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SM3 Financial Models & Growth and Decay Models

Name Key Date ______ Period ______

10pt

Find the amount that results from each investment. Round answers to the nearest cent.

Compounded Interest: $A = P(1+\frac{r}{n})^{nt}$

1. $100 invested at 4% compounded quarterly after a period of 2 years.

$\$100 = P$
$.04 = r$
$n = 4$
$t = 2$

$A = 100(1+\frac{.04}{4})^{4\cdot 2}$

$\boxed{A \approx \$108.29}$ +1

2. $1000 invested at 11% compounded monthly after a period of 2 years.

$1000 = P$
$.11 = r$
$12 = n$
$2 = t$

$A = 1000(1+\frac{.11}{12})^{12\cdot 2}$

$\boxed{A \approx \$1244.83}$ +1

Compounded Continuously Equation: $A = Pe^{rt}$

3. If Tanisha has $100 to invest at 8% per annum compounded monthly, how long will it be before she has $150?

$P = 100$
$r = .08$
$A = 150$
$t = ?$

$\frac{150}{100} = \frac{100e^{.08t}}{100}$

$1.5 = e^{.08t}$

$\frac{\ln 1.5}{.08} = \frac{.08t}{.08}$

$\boxed{t = 5.07 \text{ months}}$ +1

decimal could vary if you round sooner but don't round until the end

Find the principal needed now to get each amount; that is, find the present value. Round answers to the nearest cent. **Compounded Interest:** $A = P(1+\frac{r}{n})^{nt}$

4. To get $100 after 2 years at 6% compounded monthly

$A = 100$
$t = 2$
$r = .06$
$n = 12$

$100 = P(1+\frac{.06}{12})^{12(2)}$

$\frac{100}{(1+\frac{.06}{12})^{24}} = P$

$\boxed{P \approx \$88.72}$ +1

5. To get $300 after 4 years at 3% compounded quarterly

$A = 300$
$t = 4$
$r = .03$

$300 = P(1+\frac{.03}{4})^{4\cdot 4}$

$\frac{300}{(1+\frac{.03}{4})^{16}} = P$

$\boxed{P \approx \$266.20}$ +1

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Growth & Decay Applications **Law of uninhibited growth or decay:** $A(t) = A_0 e^{kt}$

6. The size P of a certain insect population at time t (in days) obeys the function $P(t) = 500e^{0.02t}$.

a) Determine the number of insects a t = 0 days. 500 insects +1

b) What is the growth rate of the insect population?

2% +1

c) What is the population after 10 days?

$P(10) = 500e^{.02(10)}$

$\boxed{P(10) \approx 610 \text{ insects}}$ +1

d) When will the population reach 800?

$\frac{800}{500} = \frac{500e^{.02t}}{500}$

$\frac{8}{5} = e^{.02t}$

$\ln \frac{8}{5} = .02t$

$t = \frac{\ln \frac{8}{5}}{.02}$

$\boxed{t \approx 23.5 \text{ days}}$ +1

e) When will the insect population double?

$\frac{1000}{500} = \frac{500e^{.02t}}{500}$

$2 = e^{.02t}$

$\frac{\ln 2}{.02} = \frac{.02t}{.02}$

$\boxed{t \approx 34.7 \text{ days}}$ +1

7. The population of a colony of mosquitos obeys the law of inhibited growth.

a) If there are 1000 mosquitoes initially and there are 1800 after day 1, find the rate of decay.

$\frac{1800}{1000} = \frac{1000e^{r(1)}}{1000}$

$1.8 = e^{r}$

$\ln 1.8 = r$

$r = .58779$

$\boxed{58.78\%}$ +1

b) What is the size of the colony after 3 days?

$1000e^{.58779(3)} = \boxed{A \approx 5832 \text{ mosquitoes}}$ +1

c) How long is it until there are 10,000 mosquitoes?

$\frac{10000}{1000} = \frac{1000e^{.58779t}}{1000}$

$10 = e^{.58779t}$

$\frac{\ln 10}{.58779} = \frac{.58779t}{.58779}$

$\boxed{t \approx 3.9 \text{ days}}$ +1

d) How long is it until the population doubles?

$2000 = 1000e^{.58779t}$

$2 = e^{.58779t}$

$\frac{\ln 2}{.58779} = \frac{.58779t}{.58779}$

$\boxed{t \approx 1.2 \text{ days}}$ +1

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