Pg. 413

#10/ $\log E = \log 10.61 + 0.1964 \log m$

$E = 24\,mM$

$\log 24 = \log 10.61 + 0.1964 \log \boxed{m}$

$$\frac{\log 24 - \log 10.61}{0.1964} = \log m$$

$1.805 = \log_{10} m$

$10^{1.805} = m$

$\underline{m = 64\,kg}$

#7 d) $\log\left[4(7)^{x+2}\right] = \log 9^{2x-3}$

$\log 4 + (x+2)\log 7 = (2x-3)\log 9$

$$\frac{x(\cancel{\log 7 - 2\log 9})}{\cancel{\log 7 - 2\log 9}} = \frac{[-\log 4 - 2\log 7 - 3\log 9]}{[\log 7 - 2\log 9]} \div$$

$x =$

$=$

Carbon-14 has a half-life of 5750 years. How long will it take for 80% of a 40g sample to decay?

13 351 years

t	0	5750
m	40	20

$\times \frac{1}{2}$

80% of 40 = 32g

8g Remains

$M = 40(0.5)^{\frac{t}{5750}}$

$8 = 40(0.5)^{t/5750}$

$\left(\frac{8}{40}\right)$

$\frac{1}{5} = 0.5^{t/5750}$

$\log\left(\frac{1}{5}\right) = \log(0.5)^{\frac{t}{5750}}$

$\log\left(\frac{1}{5}\right) = \frac{t}{5750}\log(0.5)$

$\frac{5750\log\left(\frac{1}{5}\right)}{\log(0.5)} = t$

$t = 13351$ years

Evaluate the following without a calculator...

$$\boxed{36^{\left(0.5+\log_6 \sqrt{2}\right)}}$$

12

Solution!

$(6^2)^{(0.5+\log_6\sqrt{2})}$

$6^{(1+2\log_6\sqrt{2})}$

$6^{(1+\log_6(\sqrt{2})^2)}$

$6^{(1+\log_6 2)}$

$(6^1)(6^{\log_6 2})$

$(6)(2)$

$=12$

$(36)^{0.5}(36)^{\log_6\sqrt{2}}$

$=6\,(6^2)^{\log_6\sqrt{2}}$

$=6\,(6^{2\log_6\sqrt{2}})$

$=6\,(6^{\log_6(\sqrt{2})^2})$

$=6\,(6^{\log_6 2})$

$=6(2)$

$=12$

Calculator:

$36^{(0.5+\log_6\sqrt{2})}$

$36^{\left(0.5+\frac{\log\sqrt{2}}{\log 6}\right)}$

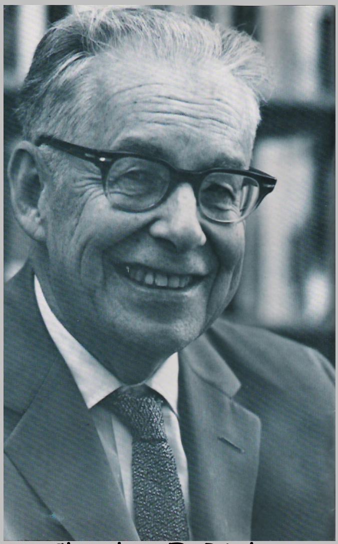
$=12$

$\log_6\sqrt{2} = \frac{\log\sqrt{2}}{\log 6}$

Logarithmic Scales

I. Richter Scale: Severity of Earthquakes

$$R = \log_{10}\left(\frac{I}{I_o}\right)$$



Charles F. Richter
1900-1985

R - magnitude of an earthquake
I - Intensity of the earthquake
(amplitude of the wave on a seismograph)
I_o - Intensity of the reference earthquake
(1 micron) (1 micron = 10^{-4} cm)

The intensity of the earthquake is measured by the amplitude of a seismograph reading taken 100 km from the epicenter of the earthquake.

This implies that an earthquake that reads a 5 on the Richter scale would be 10 times more intense than an earthquake that reads a 4 on the Richter Scale.(The scale jumps by powers of 10)

How many times more intense would an earthquake that reads an 8 on the Richter Scale be than a 5 on the Richter Scale?

If the intensity of earthquake A is 5 and the intensity of earthquake B is 650, what is the difference in their magnitudes as measured by the Richter Scale?

$$R = \log\left(\frac{I}{10^{-4}}\right)$$

2.11

A

$$R = \log\left(\frac{5}{10^{-4}}\right)$$

$$R = 4.7$$

B

$$R = \log\left(\frac{650}{10^{-4}}\right)$$

$$R = 6.8$$

The 1985 Mexico City earthquake had a magnitude of 8.1 on the Richter scale and the 1976 Tangshan earthquake was 1.26 as intense. What was the magnitude of the Tangshan earthquake on the Richter Scale?

8.2

$$R = \log \frac{I}{10^{-4}}$$

$$8.1 = \log \frac{I}{10^{-4}}$$

$$(10^{-4})\,10^{8.1} = \frac{I}{10^{-4}}\,(10^{-4})$$

$$10^{4.1} = I$$

$$I = 10^{4.1} \times 1.26$$

$$R = \log\left(\frac{10^{4.1}(1.26)}{10^{-4}}\right)$$

$$\underline{R = 8.2}$$

Exponential Growth Review

1. Exponent Laws

2. Exponential Equations
   - Common Bases
   - Substitution

3. Exponential Functions
   - Transformations

4. Exponential Applications

5. Logarithms
   - Switch Forms
   - 3 Properties

6. Laws of Logarithms

7. Logarithm Applications
   - Exponential Equations
   - Richter Scale
   - ~~Sound~~

Review of Exponentials...

- Laws of exponents
  - simplify
  - evaluate

- Solving Exponential Equations
  (1) Same base using laws of exponents
  (2) Set exponents equal and solve equation

  NOTE: "Substitution method" when adding/subtracting

- Exponential Functions

  Function Notation (Standard Form)

  notice coefficient of x must be 1 to identify horizontal stretch

$$y = ab^{\frac{1}{c}(x+h)} + k$$

  Mapping Notation - (with respect to $y = b^x$)

$$(x, y) \rightarrow (cx - h, ay + k)$$

where: a = vertical stretch factor
b = base (common ratio)
c = horizontal stretch factor
h = horizontal translation
k = vertical translation

- Exponential Growth/Decay Applications

$$y = a(b)^{\frac{x}{c}}$$

Increment (x scale)

Initial Amount (y-intercept)

Base

- finding the base... (1) Through key words

(2) Common ratio

(3) Percent

Review of Logarithms...

Switching Forms: $\boxed{\log_a x = y \Leftrightarrow a^y = x}$

General Properties of Logarithms:

If $a > 0$ and $a \neq 1$, then...
(i) $\log_a 1 = 0$
(ii) $\log_a a^x = x$
(iii) $a^{\log_a x} = x$

1) Product Law → the logarithm of a product is equal to the sum of the logarithms of the factors.

$$\log_a (MN) = \log_a M + \log_a N$$

2) Quotient Law → the logarithm of a quotient is equal to the logarithm of the numerator minus the logarithm of the denominator.

$$\log_a \left(\frac{M}{N}\right) = \log_a M - \log_a N$$

$$\log_a \left(\frac{1}{N}\right) = -\log_a N$$

3) Law of Logarithms for Powers → the logarithm of a power of a number is equal to the exponent multiplied by the logarithm of the number

$$\log_a M^p = p \times \log_a M$$

$$\log_a M^{\frac{p}{q}} = \frac{p}{q} \times \log_a M$$

Solving Logarithmic Equations

STEPS...

(1) Write left side & right side as a single logarithm
NOTE: $\log_a a = 1$

(2) Set arguments equal & solve the equation

- Solving exponential equations where both sides can not be expressed to a common base...

  Take the log of both sides of equation and apply laws of logarithms

- Change of base formula: $\log_b N = \dfrac{\log_a N}{\log_a b}$

Review Time!!!

Pages 416-418

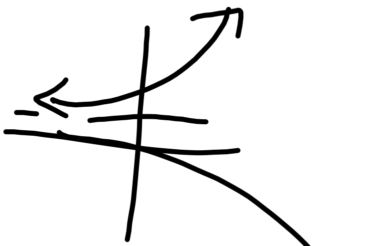
#2, 4, 5, 11, 12, 13, 14, 18, 19, 20, 21, 22

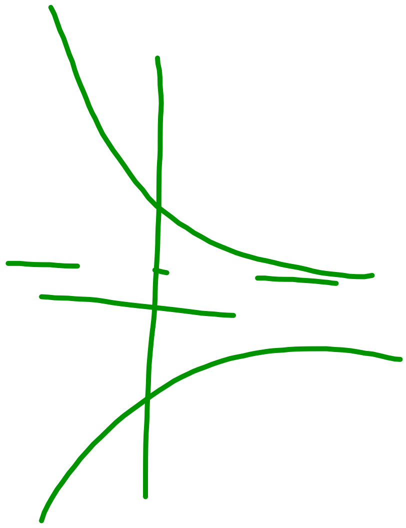
Pgs. 419-420

#1, 2, 3, 4, 5, 6, 7, 8, 11, 12

Worksheet - Review of Logarithms.doc

$-2(3)^x + 2$





t	0	x
m	40	

x.2

$$m = 40(0.2)^{\frac{t}{x}}$$

$$20 = 40(0.2)^{\frac{5750}{x}}$$

Attachments

Worksheet - Review of Logarithms.doc