crops each year due to a bug infestation. If they grew about 140,000 ears of corn this year, how many ears of corn can they expect to have 3 years from now.

7) Keri deposited $2100 in a savings account. Twenty years later the balance was $5180. What was the interest rate for the account?

8) The value of a car decreases by 12.5% each year since it was purchased. After 6 years the value is $9800. Find the original cost of the car.

9) Since January 1999, the population of the city of Jacksonite has grown according to the mathematical model $ y=420,500\left(1.019\right)^{t}$, where *t* is the number of years since January 1999.

a) Explain what the numbers $420,500$ and 1.019 represent in this model.

b) What would the population be in 2020 if the growth continues at the same rate.

10) Charlie was given an inheritance of $12,500 and is trying to determine which bank has the better savings account. Bank A offers a fixed rate of 4.8% compounded monthly whereas Bank B offers a 3.1% interest rate compounded continuously.

a) Determine how much money would be in each bank in 10 years’ time.

b) Which is the better bank for Charlie? By how much?

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**KEY**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Exponential Growth, Decay and Interest Models**

***Growth:*** $y=a\left(1+r\right)^{t}$ ***Decay:*** $y=a\left(1-r\right)^{t}$ ***Compound Interest:*** $y=P\left(1+\frac{r}{n}\right)^{nt}$

***Continuously Compounded Interest:*** $y=Pe^{rt}$

1) Charity put $4,900 into a savings account that earned a fixed interest rate of 4.5% compounded monthly. How much will be in her account in 5 years?

$$y=4900\left(1+\frac{0.045}{12}\right)^{12\*5}=\$6,133.80$$

2) Jake bought a car for $29,560 in 2008. The value of the car depreciates 7.2% each year. How much was the car worth in 2016 when he tried to sell it?

$$y=29560\left(1-0.072\right)^{8}=\$16,258.79$$

3) Monica was studying a bacteria culture in a lab. Initially there were 268 bacteria on the first day. The bacteria increased by 9.4% each day. How many bacteria were there 14 days later?

$$y=268\left(1+0.094\right)^{14}=942.71 bacteria$$

4) Zoe has $12,219 in a retirement fund that earns interest quarterly at a rate of 3.9%. How much will be in her retirement fund in 10 years’ time?

$$y=12219\left(1+\frac{0.039}{4}\right)^{4\*10}=\$18,013.17$$

5) Louis has $5000 in a savings account that earns a 4% interest rate compounded continuously. How much money will be in his account in 6 years?

$$y=5000e^{.04\*6}=\$6,356.25$$

6) A farm that grew corn began to realize that they were losing one quarter of their crops each year due to a bug infestation. If they grew about 140,000 ears of corn this year, how many ears of corn can they expect to have 3 years from now.

$$y=140000\left(1-0.25\right)^{3}=59,062.50 ears of corn$$

7) Keri deposited $2100 in a savings account. Twenty years later the balance was $5180. What was the interest rate for the account?

$$5180=2100\left(1+r\right)^{20} \rightarrow 2.47=\left(1+r\right)^{20} \rightarrow 1.046=1+r \rightarrow 0.046 \rightarrow 4.6\%$$

8) The value of a car decreases by 12.5% each year since it was purchased. After 6 years the value is $9800. Find the original cost of the car.

$$9800=a\left(1-0.125\right)^{6} \rightarrow 9800=a\left(0.45\right) \rightarrow =\$21,777.78$$

9) Since January 1999, the population of the city of Jacksonite has grown according to the mathematical model $ y=420,500\left(1.019\right)^{t}$, where *t* is the number of years since January 1999.

a) Explain what the numbers $420,500$ and 1.019 represent in this model.

$$420,500 represents the initial population$$

$$1.019 represents the growth rate of 1.9\%$$

b) What would the population be in 2020 if the growth continues at the same rate.

$$appriximately 624,344 people$$

10) Charlie was given an inheritance of $12,500 and is trying to determine which bank has the better savings account. Bank A offers a fixed rate of 4.8% compounded monthly whereas Bank B offers a 3.1% interest rate compounded continuously.

a) Determine how much money would be in each bank in 10 years’ time.

$$Bank A: 12500\left(1+\frac{0.048}{12}\right)^{12\*10}=\$20,181.60$$

$$Bank B: 12500e^{0.031\*10}=\$17,042.81$$

b) Which is the better bank for Charlie? By how much?

Bank A is better by $\$3,138.79$