

Models of Exponential Growth

Overall Expectations

- EGV.01** · demonstrate an understanding of the nature of exponential growth;
- EGV.02** · describe the mathematical properties of exponential functions;
- EGV.03** · manipulate expressions related to exponential functions.

Understanding the Nature of Exponential Growth

- EG1.01** – describe the significance of exponential growth or decay within the context of applications represented by various mathematical models (e.g., tables of values, graphs, equations);
- EG1.02** – compare the effects of exponential growth within a context (e.g., interest earned, population size) with the effects of linear or quadratic growth within the same context;
- EG1.03** – pose and solve problems related to models of exponential functions drawn from a variety of applications, and communicate the solutions with clarity and justification.

Describing the Mathematical Properties of Exponential Functions

- EG2.01** – sketch the graphs of simple exponential functions, given their equations [e.g., those with equations $y = 2^x$, $y = 10^x$, $y = (1/2)^x$], without using technology;
- EG2.02** – compare the rates of change of different types of functions (e.g., those with equations $y = 2x$, $y = x^2$, $y = 2^x$);
- EG2.03** – identify, through investigations, using graphing calculators or graphing software, the key properties of exponential functions with equations of the form $y = a^x$ ($a > 0$, $a \neq 1$) and their graphs (e.g., the domain is the set of the real numbers; the range is the set of the positive real numbers; the function either increases or decreases throughout its domain; the graph has the x-axis as an asymptote and has y-intercept = 1).

Manipulating Expressions

- EG3.01** – demonstrate the quick recall or calculation of simple powers of natural numbers (e.g., 2^8 , 6^3 , 5^4 , 20^2), without using technology;
- EG3.02** – evaluate simple numerical expressions involving rational exponents, without using technology;
- EG3.03** – evaluate numerical expressions involving negative and decimal exponents, using scientific calculators;
- EG3.04** – simplify algebraic expressions involving integral exponents, using the laws of exponents;
- EG3.05** – solve exponential equations involving common bases (e.g., $2^x = 32$, $4^{5x-1} = 4^{x+11}$, $3^{5x+8} = 27^x$).

Applications of Compound Interest and Annuities

Overall Expectations

- CIV.01** · solve problems involving arithmetic and geometric sequences and series;
- CIV.02** · solve problems involving compound interest and annuities;
- CIV.03** · demonstrate an understanding of the effect on investment and borrowing of compounding interest.

Solving Problems Involving Arithmetic and Geometric Sequences and Series

- CI1.01** – determine terms that follow three or more given terms in a sequence;
- CI1.02** – determine whether a sequence is arithmetic or geometric, or neither;
- CI1.03** – solve problems related to the formulas for the nth term and the sum of n terms of arithmetic and geometric sequences and series.

Solving Problems Involving Compound Interest and Annuities

- CI2.01** – solve problems involving the calculation of any variable in the simple-interest formula ($I = Prt$), using scientific calculators;
- CI2.02** – solve problems involving the calculation of the amount (A) and the principal (P) in the compound-interest formula $A = P(1 + i)^n$, using scientific calculators;
- CI2.03** – solve problems involving the calculation of the interest rate per period (i) and the number of periods (n) in the compound-interest formula $A = P(1 + i)^n$, using a spreadsheet;
- CI2.04** – solve problems involving the calculation of the amount and the regular payment in the formula for the amount of an ordinary annuity, using scientific calculators;
- CI2.05** – solve problems involving the calculation of the present value and the regular payment in the formula for the present value of an ordinary annuity, using scientific calculators;
- CI2.06** – demonstrate an understanding of the relationships between simple interest, arithmetic sequences, and linear growth;
- CI2.07** – demonstrate an understanding of the relationships between compound interest, geometric sequences, and exponential growth.

Understanding the Effect of Compounding

- CI3.01** – determine, through investigation, the characteristics of various savings alternatives available from a financial institution (e.g., savings accounts, GICs);
- CI3.02** – determine the effect of compound interest on deposits made into savings accounts (e.g., determine the doubling period of a single deposit; demonstrate the effect of saving a small amount on a regular basis; compare the effects of different compounding periods);
- CI3.03** – determine, through investigation, the properties of a variety of investment alternatives (e.g., stocks, bonds, mutual funds, real estate), and compare the alternatives from the point of view of risk versus return;
- CI3.04** – demonstrate, through calculation, the advantages of early deposits to long-term savings plans (e.g., compare the results of making an annual deposit of \$1000 to an RRSP, beginning at age 20, with the results of making an annual deposit of \$3000, beginning at age 50);
- CI3.05** – identify the common terminology and features associated with mortgages;
- CI3.06** – describe the manner in which interest is usually calculated on a mortgage (i.e., compounded semi-annually but calculated monthly) and compare this with the method of interest compounded monthly and calculated monthly;
- CI3.07** – generate an amortization table for a mortgage, using a spreadsheet or other appropriate software;
- CI3.08** – calculate the total amount of interest paid over the life of a mortgage, using a spreadsheet or other appropriate software, and compare the amount with the original principal of the mortgage or value of the property;
- CI3.09** – compare the effects of various payment periods, payment amounts, and interest rates on the length of time needed to pay off a mortgage;
- CI3.10** – demonstrate, through calculations, using technology, the effect on interest paid of retiring a loan before it is due;
- CI3.11** – determine, through investigation, the features of various credit and debit cards;
- CI3.12** – demonstrate, using technology, the effects of delayed payment on a credit card balance, on the basis of current credit card rates and regulations;
- CI3.13** – calculate the cost of borrowing to purchase a costly item (e.g., a car, a stereo);

- CI3.14** – design an effective financial plan to facilitate the achievement of a long-term goal (e.g., attending college, purchasing a car, moving into an apartment, purchasing a house, establishing a small business).

Personal Financial Decisions

Overall Expectations

- PFV.01** – demonstrate an understanding of the costs involved in owning and operating a vehicle;
- PFV.02** – determine, through investigation, the relative costs of renting an apartment and buying a house;
- PFV.03** – design effective personal and household budgets for individuals and families described in case studies;
- PFV.04** – demonstrate the ability to make informed decisions involving life situations;
- PFV.05** – apply decision making in the investigation of career opportunities.

Owning and Operating a Vehicle

- PF1.01** – identify the procedures, costs, advantages, and disadvantages involved in buying a new vehicle and a used vehicle;
- PF1.02** – compare the costs involved in buying versus leasing the same vehicle;
- PF1.03** – calculate the fixed and variable costs involved in owning and operating a vehicle (e.g., the licence fee, insurance, maintenance);
- PF1.04** – determine, through investigation, the cost of purchasing or leasing a chosen new vehicle or purchasing a chosen used vehicle, including financing.

Renting or Buying Accommodation

- PF2.01** – collect, organize, and analyse data involving the costs of various kinds of accommodation in the community;
- PF2.02** – compare the costs of maintaining an apartment with the costs of maintaining a house;
- PF2.03** – compare the advantages and disadvantages of renting accommodation with the advantages and disadvantages of buying accommodation;
- PF2.04** – summarize the findings of investigations in effective presentations, blending written and visual forms.

Designing Budgets

- PF3.01** – describe and estimate the living costs involved for different family groupings (e.g., a family of four, including two young children; a single young person; a single parent with one child);
- PF3.02** – design a budget suitable for a family described in a given case study, reflecting the current costs of common items (e.g., interest rates, utility rates, rents), using technology (e.g., spreadsheets, budgeting software, the Internet);
- PF3.03** – explain and justify budgets, using appropriate mathematical forms (e.g., written explanations, charts, tables, graphs, calculations);
- PF3.04** – determine the effect on an overall budget of changing one component, using a spreadsheet or budgeting software.

Making Informed Decisions

- PF4.01** – describe a decision involving a choice between alternatives (e.g., Which program should I study at college? What car should I buy? Should I stay at home or rent an apartment?);
- PF4.02** – collect relevant information related to the alternatives to be considered in making a decision;
- PF4.03** – summarize the advantages and disadvantages of the alternatives to a decision, using lists and organization charts;

- PF4.04** – compare alternatives by rating and ranking information and by applying mathematical calculations and analysis, as appropriate (e.g., calculating loan payments or interest rates; constructing graphs or tables), using technology;
- PF4.05** – explain the process used in making a decision and justify the conclusions reached;
- PF4.06** – identify the advantages and disadvantages to the purchaser of various types of selling (e.g., retail store, catalogue, telemarketing, multilevel marketing, Internet) and techniques of selling (the use of loss leaders, the use of incentives such as coupons or Air Miles);
- PF4.07** – compare the value of the Canadian dollar with the values of foreign currencies over a period of time and identify possible effects on purchasing and travel decisions.

Investigating Career Opportunities

- PF5.01** – identify the advantages and disadvantages of a variety of occupations of personal interest;
- PF5.02** – compare the expected income for a variety of occupations with the costs of the education or training required;
- PF5.03** – analyse employment trends to identify some occupations that are in high demand, and identify the skills required and the education paths recommended in order to qualify for these occupations.