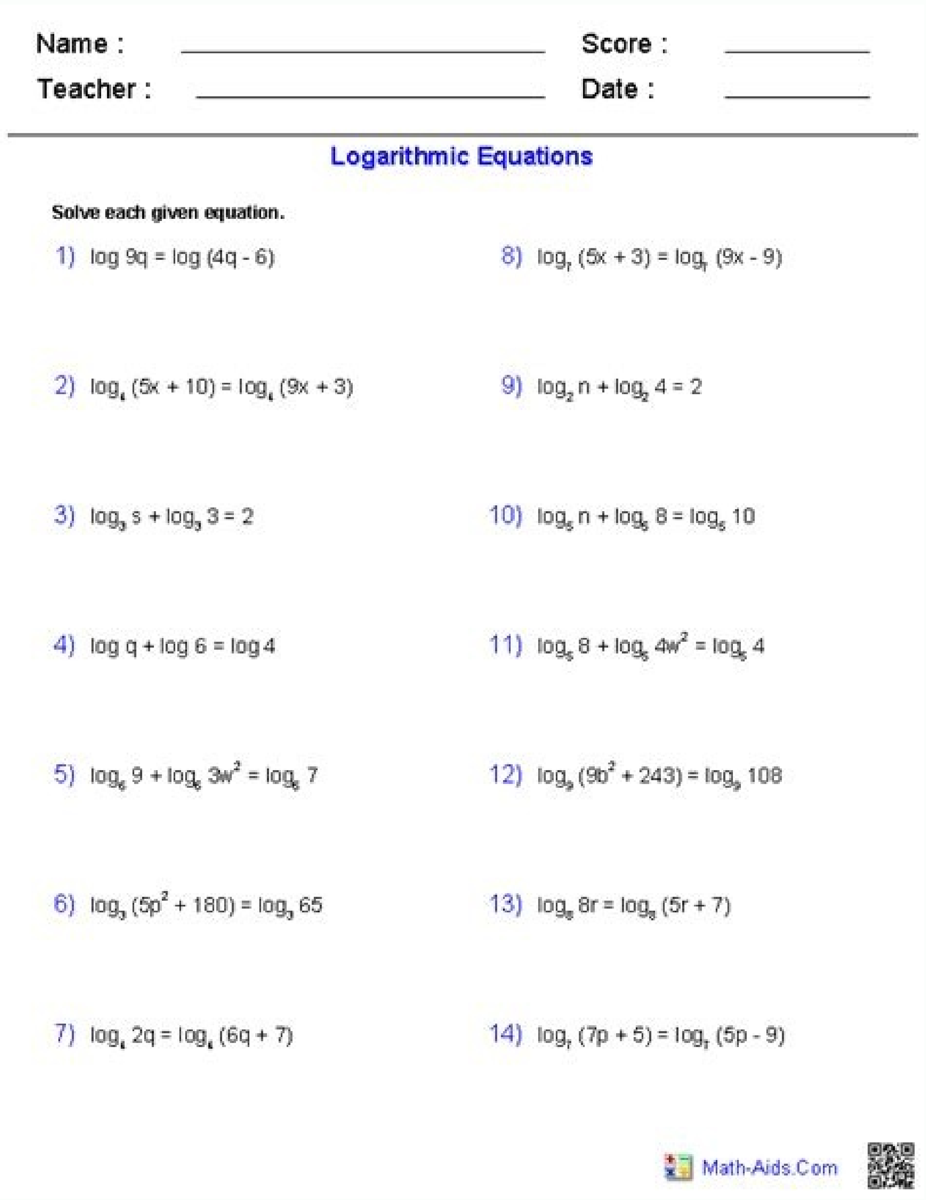
163722622.125 1540304877 603569484 183631029315 84076436882 77089407.210526 19859185.351064 19925085448 33989728290 60373790370 54819594.555556 303725062.83333 1862884.5 10764184040 16805262.148649 25827205.272727 1420401802 24243704 35755748.814815 26063814498 58210431340 19747157.134831 153634006384 13699203.75 37225890.428571 20776346630 98613758400 42869302.636364

Solving logarithmic equations worksheets pdf using word problems



Name : ______ Score : ______

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Logarithmic Equations

Solve each given equation.

1) $\log 9q = \log (4q - 6)$
2) $\log_4 (5x + 10) = \log_4 (9x + 3)$
3) $\log_3 s + \log_3 3 = 2$
4) $\log q + \log 6 = \log 4$
5) $\log_6 9 + \log_6 3w^2 = \log_6 7$
6) $\log_3 (5p^2 + 180) = \log_3 65$
7) $\log_4 2q = \log_4 (6q + 7)$
8) $\log_7 (5x + 3) = \log_7 (9x - 9)$
9) $\log_2 n + \log_2 4 = 2$
10) $\log_5 n + \log_5 8 = \log_5 10$
11) $\log_5 8 + \log_5 4w^2 = \log_5 4$
12) $\log_9 (9b^2 + 243) = \log_9 108$
13) $\log_8 8r = \log_8 (5r + 7)$
14) $\log_7 (7p + 5) = \log_7 (5p - 9)$

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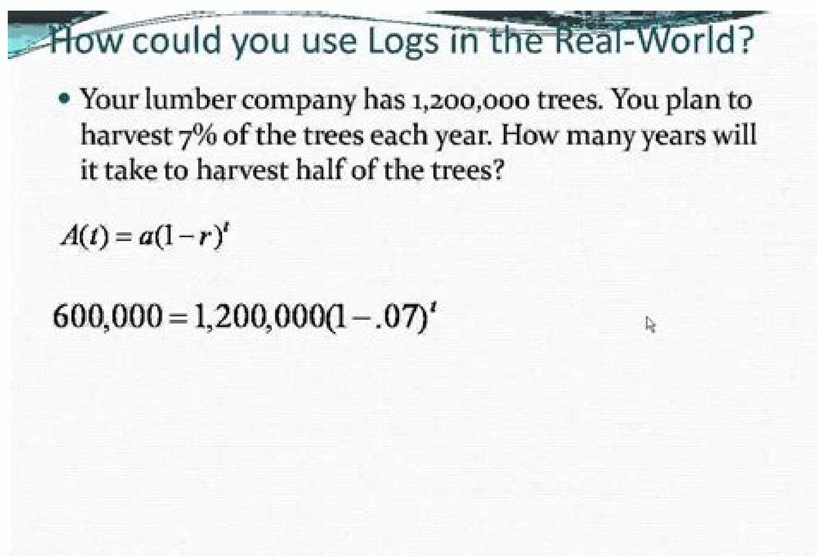

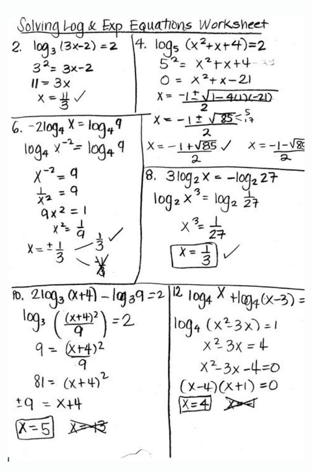

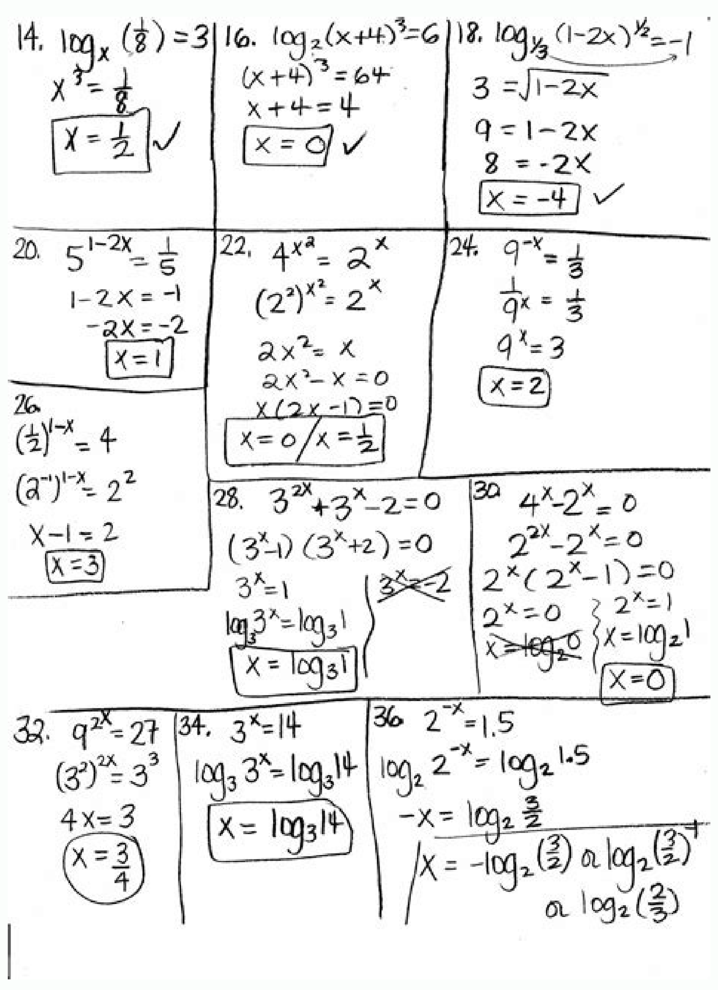

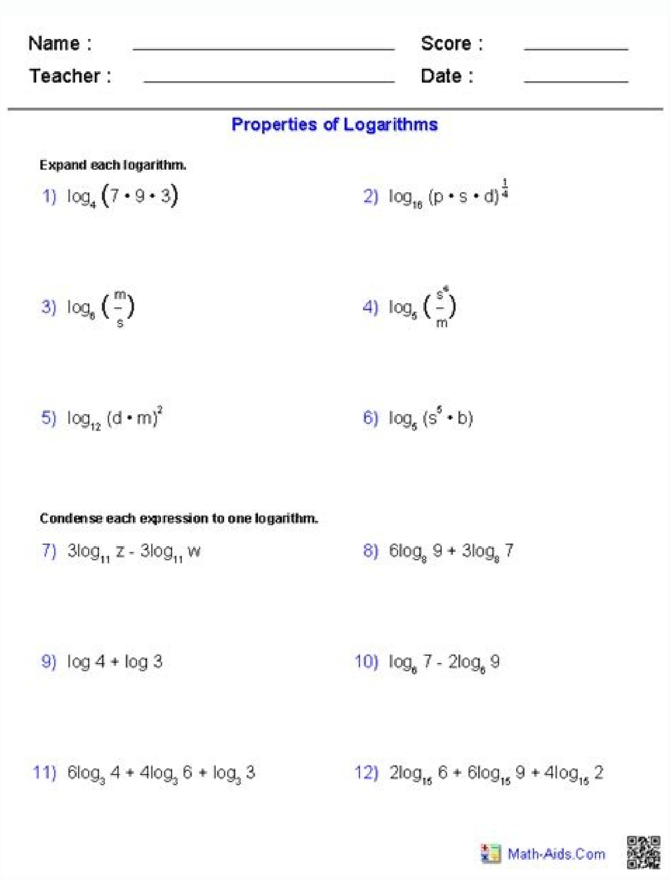

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Properties of Logarithms

Expand each logarithm.

1) $\log_4 (7 \cdot 9 \cdot 3)$
2) $\log_{16} (p \cdot s \cdot d)^{\frac{1}{4}}$
3) $\log_6 \left(\frac{m}{s}\right)$
4) $\log_5 \left(\frac{s^4}{m}\right)$
5) $\log_{12} (d \cdot m)^2$
6) $\log_5 (s^5 \cdot b)$

Condense each expression to one logarithm.

7) $3\log_{11} z - 3\log_{11} w$
8) $6\log_8 9 + 3\log_8 7$
9) $\log 4 + \log 3$
10) $\log_6 7 - 2\log_6 9$
11) $6\log_3 4 + 4\log_3 6 + \log_3 3$
12) $2\log_{15} 6 + 6\log_{15} 9 + 4\log_{15} 2$

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Solving logarithmic word problems.

3x = log9(1/3)3x = log91 - log933x = 0 - log933x = - log933x = - 1 / log393x = - 1 / log3323x = - 1 / 2log333x = - 1 / 2(1)3x = -1/2x = -1/6Answer (9) :log5 √(7x - 4) - 1/2 = log5 √(x + 2)Subtract log5 √(x + 2) from each side. log5 √(7x - 4) - log5 √(x + 2) - 1/2 = 0Add 1/2 to each side. log5 √(7x - 4) - log5 √(x + 2) = 1/2Use quotient rule.log5[√(7x - 4) / √(x + 2)] = 1/2Convert to exponential form.[√(7x - 4) / √(x + 2)] = 51/2 (7x - 4) / (x + 2) = √5 Square each side. (7x - 4) / (x + 2) = 5 Multiply each side by (x + 2). 7x - 4 = 5 (x + 2)7x - 4 = 5x + 10Subtract 5x from each side.2x - 4 = 10Add 4 to each side.2x = 14Divide each side by 2.x = 7Answer (10) :log3x + log9x + log81x = 7/4(1 / logx3) + (1 / logx9) + (1 / logx81) = 7/4(1 / logx3) + (1 / logx9) + (1 / logx81) = 7/4(1 / logx3) + (1 / logx32) + (1 / logx34) = 7/4(1 / logx3) + (1 / 2logx3) + (1 / 4logx3) = 7/4(4 / 4logx3) + (2 / 4logx3) + (1 / 4logx3) = 7/4(4 + 2 + 1) / 4logx3 = 7/47 / 4logx3 = 7/4Multiply each side by 4/7.1 / logx3 = 1log3x = 1Convert to exponential form. x = 31x = 3 Apart from the stuff given above, if you need any other stuff in math, please use our google custom search here. Use roots to solve for \(b\): \[\begin{array}{l} \sqrt[5]{0.5}=\mathrm{b} \\ 0.5^{1 / 5}=\mathrm{b} \\ 0.87=\mathrm{b} \end{array} onumber\] We can now write the decay function for the amount of caffeine (in mg.) remaining in the body \(t\) hours after drinking a cup of coffee with 120 mg of caffeine \[y=f(t)=120(0.87)^{t} onumber \] b. Express \(y =150 (0.73)^t\) in the form \(y = ae^{kt}\) \[\begin{array}{l} y=a e^{k t}=a b^{t} \\ a\left(e^{k}\right)^{t}=a b^{t} \\ e^{k}=b \\ e^{k}=0.73 \end{array} onumber\] Therefore \(\mathrm{k}=\ln 0.73 \approx-0.3147\) We rewrite the growth function as \(y = 150e^{-0.3147t}\) Suppose we invest $10,000 today and want to know how long it will take to accumulate to a specified amount, such as $15,000. We do know that when \(t\) = 24 months, then \(y\) = 50000. Find the hourly rate at which caffeine leaves the body. At the end of 3 years, the value of this one share of this stock will be \[y=43(1.07)^{3}=\$ 52.68 onumber\] STRATEGY B: If the variable is the coefficient, evaluate the expression for (base) exponent. \[t=\log _{0.93}(0.6) onumber\] \(t = \frac{\ln(0.6)}{\ln(0.93)}=7.039\) years; After 7.039 years, there are 3000 deer. If the value of one share of this stock is $43 now, find the value of one share of this stock three years from now. Kindly mail your feedback to v4formath@gmail.comWe always appreciate your feedback. He wants to know how long it would take his investment to accumulate to $12000, and how long it would take to accumulate to $15000. \[2500 = 80e^{0.12t} onumber\] Divide both sides by the coefficient, 80, to isolate the exponential expression. We don't know \(b\) or \(r\), but we know that the half- life of caffeine in the body is 5 hours. Substitute the values of \(y\) and \(t\); then we need to solve for \(r\). He hopes that if he achieves this goal his site will be purchased by a sports news outlet. Below we examine each strategy with one or two examples of its use. Suppose that the value of the car is $12000 at the end of 5 years and that its value has been decreasing at the rate of 9% per year. His business plan states that his goal is to accumulate 50,000 followers by the end of 2 years (24 months from now). Negative values for time do not make sense. Write the decay function. If the population continues to decrease at this rate, how long will it take until the population is only 3000 deer? Exponential decay function \(y = ab^t\) models this situation. \[\frac{y}{10000}=1.05^{t} onumber\] Next we rewrite this in logarithmic form to express time as a function of the accumulated future value. A fact sheet on caffeine dependence from Johns Hopkins Medical Center states that the half life of caffeine in the body is between 4 and 6 hours. \[\begin{array}{c} \frac{2500}{80}=\frac{80}{80} e^{0.12 t} \\ 31.25=e^{0.12 t} \end{array} onumber\] Rewrite the equation in logarithmic form \[0.12t = \ln(31.25) onumber \] Divide both sides by 0.04 to isolate \(t\); then use your calculator and its natural log function to evaluate the expression and solve for \(t\). STRATEGY B: If the variable is the coefficient, evaluate the expression for (base) exponent. onlinemath4all.com In this section, you will: review strategies for solving equations arising from exponential formulas solve application problems involving exponential functions and logarithmic functions When solving application problems that involve exponential and logarithmic functions, we need to pay close attention to the position of the variable in the equation to determine the proper way solve the equation we investigate solving equations that contain exponents. \[5000 = 400(1+r)^{24} onumber\] Divide both sides by 400 to isolate (1+r)24 on one side of the equation \[\begin{array}{l} \frac{50000}{400}=\frac{400}{400}(1+r)^{24} \\ 125=(1+r)^{24} \end{array} onumber\] Because the variable in this equation is in the base, we use roots: \[\begin{array}{l} \sqrt[24]{125}=1+r \\ 125^{1 / 24}=1+r \\ 1.2228 \approx 1+r \\ 0.2228 \approx r \end{array} onumber\] The website's user base needs to increase at the rate of 22.28% per month in order to accumulate 50,000 users by the end of 24 months. We are given that the exponential growth function is \(y = 80e^{0.2t}\) and we want to find the value of \(t\) for which \(y\) = 2500. Note: In Example \(\PageIndex{3}\), we needed to state the answer to several decimal places of precision to remain accurate. The growth function for this site is \(y = 400(1+r)^t\); We don't know the growth rate \(r\). To find the number of years until the value of this investment is $12,000, we substitute \(y\) = $12,000 into function \(g\) and evaluate \(t\): \[\mathrm{t}=\mathrm{g}(12000)=\frac{\ln \left(\frac{12000}{10000}\right)}{\ln (1.05)}=\frac{\ln (1.2)}{\ln (1.05)}=3.74 \text { years } onumber\] To find the number of years until the value of this investment is $15,000, we substitute \(y\) = $15,000 into function \(g\) and evaluate \(t\): \[\mathrm{t}=\mathrm{g}(15000)=\frac{\ln \left(\frac{15000}{10000}\right)}{\ln (1.05)}=\frac{\ln (1.5)}{\ln (1.05)}=8.31 \text { years } onumber\] Before ending this section, we investigate the graph of the function \(\mathrm{t}=\mathrm{g}(\mathrm{y})=\frac{\ln \left(\frac{\mathrm{y}}{10000}\right)}{\ln (1.05)}\). For the following examples, assume \(t\) is measured in years. Solution a. Evaluating the original function using a rounded value of \(t\) = 7 years gives a value that is close to 3000, but not exactly 3000. Solution Let \(y\) be the value of the car after \(t\) years: \(y = ab^t\), \(r\) = -0.09 and \(b = 1+r = 1+(-0.09) = 0.91\) The function is \(y = a(0.91)^t\) In this case we know that when \(t\) = 5, then \(y\) = 12000; substituting these values gives \[12000 = a(0.91)^5 onumber\] We need to solve for the initial value a, the purchase price of the car when new. STRATEGY D: If the variable is not in the exponent, but is in the base, we use roots to solve the equation. Express \(y = 28000e^{-0.32t}\) in form \(y = ab^t\) and find the annual percentage decay rate. b. How many days does it take until 2500 people have viewed this video? Values of the investment that are lower than the initial amount of $10,000 also do not make sense for an investment that is increasing in value. Conservationists are concerned because the deer population is decreasing at the rate of 7% per year. \[\begin{array}{l} \frac{20}{120}=\frac{120}{120}\left(0.87^{t}\right) \\ 0.1667=0.87^{t} \end{array} onumber\] Rewrite the expression in logarithmic form and use the change of base formula \[\begin{array}{l} t=\log _{0.87}(0.1667) \\ t=\frac{\ln (0.1667)}{\ln (0.87)} \approx 12.9 \text { hours } \end{array} onumber\] After 12.9 hours, 20 mg of caffeine remains in the body. Therefore the function and graph as it pertains to this problem concerning investments has domain \(y ≥ 10,000\) and range \(t ≥ 0\). The initial user base of people signed up as a result of pre-launch advertising is 400 people. Suppose that the value of the car depreciates according to an exponential decay model. Then it becomes a linear equation which we solve by dividing to isolate the variable. \[\mathrm{t}=\mathrm{g}(\mathrm{y})=\log _{1.05}\left(\frac{\mathrm{y}}{10000}\right) onumber \] Use the change of base formula to express \(t\) as a function of \(y\) using natural logarithm: \[\mathrm{t}=\mathrm{g}(\mathrm{y})=\frac{\ln \left(\frac{\mathrm{y}}{10000}\right)}{\ln (1.05)} onumber\] We can now use this function to answer Vinh's questions. WORD PROBLEMSHCF and LCM word problemsWord problems on simple equations Word problems on linear equations Word problems on quadratic equationsAlgebra word problemsWord problems on trainsArea and perimeter word problemsWord problems on direct variation and inverse variation Word problems on unit priceWord problems on unit rate Word problems on comparing ratesConverting customary units word problems Converting metric units word problemsWord problems on simple interestWord problems on compound interestWord problems on types of angles Complementary and supplementary angles word problemsDouble facts word problemsTrigonometry word problemsPercentage word problems Profit and loss word problems Markup and markdown word problems Decimal word problemsWord problems on fractionsWord problems on mixed fractionsOne step equation word problemsLinear inequalities word problemsRatio and proportion word problemsTime and work word problemsWord problems on sets and Venn diagramsWord problems on agesPythagorean theorem word problemsPercent of a number word problemsWord problems on constant speedWord problems on average speed Word problems on sum of the angles of a triangle is 180 degreeOTHER TOPICS Profit and loss shortcutsPercentage shortcutsTimes table shortcutsTime, speed and distance shortcutsRatio and proportion shortcutsDomain and range of rational functionsDomain and range of rational functions with holesGraphing rational functionsGraphing rational functions with holesConverting repeating decimals in to fractionsDecimal representation of rational numbersFinding square root using long divisionL.C.M method to solve time and work problemsTranslating the word problems in to algebraic expressionsRemainder when 2 power 256 is divided by 17Remainder when 17 power 23 is divided by 16Sum of all three digit numbers divisible by 6Sum of all three digit numbers divisible by 7Sum of all three digit numbers divisible by 8Sum of all three digit numbers formed using 1, 3, 4Sum of all three four digit numbers formed with non zero digitsSum of all three four digit numbers formed using 0, 1, 2, 3Sum of all three four digit numbers formed using 1, 2, 5, 6 Assuming that the typical half life of caffeine in the body is 5 hours for the average person and that a typical cup of coffee has 120 mg of caffeine. STRATEGY C: If the variable is in the exponent, use logarithms to solve the equation. A national park has a population of 5000 deer in the year 2016. \[y=5000(0.93)^{7}=3008.5 \text { deer } onumber \] However using \(t\) = 7.039 years produces a value of 3000 for the population of deer \[y=5000(0.93)^{7.039}=3000.0016 \approx 3000 \text { deer } onumber\] A video posted on YouTube initially had 80 views as soon as it was posted. \[\begin{array}{l} \mathrm{t}=\frac{\ln (31.25)}{0.12} \\ \mathrm{t}=\frac{3.442}{0.12} \\ \mathrm{t} \approx 28.7 \text { days } \end{array} onumber\] This video will have 2500 total views approximately 28.7 days after it was posted. In this case we know that \(t\) = 3 years, and we need to evaluate \(y\) when \(t\) = 3. \[\begin{array}{l} y=120 b^{t} \\ \frac{1}{2}(120)=120 b^{5} \\ 60=120 b^{5} \end{array} onumber\] Divide both sides by 120 to isolate the expression \(b^5\) that contains the variable. If we consider just the function \(\mathrm{t}=\mathrm{g}(\mathrm{y})=\frac{\ln \left(\frac{\mathrm{y}}{10000}\right)}{\ln (1.05)}\), then the domain of function would be \(y > 0\), all positive real numbers, and the range for \(t\) would be all real numbers. Express \(y = 28000e^{-0.32t}\) in the form \(y = ab^t\) \[\begin{array}{l} y=a e^{k t}=a b^{t} \\ a\left(e^{k}\right)^{t}=a b^{t} \end{array} onumber\] Thus \(e^k=b\)

In this example \(\mathrm{b}=e^{-0.32} \approx 0.7261\) We rewrite the growth function as y = 28000(0.7261t) To find \(r\), recall that \(b = 1+r\) \[\begin{array}{l} 0.7261=1+r \\ 0.2739=r \end{array} onumber\] The continuous decay rate is \(k\) = -0.32 and the annual percentage decay rate is 27.39% per year. Suppose we have an equation in the form : value = coefficient(base) exponent We consider four strategies for solving the equation: STRATEGY A: If the coefficient, base, and exponent are all known, we only need to evaluate the expression for coefficient(base) exponent to evaluate its value. In the sentence, we omit the negative sign when stating the annual percentage decay rate because we have used the word “decay” to indicate that r is negative. Find the value of the car when it was new. Substitute \(y\) = 2500 into the equation and use natural log to solve for \(t\). \[\begin{array}{l} 0.87=1+r \\ r=-0.13 \end{array} onumber\] The decay rate is 13%; the amount of caffeine in the body decreases by 13% per hour. STRATEGY D: If the variable is not in the exponent, but is in the base, use roots to solve the equation. STRATEGY C: If the variable is in the exponent, use logarithms to solve the equation. Express \(y = 4200 (1.078)^t\) in the form \(y =ae^{kt}\) Express \(y = 150 (0.73)^t\) in the form \(y =ae^{kt}\) Solution a. Solve for x :1) log2x = 1/22) log1/5x = 33) logx125√5 = 74) logx0.001 = -35) log5(5log3x) = 26) x + 2log279 = 07) If 2logx = 4log3, then find the value of x. 8) If 3x is equal to log(0.3) to the base 9, then find the value of x. Solve for x :9) log5 √(7x - 4) - 1/2 = log5 √(x + 2)Solve for x :10) log3x + log9x + log81x = 7/4 Detailed Answer Key Answer (1) : log2x = 1/2Convert to exponential form. x = 21/2x = √2Answer (2) :log1/5x = 3Convert to exponential form. x = (1/5)3x = 13/53x = 1/125Answer (3) :logx125√5 = 7Convert to exponential form. 125√5 = x7 5 · 5 · 5 · √5 = x7Each 5 can be expressed as (√5 · √5).Then,√5 · √5 · √5 · √5 · √5 · √5 · √5 = x7√57 = x7Because the exponents are equal, bases can be equated. x = √5Answer (4) :logx0.001 = -3Convert to exponential form. 0.001 = x-31/1000 = 1/x3Take reciprocal on both sides. 1000 = x3103 = x3Because the exponents are equal, bases can be equated. 10 = xAnswer (5) :log5(5log3x) = 2Convert to exponential form. 5log3x = 525log3x = 25Divide each side by 5.log3x = 5Convert to exponential form. x = 35x = 243Answer (6) :x + 2log279 = 0x = -2log279x = log279-2Convert to exponential form. 27x = 9-2(33)x = (32)-233x = 3-4Because the bases are equal, exponents can be equated. 3x = -4x = -4/3Answer (7) : 2logx = 4log3Divide each side by 2.logx = (4log3) / 2logx = 2log3logx = log32logx = log9x = 9Answer (8) : From the information given, we have3x = log9(0.3)Solve for x. Express \(y = 3500e^{0.25t}\) in the form \(y = ab^t\) \[\begin{array}{l} y=a e^{k t}=a b^{t} \\ a\left(e^{k}\right)^{t}=a b^{t} \end{array} onumber\] Thus \(e^k=b\) In this example \(b=e^{0.25} \approx 1.284\) We rewrite the growth function as y = 3500(1.284t) To find \(r\), recall that \(b = 1+r\) \[\begin{aligned} &1.284=1+r\\ &0.284=\mathrm{r} \end{aligned} onumber\] The continuous growth rate is \(k\) = 0.25 and the annual percentage growth rate is 28.4% per year. In the context of this investment problem, the initial investment at time \(t\) = 0 is \(y\) =$10,000. \[\begin{array}{l} \frac{60}{120}=\frac{120}{120} \mathrm{b}^{5} \\ 0.5=\mathrm{b}^{5} \end{array} onumber\] The variable is in the base and the exponent is a number. Solution Let \(y\) be the total number of views \(t\) days after the video is initially posted. Suppose that a stock’s price is rising at the rate of 7% per year, and that it continues to increase at this rate. Solution We start by writing the exponential growth function that models the value of this investment as a function of the time since the $10000 is initially invested \[y=10000(1.05)^{t} onumber\] We divide both sides by 10000 to isolate the exponential expression on one side. This tells us that when \(t\) = 5, then there is half the initial amount of caffeine remaining in the body. Solution Let \(y\) be the number of deer in the national park \(t\) years after the year 2016: \(y = ab^t\) \(r\) = -0.07 and \(b = 1+r = 1+(-0.07) = 0.93\) and the initial population is \(a\) = 5000 The exponential decay function is \(y = 5000(0.93)^t\) To find when the population will be 3000, substitute \(y\) = 3000 \[3000 = 5000(0.93)^t onumber\] Next, divide both sides by 5000 to isolate the exponential expression \[\begin{array}{l} \frac{3000}{5000}=\frac{5000}{5000}(0.93)^{2} \\ 0.6=0.93^{t} \end{array} onumber\] Rewrite the equation in logarithmic form; then use the change of base formula to evaluate. We see that the function has the general shape of logarithmic functions that we examined in section 5.5. From the points plotted on the graph, we see that function \(g\) is an increasing function but it increases very slowly. Use \(b = 1 + r\) to find the decay rate \(r\). The time \(t\) needed to reach a future value \(y\) is a logarithmic function of the future value: \(t = g(y)\) Suppose that Vinh invests $10000 in an investment earning 5% per year. Express \(y = 4200 (1.078)^t\) in the form \(y =ae^{kt}\) \[\begin{array}{l} \mathrm{y}=\mathrm{a} e^{\mathrm{k} t}=\mathrm{ab}^{\mathrm{t}} \\ \mathrm{a}\left(e^{\mathrm{k}}\right)^{\mathrm{t}}=\mathrm{ab}^{\mathrm{t}} \\ e^{\mathrm{k}}=\mathrm{b} \\ e^{k}=1.078 \end{array} onumber\] Therefore \(\mathrm{k}=\ln 1.078 \approx 0.0751\) We rewrite the growth function as \(y = 3500e^{0.0751t}\) b. The total number of views to date has been increasing exponentially according to the exponential growth function \(y = 80e^{0.2t}\), where \(t\) represents time measured in days since the video was posted. Find the monthly growth rate needed if the user base is to accumulate to 50,000 users at the end of 24 months. Solution Let \(y\) = the value of the stock after \(t\) years: \(y = ab^t\) The problem tells us that \(a\) = 43 and \(r\) = 0.07, so \(b = 1+ r = 1+ 0.07 = 1.07\) Therefore, function is \(y = 43(1.07)^t\). Now that we’ve developed our equation solving skills, we revisit the question of expressing exponential functions equivalently in the forms \(y = ab^t\) and \(y = ae^{kt}\) We’ve already determined that if given the form \(y = ae^{kt}\), it is straightforward to find \(b\). Let \(y\) be the total amount of caffeine in the body \(t\) hours after drinking the coffee. We’ll use function notation and call this function \(g(y)\). Because \(b = 0.87 < 1\) and the amount of caffeine in the body is decreasing over time, the value of \(r\) will be negative. Express \(y = 3500e^{0.25t}\) in form \(y = ab^t\) and find the annual percentage growth rate. www.hopkinsmedicine.org/psyc...fact_sheet.pdf Solution a. The value of a new car depreciates (decreases) after it is purchased. It is important to remember that we only use logarithms when the variable is in the exponent. Solution Let \(y\) be the total user base \(t\) months after the site is launched. A statistician creates a website to analyze sports statistics. How long does it take until only 20 mg of caffiene is still in the body? The graph below is restricted to the domain and range that make practical sense for the investment in this problem. To find the time at which only 20 mg of caffeine remains in the body, substitute \(y\) = 20 and solve for the corresponding value of \(t\). The initial amount of caffeine is \(a\) = 120. c. First evaluate (0.91)5 ; then solve the resulting linear equation to find \(a\). STRATEGY A: If the coefficient, base, and exponent are all known, we only need to evaluate the expression for coefficient(base)exponent to evaluate its value. \[1200 = a(0.624) onumber \] \(a=\frac{12000}{0.624} = \$ 19,230.77\); The car's value was $19,230.77 when it was new. \[\begin{array}{l} y=120(.87)^{t} \\ 20=120(.87)^{t} \end{array} onumber\] Divide both sides by 120 to isolate the exponential expression.

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