Algebra II

Exponential & Logarithmic Applications with Calculator A

Name_______________________

Date_______________ Period____

Evaluating Logarithms using the calculator.

Use the calculator to find the following values rounded to the nearest thousandth.

0.972 1. log 9.37 3.113 2. $\log_5 150$ 6.644 3. $\log_2 100$

13.084 4. ln 481,000 3 5. ~~ln~~ e^3 −2.497 6. ln .0823

Solve each equation using the Nspire. Evaluate. Round the solutions to the nearest thousandth.

7. $4^x = 2400$ $\log_4 2400 = x$ $5.614 = x$	8. $5^{2x} = 8$ $\log_5 8 = 2x$ $\frac{\log_5 8}{2} = x$ $0.646 = x$
9. $3^{x+2} = 47$ $\log_3 47 = x+2$ $\log_3 47 - 2 = x$ $1.504 = x$	10. $4^{2x+1} = 2.5$ $\log_4 2.5 = 2x+1$ $\log_4 2.5 - 1 = 2x$ $\frac{\log_4 2.5 - 1}{2} = x$ $-0.170 = x$
11. $e^{2x} = 5^{x-1}$ using Nspire $f_1(x) = e^{2x}$ $f_2(x) = 5^{x-1}$ $x = -4.12$	12. $2(3)^{-x+4} - 5 = \log_2(x+2)$ Using Nspire $f_1(x) = 2(3)^{-x+4} - 5$ $f_2(x) = \log_2(x+2)$ $x = 2.83$
11. $e^{2x} = 5^{x-1}$ same	12. $2(3)^{-x+4} - 5 = \log_2(x+2)$ same

Appreciation	$V_t = P(1+r)^t$	V_t is the appreciated value of the item, P is the initial value of the item, r is the fixed rate of increase, and t is the number of times the increase is applied
Depreciation	$V_t = P(1-r)^t$	V_t is the depreciated value of the item, P is the initial value of the item, r is the fixed rate of decrease, and t is the number of times the decrease is applied

Write the equation that models the situation and solve. Round answers to the nearest hundredth.

13. Imagine a video game where the player's game life starts at 100% and decreases by 5% of his current life with each hit the player takes. If V_t represents the percentage of game life after t hits, find the number of hits the player can take and still have 35% of his game life left.

P

depreciation

$r = 0.05$

V_t

Use $V_t = P(1-r)^t$

$\frac{35}{100} = \frac{100}{100}(1-0.05)^t$

$0.35 = (0.95)^t$

$\log_{0.95} 0.35 = t$

20.5 hits $= t$ or 20 hits only

$$V_t = P(1+r)^t \qquad V_t = P(1-r)^t$$

P, appreciation, $r = 0.06$

13. A \$175,000 home increases in value at a constant rate of 6% per year.
    a. In how many years will the house be worth \$250,000?

V_t

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

$$250{,}000 = \cancel{175{,}000}(1+0.06)^t$$

$$\frac{250{,}000}{175{,}000} \quad \frac{\cancel{175{,}000}}{\cancel{175{,}000}}$$

$$\frac{10}{7} = 1.06^t$$

$$\log_{1.06}\frac{10}{7} = t$$

$$6.12 \text{ yrs.} = t$$

b. What will be the value of the home in 20 years?

t

$$V_{20} = 175{,}000\,(1+0.06)^{20}$$

$$V_{20} = \$561{,}249$$

14. A car valued at \$35,000 depreciates at a constant rate of 14% per year.
    a. What will the value of the car be in two years?

P, t, r

$$V_t = P(1-r)^t$$

$$V_2 = 35{,}000\,(1-0.14)^2$$

$$= \$25{,}886$$

b. In how many years will the car be worth \$15,000?

V_t

$$\frac{15{,}000}{35{,}000} = \frac{\cancel{35{,}000}}{\cancel{35{,}000}}(1-0.14)^t$$

$$\frac{3}{7} = 0.86^t$$

$$\log_{.86}\left(\frac{3}{7}\right) = t$$

$$5.62 \text{ yrs.} = t$$

P

15. Suppose a smart phone company currently charges \$800 for the newest smart phone. The value of this latest phone will decrease 5% each month. How long will it take for the cost of the phone be \$500?

$r = 0.05$, V_t

$$V_t = P(1-r)^t$$

$$\frac{500}{800} = \frac{\cancel{800}}{\cancel{800}}(1-0.05)^t$$

$$\frac{5}{8} = 0.95^t$$

$$\log_{0.95}\left(\frac{5}{8}\right) = t$$

$$9.16 \text{ mos.} = t$$

t, P, V_8

16. Dave bought a new car 8 years ago for \$8400. To buy a new car comparably equipped now would cost \$12,500. Assuming a steady rate of increase, what was the yearly rate of inflation in car prices over the 8 year period?

Inflation is when prices go up

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

$r = ?$

$$\frac{12{,}500}{8{,}400} = \frac{\cancel{8400}}{\cancel{8400}}(1+r)^8$$

$$\frac{125}{84} = (1+r)^8$$

$$\sqrt[8]{\frac{125}{84}} = \sqrt[8]{(1+r)^8}$$

$$1.05 = 1+r$$

$$-1 \qquad -1$$

$r = 0.05$ or 5% p.a.

17. A baseball card bought for \$50 increases 3% in value each year. What will it be worth in 25 years?

P, $r = 0.03$, t

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

$$= 50\,(1+0.03)^{25}$$

$$V_{25} = \$104.69$$

P, $r = 0.12$

18. A piece of machinery valued at \$250,000 depreciates at 12% per year by the fixed rate method. After how many years will the value have depreciated to \$100,000?

V_t

$$V_t = P(1-r)^t$$

$$\frac{100{,}000}{250{,}000} = \frac{\cancel{250{,}000}}{\cancel{250{,}000}}(1-0.12)^t$$

$$\frac{2}{5} = 0.88^t$$

$$\log_{0.88}\left(\frac{2}{5}\right) = t$$

$$7.17 \text{ yrs.} = t$$

P $r = 0.10$ a)

19. A new snowmobile costs $4200. The value of the snowmobile decreases by 10% each year. Estimate the value after 3 years. b) How long will it take the snowmobile to be valued at $2500?

t

$V_t = P(1-r)^t$

a) $V_3 = 4{,}200(1-0.10)^3$

$V_3 = \$3{,}061.80$

b) $\frac{2{,}500}{4{,}200} = \frac{4200(1-0.10)^t}{4200}$

$\frac{25}{42} = 0.90^t$

$\log_{0.90}\left(\frac{25}{42}\right) = t$

$4.92 \text{ yrs.} = t$

$r = 0.02$ P

20. The deer population increases at a constant rate of 2% per year. There are 1573 deer on the King Ranch this year. How many deer will be on the ranch in 10 years?

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

$V_{10} = 1573(1+0.02)^{10}$

$V_{10} = 1{,}917$ deers in 10 years.