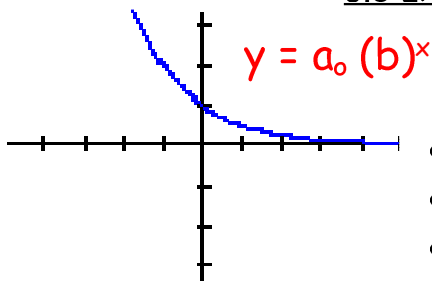
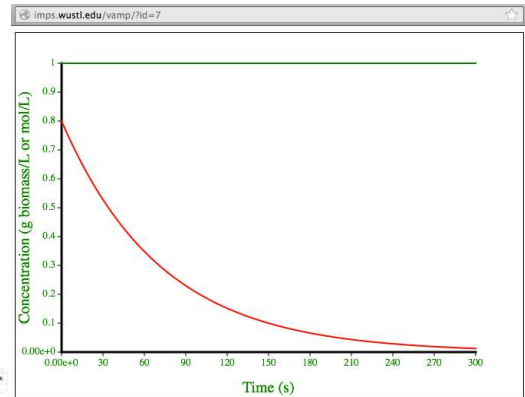
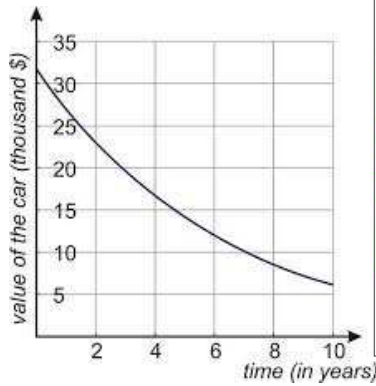
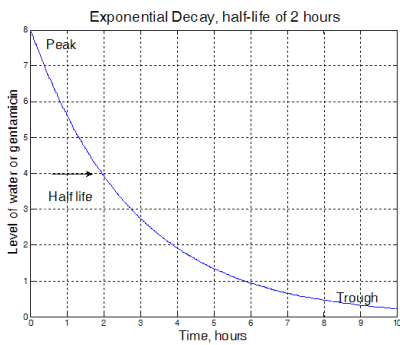


### 6.8 Exponential Decay



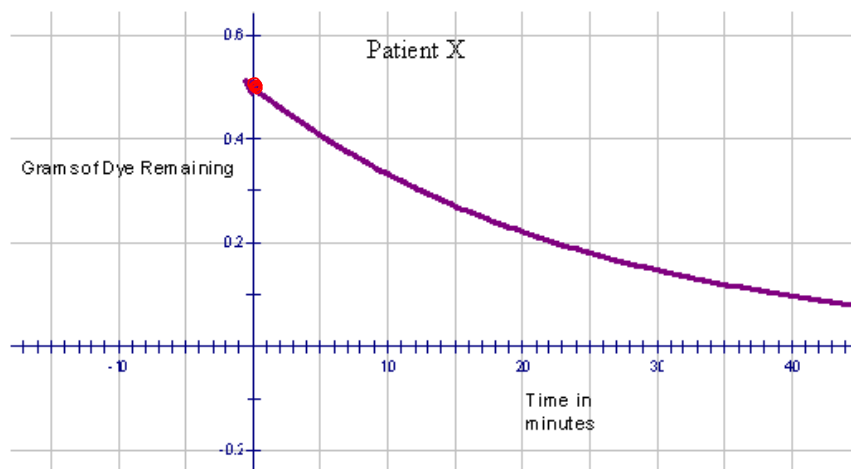
Seen in:

- DEPRECIATION on an automobile
- DEPRECIATION in the value of a home
- Population DECAY
- **HALF-LIFE** of a radioactive element  
(time it takes for 1/2 the population to decay)



Ex 1:

Dye is injected into a patient to test pancreas function. The mass,  $R$  grams of dye remaining in a healthy pancreas after  $t$  minutes is given by the equation  $R = M(0.96)^t$ , where  $M$  grams is the mass of dye initially injected. The graph below represents the results of a patient having their pancreas tested:



- How many grams of dye were injected initially into the patient? \_\_\_\_\_
- How much time has elapsed when 0.35 g remains? \_\_\_\_\_
- How long does it take for the patient to have half the amount of dye in their system? \_\_\_\_\_  
(this is half life)
- How many grams of dye remain after 50 minutes? \_\_\_\_\_
- Use the equation above to verify your answer in part c). (Show your substitution)  
and d)

Formula:  $P(n) = P_0(1-r)^n$


 $P(n)$ : final amount  
 $r$ : rate of decay

$P_0$ : initial amount  
 $n$ : number of decay periods

When the base  $(1-r)$  is  $0 < (1-r) < 1$ : decay

Read Example 2 page 435 
when we look at decay we look for half life instead of doubling time


Ex 2: page 438 # 3

A new car costs \$24000. It loses 18% of its value each year after it is purchased. This type of loss is called depreciation. The value of the car is given by  $V(n) = V_0(1-0.18)^n$ , where  $V_0$  is the original value of the car, and  $n$  is the number of years after the car was purchased.

a) Use the formula to determine how much of the car's initial value is lost after 5 years.

b) Use the formula to determine the value of the car after 30 months.

Ex 3: p 438 # 7

Gels used to change the colour of spotlights each reduce the intensity of the light.

The algebraic model for this situation is  $I=100(0.96)^n$

a) Describe what each part of the equation represents.

b) State the rate of decay.

c) Determine the intensity of the spotlight if three gels are used.

d) How many gels would reduce the intensity by more than 75%?

Ex 4: p 439 # 9

A hot cup of coffee cools accordingly to the equation  $T(t) = 68\left(\frac{1}{2}\right)^{\frac{t}{22}}$  where  $T(t)$  is the temperature in degrees Celsius, and  $t$  is time in minutes.

a) Which part of the equation indicates that it models exponential decay?

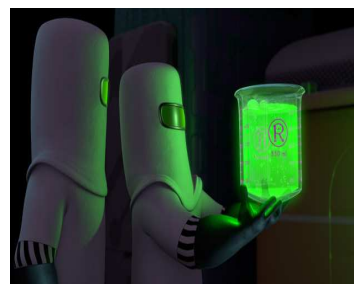
b) What value of  $t$  makes the exponent in the equation equal to 1?

c) What is the significance of this value?

d) What was the initial temperature of the coffee?

e) determine the temperature of the coffee after 40 minutes

Ex. 5: The half-life of a radioactive element is 15 days. This means that every 15 days, the amount decreases by 50%. How much of a 200 gram sample will be left after 150 days?



Hmwk:  
p 437 # 5, 8, 10 - 13



"I'm Bob, but my friends call me Rusty on account of my red hair."