Algebra 2 Name_____

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8.7 Solving Natural Log Equations

Expand each logarithm.

1) $\ln\left(\frac{8^5}{7}\right)^4$

$20\ln 8 - 4\ln 7$

2) $\ln\left(c\sqrt{a \cdot b}\right)$

$\ln c + \frac{\ln a}{2} + \frac{\ln b}{2}$

3) $\ln\left(uv^6\right)^5$

$5\ln u + 30\ln v$

4) $\ln\left(x \cdot y \cdot z^6\right)$

$\ln x + \ln y + 6\ln z$

Condense each expression to a single logarithm.

5) $25\ln 5 - 5\ln 11$

$\ln \frac{5^{25}}{11^5}$

6) $5\ln x + 6\ln y$

$\ln\left(y^6x^5\right)$

7) $\frac{\ln 5}{2} + \frac{\ln 6}{2} + \frac{\ln 7}{2}$

$\ln\sqrt{210}$

8) $20\ln a - 4\ln b$

$\ln \frac{a^{20}}{b^4}$

Use a calculator to approximate each to the nearest thousandth.

9) $\ln 39$

3.664

10) $\ln 2.2$

0.788

11) $\ln 21$

3.045

12) $\ln 3.4$

1.224

Solve each equation.Round your final answer to the nearest thousandth.

13) $\ln(7 - p) = \ln(-5p - 1)$

$\{-2\}$

14) $\ln -2x = \ln(3x + 10)$

$\{-2\}$

15) $\ln 8 - \ln(x + 4) = 1$

$\left\{\frac{8 - 4e}{e}\right\}$

16) $\ln(x + 1) - \ln x = 5$ $\left\{-\frac{1}{1 - e^5}\right\}$

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17) $\ln(x+8) - \ln 7 = 3$

$\{7e^3 - 8\}$

18) $\ln 10 + \ln(5x-2) = 3$

$\left\{\frac{e^3+20}{50}\right\}$

19) $\ln(-4x-4) - \ln 3 = 3$

$\left\{\frac{-3e^3-4}{4}\right\}$

20) $\ln 3 + \ln(2x^2+4) = \ln 12$

$\{0\}$

21) $\ln(2x^2-2) - \ln 9 = \ln 80$

$\{19, -19\}$

22) $\ln(-3+3n) = \ln(n^2-n)$

$\{3\}$

Solve each equation. Round your answers to the nearest thousandth.

23) $-8e^{-p} = -49$

-1.8124

24) $2e^{8x} = 45$

0.3892

25) $e^{-4x} + 8 = 35$

-0.824

26) $e^{3r} + 4 = 59$

1.3358

27) $3e^{-b} = 56$

-2.9267

28) $-9.3e^{10b} = -67$

0.1975

29) $4e^{r+5} = 29$

-3.019

30) $6e^{-10r} = 63$

-0.2351

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Name: _____ Date: _____

EXPONENTIAL MODELING WITH PERCENT GROWTH AND DECAY
COMMON CORE ALGEBRA II HOMEWORK

APPLICATIONS

1. If \$130 is invested in a savings account that earns 4% interest per year, which of the following is closest to the amount in the account at the end of 10 years?

   $y = 130(1+.04)^{10}$

   (1) \$218 (3) \$168

   (2) \$192 (4) \$324

   2

2. A population of 50 fruit flies is increasing at a rate of 6% per day. Which of the following is closest to the number of days it will take for the fruit fly population to double?

   $y = 50(1.06)^x$ $\quad 100 = 50(1.06)^x$ $\quad 2 = 1.06^x$ $\quad \log_{1.06} 2 = x$ $\quad \frac{\log 2}{\log 1.06} = x$

   (1) 18 (3) 12

   (2) 6 (4) 28

   3

3. If a radioactive substance is quickly decaying at a rate of 13% per hour approximately how much of a 200 pound sample remains after one day?

   $y = 200(1-.13)^{24}$

   (1) 7.1 pounds (3) 25.6 pounds

   (2) 2.3 pounds (4) 15.6 pounds

   1

4. A population of llamas stranded on a dessert island is decreasing due to a food shortage by 6% per year. If the population of llamas started out at 350, how many are left on the island 10 years later?

   $y = 350(1-.06)^{10}$

   (1) 257 (3) 102

   (2) 58 (4) 189

   4

5. Which of the following equations would model a population with an initial size of 625 that is growing at an annual rate of 8.5%?

   (1) $P = 625(8.5)^t$ (3) $P = 1.085^t + 625$

   (2) $P = 625(1.085)^t$ (4) $P = 8.5t^2 + 625$

   2

6. The acceleration of an object falling through the air will decrease at a rate of 15% per second due to air resistance. If the initial acceleration due to gravity is 9.8 meters per second per second, which of the following equations best models the acceleration t seconds after the object begins falling?

   (1) $a = 15 - 9.8t^2$ (3) $a = 9.8(1.15)^t$

   (2) $a = \frac{9.8}{15t}$ (4) $a = 9.8(0.85)^t$

   4

Name: _____ Date: _____

COMPOUND INTEREST
COMMON CORE ALGEBRA II HOMEWORK

APPLICATIONS

1. The value of an initial investment of \$400 at 3% nominal interest compounded quarterly can be modeled using which of the following equations, where t is the number of years since the investment was made?

   (1) $A = 400(1.0075)^{4t}$ (3) $A = 400(1.03)^{4t}$

   (2) $A = 400(1.0075)^{t}$ (4) $A = 400(1.0303)^{4t}$

   1

2. Which of the following represents the value of an investment with a principal of \$1500 with a nominal interest rate of 2.5% compounded monthly after 5 years?

   $A = 1500\left(1 + \frac{.025}{12}\right)^{12*5}$

   (1) \$1,697.11 (3) \$4,178.22

   (2) \$1,699.50 (4) \$5,168.71

   2

3. Franco invests \$4,500 in an account that earns a 3.8% nominal interest rate compounded continuously. If he withdraws the profit from the investment after 5 years, how much has he earned on his investment?

   (1) \$858.92 (3) \$922.50

   (2) \$912.59 (4) \$941.62

   _____

4. An investment that returns a nominal 4.2% yearly rate, but is compounded quarterly, has an effective yearly rate closest to

   (1) 4.21% (3) 4.27%

   (2) 4.24% (4) 4.32%

   _____

5. If an investment's value can be modeled with $A = 325\left(1 + \frac{.027}{12}\right)^{12t}$ then which of the following describes the investment?

   (1) The investment has a nominal rate of 27% compounded every 12 years.
   (2) The investment has a nominal rate of 2.7% compounded ever 12 years.
   (3) The investment has a nominal rate of 27% compounded 12 times per year.
   (4) The investment has a nominal rate of 2.7% compounded 12 times per year.

   4

① Determine if the data represents Linear, Exponential, or logarithmic. Estimate the average height of the tree at 20 years of age.

Age of Tree (in years)	Height (in feet)
1	6
2	9.5
3	13
4	15
5	16.5
6	17.5
7	18.5
8	19
9	19.5
10	19.7
11	19.8

Linear: $r = .9165$

Exp: $r = .8549$

LN: $r = .9931$

$y = 6.099 + 6.1081 \ln x$

$y = 6.099 + 6.108 \ln(20)$

$y = 24.40$ ft

② Determine if the data represents ~~Quadratic~~ Linear, Exponential, or logarithmic.

Time (mins)	Temp (°F)
0	179.5
5	168.7
8	158.1
11	149.2
15	141.7
18	134.6
22	125.4
25	123.5
30	116.3
34	113.2
38	109.1
42	105.7
45	102.2
50	100.5

~~Quadratic: r = .99467~~

Exp: $r = -.9895$

Linear: $r = -.9695$

$y = 171.46 * .9882^x$

a) What is the coffee's temperature after 1 hour?

$y = 171.46 * .9882^{60}$

$y = 84.1°$

b) When will the coffee's temperature reach 106°

$106 = 171.46 * .9882^x$

$.6182 = .9882^x$

$\log_{.9882} .6182 = x$

$x = \frac{\log .9882}{\log .6182}$

$x = .024 \rightarrow$ less than 1 min.