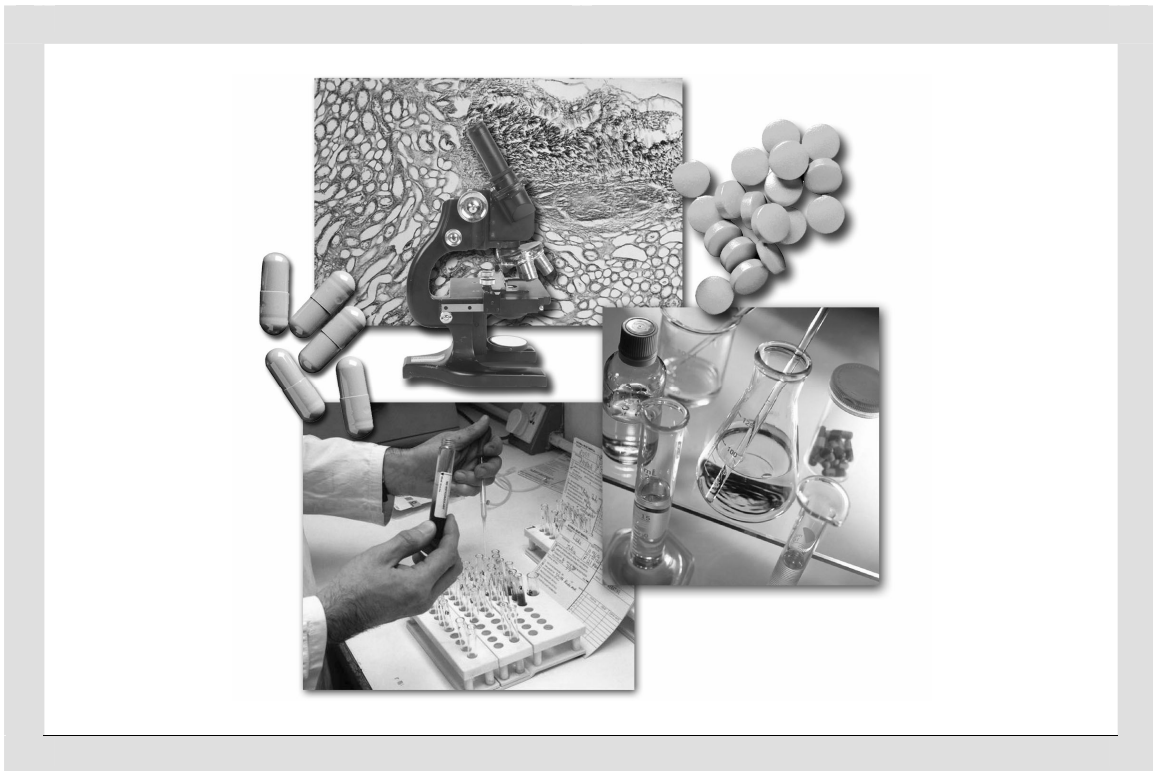


*Pure Mathematics 30*

**Teacher Notes:  
Applications of  
Exponential Functions**



**September 2006**

Distribution: This document is posted on the Alberta Education web site at [www.education.gov.ab.ca](http://www.education.gov.ab.ca).

Copyright 2006, the Crown in Right of Alberta, as represented by the Minister of Education, Alberta Education, Learner Assessment, 44 Capital Boulevard, 10044 108 Street NW, Edmonton, Alberta T5J 5E6, and its licensors. All rights reserved.

**Special permission** is granted to **Alberta educators only** to reproduce, for educational purposes and on a non-profit basis, parts of this document that do **not** contain excerpted material.

Excerpted material in this document **shall not** be reproduced without the written permission of the original publisher (see credits, where applicable).

# *Pure Mathematics 30*

## *Applications of Exponential Functions —Teacher Notes*

### *Introduction*

The following project related to exponential growth allows students to use their knowledge from the Exponents, Logarithms, and Geometric Series unit and the Statistics unit. It is designed to be completed in three to five hours of student time. The use of this project is optional; however, if you do choose to use it, you may include it as part of your assessment. Sample solutions for the project questions can be found on the Alberta Education extranet <https://phoenix.edc.gov.ab.ca>. A hard copy will be mailed to your school in August 2006. The general scoring guide for the project is the same as the one issued in September 2000.

The first written-response question, which is worth 10%, on the Pure Mathematics 30 January 2007 Diploma Examination will be related to this project. Students who do not complete the project but who have completed the course will have the knowledge to answer the written-response question; however, students who do complete this project will gain experience with the related mathematical skills.

### *Specific Notes*

Teachers may want to

- discuss why rounding down to the nearest whole number is appropriate as the values used are approximate and the number of bacteria represent discrete data. Students may choose to round data down after each hour, or at the end of each cycle. Both methods are acceptable.

## ***Program of Studies***

The project relates to mathematics learned in the following units of Pure Mathematics 30.

### ***Exponents, Logarithms, and Geometric Series***

- Specific Outcomes:**
- 2.1 Derive and apply expressions to represent general terms and sums for geometric growth and to solve problems. [CN, R, T]
  - 2.2 Connect geometric sequences to exponential functions over the natural numbers. [E, R, V]
  - 2.4 Use the laws of exponents and logarithms to:
    - solve and verify exponential equations and identities
    - solve logarithmic equations
    - simplify logarithmic expressions [R]
  - 2.6 Model, graph, and apply exponential functions to solve problems. [PS, T, V]
  - 2.7 Change functions from exponential form to logarithmic form and vice versa. [CN]
  - 2.8 Use logarithms to model practical problems. [CN, PS, V]
  - 2.10 Graph and analyze logarithmic functions with and without technology. [R, T, V]

### ***Statistics***

- Specific Outcome:**
- 6.3 Use z-scores to solve problems related to the normal distribution. [PS, R, T, V]

## ***ICT Program of Studies***

***C.1—Students will access, use, and communicate information from a variety of technologies.***

**Specific Outcome:** 4.2: Select information from appropriate sources, including primary and secondary sources.

***C.6—Students will use technology to investigate and/or solve problems.***

**Specific Outcomes:** 4.1: Investigate and solve problems of prediction, calculation, and inference.

4.2: Investigate and solve problems of organization and manipulation of information.

4.3: Manipulate data by using charting and graphing technologies in order to test inferences and probabilities.

***P.2—Students will organize and manipulate data.***

**Specific Outcome:** 4.1: Manipulate and present data through the selection of appropriate tools, such as scientific instrumentation, calculators, databases, and/or spreadsheets.

## ***Mathematical Processes***

The seven mathematical processes identified in the *Program of Studies* are addressed in this project in the following manner.

**Communication:** Explain why the graph of  $L_3$  as a function of  $L_1$  is a certain type of graph. Explain why a particular administration of an antibiotic will not result in a cure.

**Connections:** Relate mathematics to real-life situations and connect different units within Pure Mathematics 30. The study of *E. coli* bacteria is related to biology. The administration of antibiotics is related to biology, pharmacology, and medicine.

### **Estimation and**

**Mental Mathematics:** Check reasonableness of calculations and claims.

**Problem Solving:** Compare graphs of exponential functions to logarithmic functions and determine the relationship between the functions.

**Reasoning:** Decide which form of an equation best represents the data. Decide why the graph of  $L_3$  as a function of  $L_1$  is a certain type of graph.

**Technology:** Use a spreadsheet and/or a graphing calculator to solve and display problems. Create graphs using different lists as data. Perform regression analysis on data to generate equations.

**Visualization:** Visualize the shape of an exponential growth curve before creating it. Visually recognize the type of graph created by graphing  $L_3$  as a function of  $L_1$ .