(A) Lesson Context

BIG PICTURE of this UNIT:	• How can I analyze growth or decay patterns in data sets & contextual problems? • How can I algebraically & graphically summarize growth or decay patterns? • How can I compare & contrast linear and exponential models for growth and decay problems.		
CONTEXT of this LESSON:	Where we've been In Lessons 1 & 2 you generated & analyzed data from a variety of activities	Where we are How do we work with equations & situations that model growth & decay patterns	Where we are heading How can I use equations that will help me make predictions about scenarios which feature exponential growth & decay?

(A) Lesson Objectives:

a. Write exponential equations to model real world applications
b. Make predictions/extrapolations through numeric or algebraic analysis
c. Use multiple representations to solve the exponential equations that arise from real world applications

(B) Review ➔ An Exponential equation has the form $\mathbf{Y = C(a)^x}$ or $\mathbf{Y = C(1 + r)^x}$, where **C** = initial value, **a** is the growth factor/common ratio. (It turns out that **a** = **1 + r** , where **r** is the decimal value of % increase given).

For the following equations, (i) decide if they can be used to model growth or decay and (ii) determine the rate at which the change happens.

$Y = 200(1.15)^x$		
$Y = 400(0.85)^x$		
$Y = 100(2)^x$		
$Y = 100(½)^x$		
$Y = 200(1.05)^x$		
$Y = 400(1.75)^x$		
$Y = 100(0.75)^x$		
$Y = 100(0.995)^x$		
$Y = 1{,}000(0.30)^x$		
$Y = 2500(1.5)^x$		

(C) Opening Exploration ➔ Mr Santowski has been given a new job contract. He will earn $40,000 per year and get a raise of 6% of his previous years' salary (i.e his salary grows by 6% per year)

a) Define the variables that you will be using to model this problem.

b) Graph the function on your TI-84

c) Write an equation for Mr. S's salary.

d) What does the y-intercept represent?

e) What would my salary be in 8 years?

f) After how many years would my salary be $70,000?

g) What assumption are you making as you answer Qd,e?

h) I would like Mr. S's salary to be modelled with a linear relation. HOW would you change the original info so that a linear model can be used?

(D) Opening Exploration ➔ Mr Santowski has purchased a new car. It cost $50,000 but its value depreciates at a rate of 12% raise per year for the next 6 years

a) Define the variables that you will be using to model this problem.

b) Graph the function on your TI-84.

c) Write an equation for the value of Mr. S's car.

d) What does the y-intercept represent?

e) What would be the value of my car be in 8 years?

f) After how many years would the value of my car be $7,000?

g) I would like the value of Mr. S's car to be modelled with a linear relation. HOW would you change the original info so that a linear model can be used?

(E) Examples: For each question, show your equation and a sketch of your graph.

a. A colony of 1,000 ants can increase by 15% in a month.

   i. How many ants will be in the colony after 10 months?

   ii. How long will it take to get 7,500 ants in the colony?

b. A population of 10 hamsters will triple every year.

   i. What will be the population after 4 years?

   ii. How long will it take to get 1,500 hamsters?

   iii. Determine the WEEKLY growth rate for the hamsters.

c. A baby weighing 7 pounds at birth may increase in weight every month according to the function $W(m) = 7(1.11)^m$.

   i. How much will the baby weigh after 1 year?

   ii. When will the baby weigh 18 pounds?

   iii. Determine the monthly rate of growth for this infant.

   iv. Determine the approximate DAILY rate of growth for this infant.

d. A deposit of $1500 in an account pays interest on the balance annually and the account balance is modeled by the function $B(t) = 1500(1.0725)^t$.

   i. Determine the yearly rate of increase of the account balance.

   ii. What is the account balance after 8 years?

   iii. When will the value of the account be double its original value?

(F) Examples : For each question, show your equation and a sketch of your graph

a. A colony of 100,000 ants is infected by a virus and its monthly population is modeled by the following function: $P(m) = 100000(0.88)^m$.
   i. How many ants will be in the colony after 10 months?
   ii. How long will it take to get 25,000 ants in the colony?
   iii. Determine the monthly rate of decrease of ant population.
   iv. Determine the DAILY death rate for the ant colony.

b. A sample of 100 g radioactive plutonium-238 has a half-life of 87.7 years, so it will exponentially decay every year.
   i. Determine the YEARLY decay rate for plutonium.
   ii. What amount will remain after 400 years?
   iii. How long will it take to eliminate 95% of the plutonium?

c. An investment of $150,000 in an account loses value at a rate of 3.25% annually.
   i. What is the account balance after 5 years?
   ii. When will the value of the account be half its original value?

(G) Homework Links:

http://frontenacss.limestone.on.ca/teachers/dcasey/0F7D449A-00870BC8.23/Exp%20Growth%20Decay%20Word%20Probs.pdf