Sec 8.7 Solving Problems involving exponential and log functions

Recall:

-exponential growth and decay questions

$$A_f = A_i\left(B\right)^y$$

A_f= *final amount*
A_i= *initial amount*
B = *percentage growth*
y= *period of time*

Half life: B=0.5
Doubling time: B=2
Compounding interest: $B = (1+i)$

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Example:

The half-life of radium is 1620 years.
If a laboratory has 12 grams of radium,
how long will it take before it has 8 grams of radium left?

Jun 3-10:21 AM

Now, we can also solve problems involving logs.

Ex:

$pH = -\log [H^+]$ *-see Ex 1 p494*

Ex:

Apple juice has a pH of 3.3 and grapefruit juice has a pH of 3.2. How much more acidic is grapefruit juice than apple juice?

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Richter magnitude scale - the number of the magnitude is really the exponent on base 10.

Earthquake of magnitude $2 = 10^2$

$\log 10^2 = 2$

-see Ex 2 p496

How much more powerful is an earthquake that measures 8 than one that measures 4.5 on the Richter scale?

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Sound intensity:

-log scale used because the range of loudness that we can hear is huge.

Quietest sound ~ 10^{-12} W/m^2 (this is used as I_0)

Formula to measure sound is

$$L = 10 \log\left(\frac{I}{I_0}\right)$$

L = loudness in decibels (dB)
I = intensity of sound being measured
I_0 = intensity of sound as threshold of hearing

-see Ex 4 on p497

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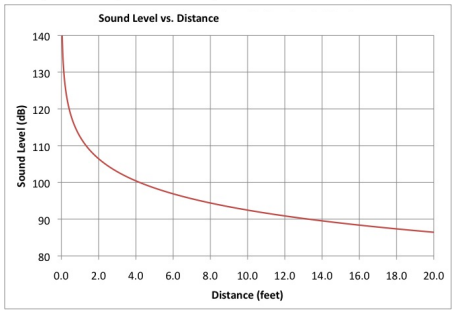
Sound Levels (dB)	Intensity (W/m^2)	Effect / Examples
0	1×10^{-12}	Threshold of hearing at 1000 Hz
10	1×10^{-11}	Rustle of leaves
20	1×10^{-10}	Whisper 1 m away
30	1×10^{-9}	Quiet home
40	1×10^{-8}	Average home
50	1×10^{-7}	Average office, soft music
60	1×10^{-6}	Normal conversation
70	1×10^{-5}	Noisy office, busy traffic
80	1×10^{-4}	Loud radio, classroom lecture
90	1×10^{-3}	Inside a subway train
100	1×10^{-2}	Noisy factory, siren from 30m
110	1×10^{-1}	Damage from 30 minutes exposure
120	1×10^{0}	Loud rock music, threshold of pain damage in seconds
140	1×10^{2}	Jet plane at 30 meters, severe pain
160	1×10^{3}	Bursting of eardrum



DISTANCE	SIL or SPL
0m	0dB
1m	-11dB
2m	-17dB
4m	-23dB
8m	-29dB
16m	-35dB
32m	-41dB
64m	-47dB
128m	-53dB
256m	-59dB
512m	-65dB
1024m	-71dB

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Ex:

The sound intensity in the cafetorium on a busy day was measured to be 82 dB. A motorcycle accelerating in front of the building was measured at 98 dB.

How much louder is the motorcycle than the cafeteria?

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There are also a number of word problems involving exponents that can be solved using logs.

- *see Ex 3 on p496*

Blue jeans fade at 2.2% per wash. How many washes are necessary to go to 30%?

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Homework!

p499 #1,2,4,6ac,8,13,14

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