

(Solutions shown on separate sheet)

H10 Exponential + Log Review Answer Key.

1. $y = 430(1.12)^x$; 4147.91 2. $y = 120,000(1.012)^x$; 152,332.12

3. $y = 2(5)^x$ 4. $y = 14.336 \text{ mg}$

5. $y = 192.70 \text{ kg}$ 6. \$1319.59

7. \$705.78

8. y-int (0, 3)
asymptote $y = 0$
see solutions for graph

9a) $\frac{125}{384x^{33}y^{16}z^4}$

b) $\frac{512d^{12}}{c^{12}}$

c) $25g^{24}h^{20}$

10a. The earthquake in 1900 was 6926.5 x stronger than the earthquake in 2000.

b. The earthquake in 1956 was 455.9 times stronger than the earthquake in 1900.

11a) $\log_6 36 = 2$

b.) $\log_2 .0125 = -3$ c.) $\log_3 27 = 3$

12a) $2^4 = 16$

b.) $49^{1/2} = 7$

c.) $10^4 = 10,000$

13a. $x = 3$

b.) $x = 1$

c.) $x = -3$

d.) $x = -3$

14 a) $\text{pH} = 2.14$

b) $\text{H}^+ = 6.31 \times 10^{-4}$

15 a.) $\log_2 \frac{x^4}{\sqrt{2}}$

b.) $\log_2 x^3$

c.) $\log_2 (xy)^2$

d.) $\ln 64$

e.) $\ln 9p^4$

f.) $\ln x\sqrt{2}/4$

Answer Key, cont.

16a) $\ln 2 + \ln x + 4 \ln y$

b) $\frac{1}{2} \log 2 + \frac{3}{2} \log x$

c) $\log_6 4 + 2 \log_6 x - \log_6 3$

d) $\log_5 r - \log_5 s$

17a) $x = .861$

b.) $x = 1.684$

c.) $x = 1.002$

d.) $x = 5001$

e.) $x = 58.480$

f.) $x = 315.23$

g.) $x = 439605247.8$

h.) $x = 1.816 \times 10^{-9}$

i) $x = 1.359$

j) $x = .828$

k.) $x = 3.773$

l) $x = 3.258$

18. Approx. 21 years

19. $x = 5.148$

20.) 2% interest

* Try this same problem as if you were given the 2% interest rate and looking for time.

Review Section

1. $m = 4, -2$

2. no solution

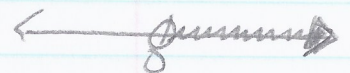
3. $k = \pm 8$

4. $x = \frac{p-ty}{z}; z \neq 0$

5. $x = 2m + 2n + 2$

6-8 (Same as # 1-3)

9. $x > 0$

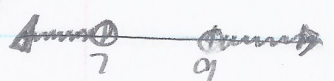


10. no solution

11. $2 \leq n \leq 3$



12. $x < 7$ or $x > 9$



H10: Exponential + Log Review - Solutions

1. $y = 430(1.12)^x$; 4147.91

$x = \text{time (years)}$
 $y = \# \text{ of quail}$
430 = initial amount
1.12 = growth factor

$$y = 430(1.12)^{20}$$
$$= 4147.91$$

2. $y = 120,000(1.012)^x$; 152,332.12

$$y = 120,000(1.012)^{20}$$
$$= 152,332.12$$

3. $y = ab^x$

$2 = ab^0$
 $*2 = a$

$y = ab^x$
 $50 = 2(b)^2$
 $25 = b^2$
 $*b = 5$

$$y = 2(5)^x$$

4. $y = 15\left(\frac{1}{2}\right)^{100/1532}$

$$y = 14.336$$

5. $y = 204\left(\frac{1}{2}\right)^{x/73}$

$$y = 204\left(\frac{1}{2}\right)^{6/73}$$

$$y = 192.70$$

$x = \text{time (days)}$
 $y = \text{amt. of material remaining}$
204 = initial value
 $\frac{1}{2} = \text{decay factor}$
73 = half life.

$$6. \quad A = Pe^{rt}$$

$$= 1200e^{.038 \cdot 2.5}$$

$$= \boxed{1319.59}$$

$$7. \quad A = Pe^{rt}$$

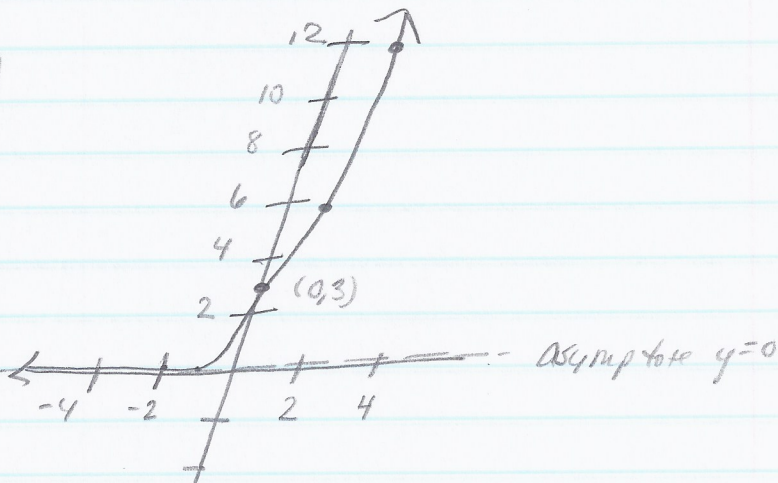
$$820 = Pe^{.05 \cdot 3}$$

$$820 = P e^{-.15}$$

$$P = \boxed{705.78}$$

$$8. \quad y = 3(2)^x$$

| x | y |
|----|-----|
| -2 | 1/2 |
| -1 | 1/6 |
| 0 | 3 |
| 1 | 6 |
| 2 | 12 |



$$9. \quad a) \frac{(5x^{-4}y^6z)^3}{(2x^2y^4z)^7} \cdot \frac{3x^5y^9}{9x^{12}y} = \frac{125}{384x^{33}y^{16}z^4}$$

$$\frac{125x^{-12}y^{18}z^3}{128x^{14}y^{42}z^7} \cdot \frac{3x^5y^9}{9x^{12}y} = \frac{125x^{-7}y^{27}z^3}{128 \cdot 3x^{26}y^{43}z^7} = \frac{125x^{-33}y^{16}z^{-4}}{384}$$

$$= \frac{125}{3 \cdot 128x^{33}y^{16}z^4}$$

$$b) \left(\frac{2^4c^5d}{2^7cd^3} \right)^{-3} = (2^{-3}c^4d^{-4})^{-3} = 2^9c^{-12}d^{12} = \boxed{\frac{2^9d^{12}}{c^{12}}}$$

$$c) (-5g^5h^6)^2 (g^4h^2)^4 = 25g^{10}h^{12} \cdot g^{16}h^8 = \boxed{25g^{26}h^{20}}$$

$$10a) \frac{30^{6.8}}{30^{4.2}} = 30^{2.6} = 6926.52$$

times stronger

$$b) \frac{30^{8.6}}{30^{4.8}} = 30^{3.8} = 455.85 \text{ times stronger}$$

$$11. a) \log_6 36 = 2$$

$$b) \log_2 0.125 = -3$$

$$c) \log_3 27 = 3$$

$$12. a) 2^4 = 16$$

$$b) 49^{1/2} = 7$$

$$c) 10^4 = 10,000$$

$$13. a) \begin{aligned} 2 \log 5 + \log 40 \\ \log 25 + \log 40 \\ \log 1000 \\ 10^x = 1000 \\ 10^x = 10^3 \\ x = 3 \end{aligned}$$

$$b) \begin{aligned} \log_3 27 - \log_3 9 \\ \log_3 \frac{27}{9} \\ \log_3 3 \\ 3^x = 3 \\ 3^x = 3^1 \\ x = 1 \end{aligned}$$

$$c) \begin{aligned} \log_5 \frac{1}{125} \\ 5^x = \frac{1}{125} \\ 5^x = 5^{-3} \\ x = -3 \end{aligned}$$

$$d) \begin{aligned} \log_3 \frac{1}{27} \\ 3^x = \frac{1}{27} \\ 3^x = 3^{-3} \\ x = -3 \end{aligned}$$

$$14a) \text{pH} = -\log(2.3 \times 10^{-3}) = 2.14$$

$$b) \begin{aligned} \text{pH} &= -\log[H^+] \\ 3.2 &= -\log[H^+] \\ -3.2 &= \log[H^+] \\ H^+ &= 10^{-3.2} = 6.31 \times 10^{-4} \end{aligned}$$

$$15a) \begin{aligned} \log_7 x + 3 \log_7 y - \frac{1}{2} \log_7 z \\ \log_7 x + \log_7 y^3 - \log_7 z^{1/2} \\ \log_7 \frac{xy^3}{\sqrt{z}} \end{aligned}$$

$$b) \begin{aligned} \log 8 - \log 4 + 3 \log x \\ \log 8 - \log 4 + \log x^3 \\ \log \frac{8x^3}{4} \\ \log 2x^3 \end{aligned}$$

$$15c. \quad 2 \log_2 x + 2 \log_2 y$$

$$\log_2 x^2 + \log_2 y^2$$

$$\boxed{\log_2 (xy)^2}$$

$$d.) \quad 3 \ln 4$$
$$\ln 4^3$$
$$\boxed{\ln 64}$$

$$e. \quad 4 (\ln p + \ln 3) - \ln 9$$

$$(\ln p + \ln 3)^4 - \ln 9$$

$$\ln p^4 + \ln 81 - \ln 9$$

$$\ln \frac{81p^4}{9}$$

$$\boxed{\ln 9p^4}$$

$$f.) \quad \ln x - 4 \ln y + \frac{1}{2} \ln z$$

$$\ln x - \ln y^4 + \ln z^{\frac{1}{2}}$$

$$\ln \frac{xz^{\frac{1}{2}}}{y^4}$$

$$\boxed{\ln \frac{x\sqrt{z}}{y^4}}$$

$$16a.) \quad \ln 2xy^4$$

$$\ln 2 + \ln x + \ln y^4$$

$$\boxed{\ln 2 + \ln x + 4 \ln y}$$

$$b.) \quad \log \sqrt{2x^3}$$

$$\log (2x^3)^{\frac{1}{2}}$$

$$\log 2^{\frac{1}{2}} x^{\frac{3}{2}}$$

$$\log 2^{\frac{1}{2}} + \log x^{\frac{3}{2}}$$

$$\boxed{\frac{1}{2} \log 2 + \frac{3}{2} \log x}$$

$$16c.) \log_6 \frac{4x^2}{3}$$

$$\log_6 4 + \log_6 x^2 - \log_6 3$$

$$\boxed{\log_6 4 + 2 \log_6 x - \log_6 3}$$

$$d.) \log_5 \frac{r}{s}$$

$$\boxed{\log_5 r - \log_5 s}$$

$$\bullet 17. a.) 5^{2x} = 16$$

$$\log 5^{2x} = \log 16$$

$$2x \log 5 = \log 16$$

$$\frac{2 \log 5}{2 \log 5} = \frac{\log 16}{2 \log 5}$$

$$\boxed{x = 1.861}$$

b.)

$$4^{3x} = 1100$$

$$\log 4^{3x} = \log 1100$$

$$3x \log 4 = \log 1100$$

$$\frac{3 \log 4}{3 \log 4} = \frac{\log 1100}{3 \log 4}$$

$$\boxed{x = 1.684}$$

$$c.) 5^{2x+1} - 6 = 120$$

$$5^{2x+1} = 126$$

$$\log 5^{2x+1} = \log 126$$

$$(2x+1) \log 5 = \log 126$$

$$2x+1 = \frac{\log 126}{\log 5}$$

$$\log 5$$

$$2x+1 = 3.005$$

$$\boxed{x = 1.002}$$

$$d.) \log (2x-2) = 4$$

$$2x-2 = 10^4$$

$$2x-2 = 10000$$

$$2x = 10002$$

$$\boxed{x = 5001}$$

$$e.) 3 \log x - \log 2 = 5$$

$$\log x^3 - \log 2 = 5$$

$$\log \frac{x^3}{2} = 5$$

$$\frac{x^3}{2}$$

$$x^3 = 10^5$$

$$\frac{x^3}{2}$$

$$x^3 = 200000$$

$$x = 58.480$$

$$f.) 2 \log (x+1) = 5$$

$$\log (x+1) = 2.5$$

$$10^{x+1} = 10^{2.5}$$

$$x+1 = 316.23$$

$$\boxed{x = 315.23}$$

$$g.) \ln(3x-9) = 21$$

$$3x-9 = e^{21}$$

$$3x-9 = 1318815734$$

$$\boxed{x = 439605247.8}$$

$$h.) \ln 4 - \ln x = 10$$

$$\ln \frac{4}{x} = 10$$

$$e^{10} = \frac{4}{x}$$

$$x \cdot 22026.466 = \frac{4}{x} \cdot x$$

$$22026.466x = 4$$

$$x \cdot 22026.466 = \frac{4}{22026.466}$$

$$\boxed{x = 1.816 \times 10^{-4}}$$

$$i.) \ln 2 + \ln x = 1$$

$$\ln 2x = 1$$

$$2x = e^1$$

$$2x = 2.7183$$

$$\boxed{x = 1.359}$$

$$j.) e^{3x} = 12$$

$$\ln e^{3x} = \ln 12$$

$$3x \ln e = \ln 12$$

$$3x = \ln 12$$

$$\boxed{x = .828}$$

$$k.) 4e^{(x-1)} = 64$$

$$e^{(x-1)} = 16$$

$$\ln e^{x-1} = \ln 16$$

$$x-1 = \ln 16$$

$$x-1 = 2.773$$

$$\boxed{x = 3.773}$$

$$l.) e^x - 5 = 21$$

$$e^x = 26$$

$$\ln e^x = \ln 26$$

$$x \ln e = \ln 26$$

$$x = \ln 26$$

$$\boxed{x = 3.258}$$

$$18.) A = Pe^{rt}$$

Let $P = \$100$, so $A = \$200$, after it doubles

$$200 = 100e^{0.033t}$$

$$2 = e^{0.033t}$$

$$\ln 2 = \ln e^{0.033t}$$

$$\ln 2 = 0.033t \ln e$$

$$\ln 2 = 0.033t$$

$$t = \frac{\ln 2}{0.033} = 21.0$$

Approx 21 years

$$19. \frac{30^{7.9}}{30^x} = 11,600$$

$$30^{7.9-x} = 11,600$$

$$\log 30^{7.9-x} = \log 11,600$$

$$\frac{7.9-x}{\log 30} \log 30 = \frac{\log 11,600}{\log 30}$$

$$7.9-x = 2.752$$

$$-x = -5.148$$

$$x = 5.148$$

$$20. 12000 = 10000 \left(1 + \frac{r}{4}\right)^{40}$$

$$1.2 = \left(1 + \frac{r}{4}\right)^{40}$$

$$1.005 = 1 + \frac{r}{4}$$

$$.005 = \frac{r}{4}$$

$$r = .02, \text{ or } 2\% \text{ interest}$$

Try this same problem where you are given the rate, and looking for time!

REVIEW PROBLEMS

$$1. \frac{2-5}{-2} \Big/ \frac{5m-5}{-2} = -73$$

$$\frac{-5}{5m-5} = -75$$

$$|5m-5| = 15$$

$$5m-5 = 15$$

$$5m = 20$$

$$m = 4$$

$$5m-5 = -15$$

$$5m = -10$$

$$m = -2$$

$$2. \frac{|x-4|}{|x-4|} + 3 = 1$$

$$|x-4| = -2$$

no solution

$$3. \frac{|k|}{4} - 2 = 0$$

$$\frac{|k|}{4} = 2$$

$$|k| = 8$$

$$k = 8 \quad k = -8$$

$$4. 2x + ty = p$$

$$2x = p - ty$$

$$x = \frac{p - ty}{2} ; z \neq 0$$

$$5. \frac{x-2}{2} = m+n$$

#6-8; same as #1-3

$$x-2 = 2(m+n)$$

$$x = 2m + 2n + 2$$

$$9. -2(1-5x) > -(x+1) - 1$$

$$-2 + 10x > -x - 2$$

$$+x \quad +x$$

$$-2 + 11x > -2$$

$$11x > 0$$

$$x > 0$$

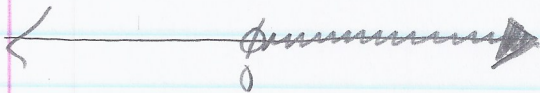
$$10.) 3x - 10 > 3(x - 2)$$

$$3x - 10 > 3x - 6$$

$$-3x \quad -3x$$

$$-10 > -6$$

no solution

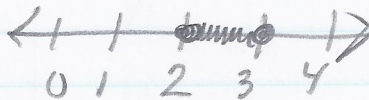


$$11.) \quad \begin{array}{r} -33 \leq -7n - 12 < -26 \\ +12 \qquad \qquad +12 \quad +12 \end{array}$$

$$\frac{-21}{-7} \leq \frac{-7n}{-7} < \frac{-14}{-7}$$

$$3 \geq n \geq 2$$

$$\text{or} \\ 2 \leq n \leq 3$$



$$12.) \quad \begin{array}{l} 2x - 3 < 11 \\ 2x < 14 \\ x < 7 \end{array} \quad \text{or} \quad \begin{array}{l} -8x - 10 < -82 \\ -8x < -72 \\ x > 9 \end{array}$$



13.