Converting rates: raise $\frac{1}{n}$

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Algebra II

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 $A(t) = 72000(1.127)^t$.

$1.127^{\frac{1}{12}} = 1.010013$

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

$A(t) = 72000(1.010013)^{12t}$ you get the monthly rate 12 times per year

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

$A(m) = 72000(1.010013)^{m}$ you get the monthly rate 1 time per month.

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

$$\begin{array}{r} 1.010013 \\ -1 \\ \hline .010013(100) = 1.001\% \end{array}$$

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

$1.127^{\frac{1}{52}} = 1.002302$

$A(t) = 72000(1.002302)^{52t}$ you get the weekly rate 52 times per year

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

$A(w) = 72000(1.002302)^{w}$ you get the weekly rate 1 time per week.

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

$$\begin{array}{r} 1.002302 \\ -1 \\ \hline .002302(100) = .230\% \end{array}$$

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

$1.127^{\frac{1}{365}} = 1.000327$

$A(t) = 72000(1.000327)^{365t}$ you get the daily rate 365 times per year

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

$A(d) = 72000(1.000327)^{d}$ you get the daily rate 1 time per day.

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

$$\begin{array}{r} 1.000327 \\ -1 \\ \hline .000327(100) = .033\% \end{array}$$

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.

$1.116^{\frac{1}{12}} = 1.009188$

$A(t) = 452000(1.009188)^{12t}$ monthly rate 12 times per year

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

$A(m) = 452000(1.009188)^m$ monthly rate 1 time per month

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

$1.009188 - 1 = .009188(100) = .919\%$

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

$1.116^{\frac{1}{52}} = 1.002113$

$A(t) = 452000(1.002113)^{52t}$ weekly rate 52 times per year

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

$A(w) = 452000(1.002113)^w$ weekly rate 1 time per week

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

$1.002113 - 1 = .002113(100) = .211\%$

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

$1.116^{\frac{1}{365}} = 1.000301$

$A(t) = 452000(1.000301)^{365t}$ daily rate 365 times per year

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

$A(d) = 452000(1.000301)^d$ daily rate 1 time per day

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

$1.000301 - 1 = .000301(100) = .030\%$

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?

$1.08^{\frac{1}{12}} = 1.00643$

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

Monthly rate 12 times per year

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?

$1.14^{\frac{1}{52}} = 1.0025$

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

Weekly rate once per week

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?

$1.36^{\frac{1}{12}} = 1.026$

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

Monthly rate once per month

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

$1.16^{\frac{1}{12}} = 1.012$

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

Monthly rate 12 times per year

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

$1.0325^{\frac{1}{12}} = 1.0027$

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

monthly rate 12 times per year

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) $10421(1.004)^{w}$

$1.23^{\frac{1}{52}} = 1.004$

weekly rate one time per week

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) $29,400\left(1.068^{\frac{1}{365}}\right)^{365t}$

$1.068^{\frac{1}{365}}$

daily rate 365 times per year

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) $P = 714(0.9750)^y$

$.75^{\frac{1}{10}} = .9716$

yearly rate one time per year

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) $(1.0013)^w$

$1 + .0715$
1.0715

$1.0715^{\frac{1}{52}} =$
1.0013

weekly rate once per week

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) $(1.0715)^t$

$1 + .0715$
1.0715

$1.0715^{\frac{1}{52}}$
1.0013

weekly rate 52 times per year

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) $(1.00427)^{m}$ → monthly rate one time per month.
2) $(1.0525)^{\frac{12}{m}}$
4) $(1.00427)^{\frac{m}{12}}$

$1+.0525$ $\quad 1.0525^{\frac{1}{12}}$

1.0525^{t} $\quad 1.00427$

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

monthly rate 12 times per year

$65{,}000(1+.092)^{t}$ $\quad 1.092^{\frac{1}{12}}$

$65{,}000(1.092)^{t}$ $\quad 1.0074$

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) $240(1.002)^{w}$

$240(1+.124)^{t}$ $\quad 1.124^{\frac{1}{52}}$

$240(1.124)^{t}$ $\quad 1.002$

weekly rate one time per week.

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) $1200(1.03)^{7t}$

$1200(1+.23)^{t}$ $\quad 1.23^{\frac{1}{365}}$

$1200(1.23)^{t}$ $\quad 1.03$

daily rate 7 times per week

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?

yearly rate one time per year

1) $a(t) = 87.24(1.032)^{t}$ ✓
3) $a(m) = 87.24(1.0026)^{12m}$ monthly rate 12 times per month ✗
2) $a(t) = 87.24(1.0026)^{12t}$ ✓
4) $a(m) = 87.24(1.0026)^{m}$

monthly rate 12 times per year

✓ monthly rate one time per month

$87.24(1+.032)^{t}$ $\quad 1.032^{\frac{1}{12}}$

$87.24(1.032)^{t}$ $\quad 1.0026$

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

$.461^{\frac{1}{10}} = .925$

$.679^{\frac{1}{10}} = .962$

$.996^{\frac{1}{10}}$ $.999$

$.998^{\frac{1}{10}}$ $.999$

years to decades opposite direction