#### WARM UP WITH CALCULATOR

Solve for x:

4) You purchased a new car for \$24,900. It is depreciating at a rate of 10.3% per year. What will be the estimated value of the car in 4 year?

$$y = ab^{x}$$
  $r = .103$   
 $a = 24,900$   $24,900(1-.103)^{4}$   
 $b = | tr = |b,120.15 dollars$ 

5) Condense:  $5 \log_4 x + 3 \log_4 y - \log_4 z$ 

$$1094X^{5}+1094Y^{3}-1094Z$$
  
 $1094X^{5}Y^{3}-1094Z$   
 $1094\frac{X^{5}Y^{3}}{Z}$ 

#### HW 8.5 p. 465 Part II - ANSWERS

**55.** 
$$\frac{1}{2}$$

**57.** 
$$\frac{1}{3}$$

**60.** 
$$-\frac{1}{2}$$

**96.** 3.0417

**94.** 
$$114.\overline{3}$$

4. 
$$2 \log_6 3 + 2 \log_6 x + 2 \log_6 y$$

5. 
$$\log_6 4 + 1/2 \log_6 x$$

# 8.6 Natural Logarithms

For the equation  $\log 100 = x$ , what is the implied base?

If the base of a log is e, we use the ln button on the calculator so,  $log_e$  is written ln

In is said to be "the natural log"

All properties of logs apply to the natural log.

# Write as a single In.

2 ln 12-ln 9 
$$\frac{1}{4}$$
 ln  $\frac{1}{2}$  ln  $\frac{1}{4}$  ln  $\frac{1$ 

# Solve for x.



Solve for x.

Get e<sup>x</sup> alone, then take *ln* of each side.

$$\frac{e^{2x} - 8 = 7}{+8 + 8}$$

$$\frac{+8 + 8}{e^{2x}} = |5|$$

$$\frac{-15}{2} = |15|$$

$$\frac{-15}{2} = |35|$$

$$\frac{-135}{4}$$

$$\frac{-13}{4} = |3.2|$$

$$\frac{-13}{3} = |3.2|$$

### HOMEWORK 8.6 - Part I

p. 472 #1-9 odd, 15-37 odd, omit #29

# Warm Up - Solve for x in each equation (#1-3).

1) 
$$\ln (2x-3) = 9$$

2) 
$$2 + \ln (x-1)^2 = 7$$

3) 
$$e^{2x} - 8 = 7$$

4) Evaluate:

$$\log_9 \frac{1}{3} + 3\log_9 3 - \log_9 9$$

#### CHECK HW 8.6 Part 1 p. 472

**5.** 
$$\ln \frac{1}{81}$$

7. 
$$\ln \frac{m^5}{n^3}$$

**8.** 
$$\ln \frac{\sqrt[3]{xy}}{z^4}$$

9. 
$$\ln \frac{a\sqrt{c}}{b^2}$$

**36.** 
$$\frac{1}{4}$$

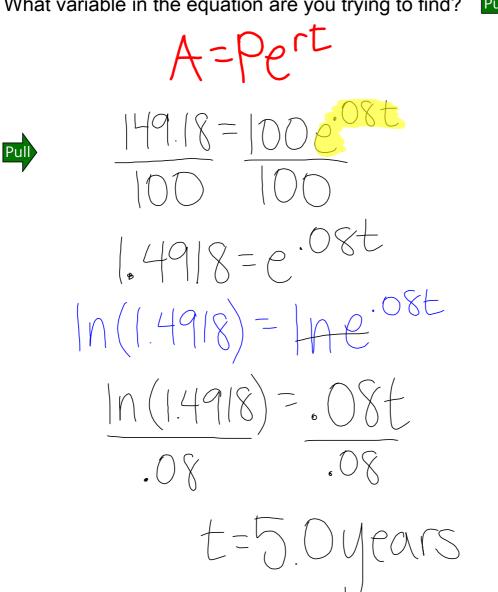
# Word Problems involving the Natural Log

What equation about growth do you know which involves e?

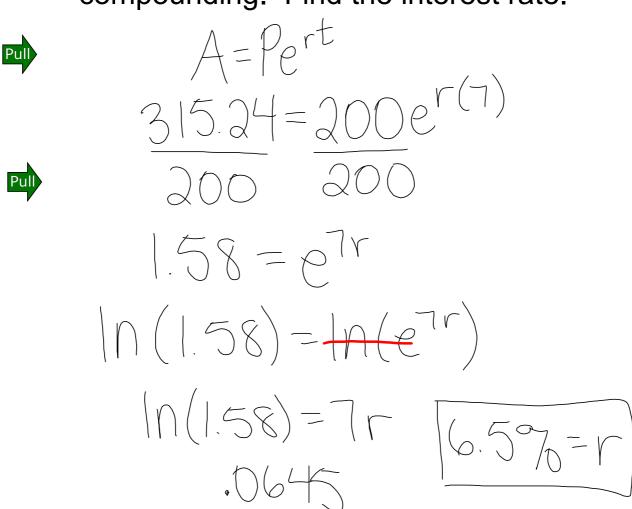
## Solve the following problem. Remember to use A = Pet

An investment of \$100 is now valued at \$149.18. The interest rate is 8% compounded continuously. About how long has the money been invested? Use  $A=Pe^{rt}$ 

What variable in the equation are you trying to find? Pull



An initial investment of \$200 is worth \$315.24 after 7 years of continuous compounding. Find the interest rate.



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The population of Boringville is 800 dull folks. The number of residents is decreasing at a rate of 32% per year. How many years will it take before the number of inhabitants is 250 people?

#### HOMEWORK 8.6 - Part2

P. 472 #2-8 even, 14-38 even, 29, 47-53 odd, 56-59 all

1. 
$$ab^{x}$$
 $b=1+r$ 
 $1-.023$ 
 $3500(1-.023)^{7}$ 

1.05 5%

.65 .65=1+r

-.35=r

$$109_{10} = 10$$
 $10^{x} = 10$ 
 $10$ 

# **EXTRA PROBLEMS**

- 1) You have inherited land that was purchased for \$20,000 in 1970. The value of the land increased by approximately 8% per year. What was the value of the land last year?
- 2) You purchased a new car for \$24,900. It is depreciating at a rate of 10.3% per year. What will be the estimated value of the car in 4 year?
- 3) Solve for x:

4) Expand: 
$$\log \frac{x^5 y^{-2}}{2z}$$

5) Condense: 
$$5 \log_4 x + 3 \log_4 y - \log_4 z$$

6) Evaluate: 
$$\log_9 \frac{1}{3} + 3\log_9 3 - \log_9 9$$

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#### Solve each equation. If necessary, round to the nearest ten-thousandth. **80.** $14^{9x} = 146$ **0.2098 79.** $8^x = 444$ **2.9315 82.** $\frac{1}{2} \log x + \log 4 = 2$ **625 81.** $3^{7x} = 120$ **0.6225 84.** $\log x^2 = 2$ **10 83.** $4 \log_3 2 - 2 \log_3 x = 1$ **2.3094 86.** $\log_8 (2x - 1) = \frac{1}{3}$ **1.5 85.** $9^{2x} = 42$ **0.8505** 87. $1.3^x = 7$ 7.4168 **88.** $\log (5x - 4) = 3$ **200.8 90.** $12^{4-x} = 20$ **2.7944 89.** $2.1^x = 9$ **2.9615 91.** $5^{3x} = 125$ **1** 92. $\log 4 + 2 \log x = 6$ 500 **93.** $4^{3x} = 77.2$ **1.0451 94.** $\log_7 3x = 3$ **114.**3**95.** $3^x + 0.7 = 4.9$ **1.3063 96.** $7^x - 1 = 371$ **3.0417** itial and Logarithmic Functions

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