HW 9-3H
Secondary III

Name: Key
Date: _____ Class: _____

Solve the following equations graphically

1. $4e^{0.1x} = 60$

$x = 27.08$

2. $120e^{2x} = 75e^{3x}$

$x = 0.47$

3. $5 = 625e^{0.02x}$

$x = -241.42$

Solve the following equations algebraically

4. $6^{3x-9} - 10 = -3$

$6^{3x-9} = 7$

$3x - 9 = \log_6 7$

$\frac{3x}{3} = \frac{(\log_6(7) + 9}{3}$

$x = \frac{\log_6(7) + 9}{3}$

$= 3.36$

5. $\frac{7e^{3x}}{7} = \frac{42}{7}$

$e^{3x} = 6$

$\frac{3x}{3} = \frac{\ln 6}{3}$

$x = \frac{\ln 6}{3}$

$= .60$

6. $11^{6x+2} = 12$

$6x + 2 = \log_{11}(12) - 2$

$\frac{6x}{6} = \frac{\log_{11}(12) - 2}{6}$

$x = -.16$

7. $5^{\frac{x}{4}} = 30$

$\frac{x}{4} = (\log_5 30)$ 4

$x = 8.45$

8. $3\ln(x-3) + 4 = 5$

$-4 \quad -4$

$\frac{3\ln(x-3)}{3} = \frac{1}{3}$

$\ln(x-3) = 1/3$

$e^{1/3} = x - 3$

$+3 \quad +3$

$x = 4.396$

$= 4.4$

9. $\ln x^2 = 4$

$\sqrt{e^4} = \sqrt{x^2}$

$x = 7.39$

10. $\ln(x-3) + \ln(x+4) = 3\ln 2$

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

$x = -4$, 4

$\ln(x^2 + x - 12) = \ln 8$

$x^2 + x - 12 = 8$

$-8 \quad -8$

$x^2 + x - 20 = 0$

$(x+5)(x-4) = 0$

11. $\log_4(x-5) = -1$

$4^{-1} = x - 5$

$+5 \quad +5$

$x = 5.25$

12. The price P of a gallon of gas after t years is given by the equation $P = P_0(1 + r)^t$ where P_0 is the initial price of gas and r is the rate of inflation. If the price of a gallon of gas is currently $3.25, how long will it take for the price to rise to $4.00 if the rate of inflation is 10.5%?

$\frac{4.00}{3.25} = \frac{3.25(1 + .105)^t}{3.25}$

$\frac{4}{3.25} = (1 + .105)^t$

$t = \log_{1.105}\left(\frac{4}{3.25}\right)$

$t = 2.08$ years

9. A veterinarian has instructed Harrison to give his 75-lb dog one 325-mg aspirin tablet for arthritis. The amount of aspirin, A, remaining in the dog's body after t minutes can be expressed by $A = 325\left(\frac{1}{2}\right)^{\frac{t}{16}}$. How long will it take for the amount of aspirin to drop to 50-mg?

$\frac{50}{325} = \frac{325\left(\frac{1}{2}\right)^{t/16}}{325}$

$16 \cdot \frac{t}{16} = 16 \log_{1/2}\left(\frac{50}{325}\right)$

$t = 43.21$ minutes

10. On the Richter scale, the magnitude M of an earthquake depends on the amount of energy, E (measured in ergs), released by the earthquake as follows:

$M = \frac{2}{3}\log\frac{E}{10^{11.8}}$ In 1985, an earthquake hit Mexico City and measured 8.1 on the Richter scale. Find the amount of energy, E, released by this earthquake.

$\frac{3}{2}(8.1) = \frac{3}{2}\cdot\frac{2}{3}\log\frac{E}{10^{11.8}}$

$12.15 = \log E - \log 10^{11.8}$

$12.15 = \log E - 11.8$

$+11.8 \quad +11.8$

$23.95 = \log E$

$10^{23.95} = E$

$E = 8.91 \times 10^{23}$ ergs

11. **Match the equations with the solutions.**

a. $9e^{3x} = 27$	b	$x \approx 1.099$
b. $9e^{x} = 27$	d	$x \approx 1.022$
c. $9e^{3x-4} = 27$	a	$x \approx 0.366$
d. $9e^{3x} + 2 = 27$	c	$x \approx 1.700$

Review

1. The population of Smallville in the year 1890 was 6250. Assume the population increased at a rate of 2.75% per year. Find the population in 1915 and 1940.

$P(t) = 6250(1.0275)^t$

$P(25) = 6250(1.0275)^{25} = 12{,}314.76$

$P(50) = 6250(1.0275)^{50} = 24{,}264.51$