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

$A=38,000(.987^{12})^t$
$A=38,000(.85468\ldots)^t$
$1-.85468=.145315\ldots(100)$
14.5% decrease

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

$A=16,000(.887^{8.4})^t$
$A=16,000(.3652\ldots)^t$
$1-.3652=.63477\ldots(100)=63.5\%$
decrease

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

$A=9200(1.985^{\frac{1}{2}})^t$
$A=9200(1.4089\ldots)^t$
$1.4089\ldots-1=.4089\ldots(100)$
40.9% increase

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

$A=9324(1.562^{\frac{1}{5}})^t$
$A=9324(1.093\ldots)^t$
$1.093-1=.093\ldots(100)$
9.3% increase

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) $P(t) = 3500(1.00206)^{12t}$ 12t monthly rate 12 times per year.
2) $P(t) = 3500(1.00206)^{\frac{t}{12}}$
3) $P(t) = 3500(1.34489)^{12t}$
4) $P(t) = 3500(1.34489)^{\frac{t}{12}}$

$1.025^{\frac{1}{12}}$
1.00206

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

$3200(1+.033)^t$
$3200(1.033)^t$
$1.033^{\frac{1}{365}}$

daily rate 1 time per day

initial$(1+r)$

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%. $1.025-1=.025(100)=2.5\%$ ✓
3) The value of the account after 5 years is \$4073.07. $3600(1.025)^5=4073.07$
4) It will take 12 years for the value of the account to double. $3600(1.025)^{12}=4841.$ ✗
it did not double

initial $(1-r)$

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. $1-.887=.113(100)=11.3\%$ ✓
3) The car is worth \$15,324.18 after 5 years. $40,000(.887)^5=21962$ ✗
4) The decreased \$3,556.20 from years 2 to 3. $40,000(.887)^2=31470.76$

$40,000(.887)^3=27914.56$

$31470.76-27914.56=3556.20$ ✓

9. Joe Manana just opened a bank account with a \$5000 initial balance. If the interest is compounded quarterly at a rate of 2.8%, how long would it take for his money to double? Round your answer to the *nearest tenth of a year*.

p $n=4$ $r=.028$

$A=2(5000)$
$P=5000$
$r=.028$
$n=4$
$t=t$

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

$2(5000)=5000(1+\frac{.028}{4})^{4t}$

$\frac{2(5000)}{5000}=\frac{5000(1.007)^{4t}}{5000}$

$\log 2=\log 1.007^{4t}$ A $2(5000)$

$\frac{\log 2}{4\log 1.007}=\frac{4t\log 1.007}{4\log 1.007}$

$24.8=t$

10. The half-life of substance X is 12.4 minutes. How much of a 300mg sample of substance X will remain after 1 hour to the *nearest milligram*?

h p 60 t

$A=A$
$p=300$
$t=60$ min
$h=12.4$min

$A=P(\frac{1}{2})^{\frac{t}{h}}$

$A=300(\frac{1}{2})^{\frac{60}{12.4}}$

$A=10$

11. 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*. No key words

t p A

$A=P(1\pm r)^t$

$A=12824$
$p=12000$
$r=r$
$t=3$

$\frac{12824}{12000}=\frac{12000(1+r)^3}{12000}$

$\sqrt[3]{1.0686}=\sqrt[3]{(1+r)^3}$

$1.0223-1=1+r-1$

$.0223=r$

$.0223(100)=2.2\%$

12. How much money is in a bank account opened 6.5 years ago with \$2155.67 that is compounded weekly with an interest rate of 5.16% rounded to the *nearest cent*?

t P r $n=52$

$A=A$
$P=2155.67$
$r=.0516$
$n=52$
$t=6.5$

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

$A=2155.67(1+\frac{.0516}{52})^{52(6.5)}$

$A=3014.20$

13. The table below shows three different investment options in which Lauren can invest $8,000.

Option	Annual Interest Rate	Frequency of Compounding
A	6.45%	Annually
B	6.43%	Continuously
C	6.44%	Weekly

Which option will allow Lauren to earn the most money over the course of a four-year period? Justify your answer.

Option C

Option A

$A = P(1+r)^t$

$A = 8000(1+.0645)^4$

$A = 10272.42$

Option B

$A = Pe^{rt}$

$A = 8000 \cdot e^{.0643(4)}$

$A = 10346.43$

Option C

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

$A = 8000(1+\frac{.0644}{52})^{52(4)}$

$A = 10348.92$

14. Jeff opened a bank account with a principal balance of $3000. Interest is compounded continuously at a rate of 1.3%. After how many years, to the *nearest tenth of a year*, will it take for Jeff's account to increase by 50%?

$A = 1.5(3000) = 4500$

$A = Pe^{rt}$

$P = 3000$

$r = .013$

$t = t$

$\frac{4500}{3000} = \frac{3000e^{.013t}}{3000}$

$\ln 1.5 = \ln e^{.013t}$

$\frac{\ln 1.5}{.013\ln e} = \frac{.013t \ln e}{.013 \ln e}$

$31.2 = t$

15. 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*?

$A = 110000$ $A = P(1-r)^t$

$P = 424100$

$r = r$

$t = 19$

$\frac{110000}{424100} = \frac{424100(1-r)^{19}}{424100}$

$\left(\frac{1100}{4241}\right)^{\frac{1}{19}} = ((1-r)^{19})^{\frac{1}{19}}$

$.9314.. = 1 - r$

$\frac{-.06856...}{-1} = \frac{-r}{-1}$

$100(.06856..) = r$

6.85620761

6.9%

16. 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. To the *nearest day*, after how many days will Jay owe $25000?

$A = 25000$ $A = P(1+r)^{\frac{t}{n}}$

$P = 15000$

$r = .025$

$t = t$

$n = 5$

$\frac{25000}{15000} = \frac{15000(1+.025)^{\frac{t}{5}}}{15000}$

$\log \frac{5}{3} = \log(1.025)^{\frac{t}{5}}$

$5\left(\log \frac{5}{3}\right) = \left(\frac{t}{5}\log 1.025\right)5$

$\frac{5\log\frac{5}{3}}{\log 1.025} = \frac{t\log 1.025}{\log 1.025}$

$103 = t$