

Section 8.5 Exponential Functions

- 1) Consider the following exponential functions. For each, determine whether they represent growth or decay, state their initial value and their rate of growth or decay. Sketch a graph for each.

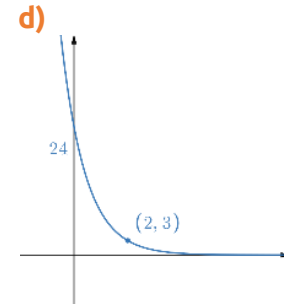
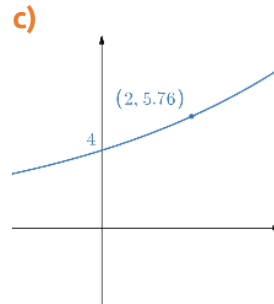
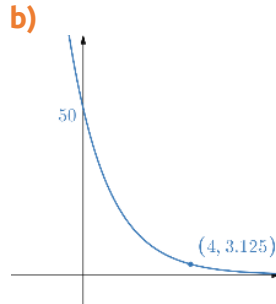
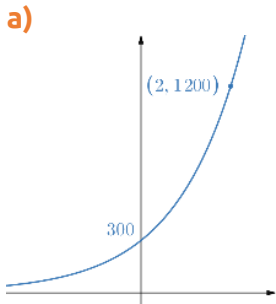
a) $P(x) = 200(1.17)^x$

b) $m(t) = 0.5(1.008)^t$

c) $x(p) = 45000(0.8)^p$

d) $f(x) = -(1.5)^x$

- 2) Assuming the graphs below represent exponential growth or decay, give a possible formula for the functions each graph would represent.



- 3) The following functions are used to project the population size (in thousands) of three municipalities in t years from now.

A. $P(t) = 625(1.06)^t$

B. $P(t) = 43(1.13)^t$

C. $P(t) = 1187(0.98)^t$

D. $P(t) = 12(0.87)^t$

- a) Which of the municipalities have the highest percent growth rate and what is the rate?
 b) Which of the municipalities has the largest population today and what is the size of their population?
 c) Are any of the municipalities projecting a decrease in population and at what rate?
- 4) The Consumer Price Index (CPI) is used as an indicator for inflation, or the change in consumer's purchasing power over time. Bank of Canada's monetary policies are aimed at keeping the inflation close to 2%. If in 2002 the CPI was valued at 100, write the formula for the CPI function $I(t)$, where t is years since 2002, which has CPI increasing by 2% per year. Using this model, what would be the expected CPI for year 2020?

Compare your result with the actual CPI for 2020 using Statistics Canada's CPI data (Statistics Canada, [Consumer Price Index, annual average, not seasonally adjusted](#)). How close are the projection and the actual CPI and what could account for difference, if any?

- 5) The data on global revenues from consumer electronic sales shows 3.5% year-over-year increase. If the global consumer electronic revenues were \$850 million in 2012, determine the function modeling the global revenues (in millions of dollars) t years from 2012 and estimate the global revenue from the sales in 2025.
- 6) A soil decontamination company bidding on a contract with a municipality to clean up an abandoned industrial site estimates that the percentage of soil contamination will decrease by 15% with each \$1000 increase in cost. Write the function $p(x)$ that describes the percentage of soil contamination (measured in %) at the cost of x thousand dollars if the current, pre-cleanup, contamination is estimated to be 65%.
- 7) One insurance broker is maintaining an increase of two new clients per day while their colleague is maintaining a daily increase of two percent in the number of new clients. They both started with 10 clients. Determine the function for each that describes the number

of clients they have after t days. Use a graphing calculator (desmos.com, for example), to graph the number of clients after t days for each of the brokers and examine which of the brokers has more clients over time. When will they have the same number of clients?

- 8) In their desire to increase profits, a multinational company's financial analyst determined that the company needs to reduce their current costs of \$375 million by 0.8% annually to reach their long-term objectives. Describe the costs $C(t)$ as a function of time (in years from now) that would meet the objective. What should their costs be in five years?
- 9) For each of the following, determine the function $A(t)$ that describes the return on an investment of \$2300 in t years with interest rate of 1.5%
 - a) compounded monthly
 - b) compounded quarterly
 - c) compounded continuously
- 10) For each of the following, determine the function $I(t)$ that describes the interest in t years owed on a loan in the amount of \$23,000 with interest rate of 2.57%
 - a) compounded monthly
 - b) compounded quarterly
 - c) compounded continuously
- 11) Suppose \$5000 is invested in an account earning interest at 4.5% annual rate. How much is in the account after 8 years if the interest is compounded
 - a) annually
 - b) continuously
- 12) If you need \$10,000 in 5 years for a deposit on a house purchase and you can invest today into an account earning 3.6% annually, compounded monthly, how much would you have to invest today to reach your objective?
- 13) You want to invest into a Registered Education Savings Plan for your newly born child using a Certificate of Deposit (CD). You have two options: monthly compounding at 2.156% or continuous compounding at 2.155%. Which of the two will be a better option 18 years from now?
- 14) A local restaurant estimates that weekly sales s and weekly advertising costs x (both in dollars) are related by

$$s(x) = 14,000 - 13,000e^{-0.0006x}$$

- a) Determine the sales if no investment is made in advertising.
 - b) What should they expect in weekly sales if they invest \$2,000 per week in advertising?
- 15) Using the data from the [2019 Communication Monitoring Report](#), LTE (wireless broadband) population coverage (%) in Canadian rural communities since 2013 can be modeled by

$$w(t) = -61.836(0.412656)^t + 96.9666$$

where t is years since 2013. Interpret all of the components in this model by briefly explaining what each represents. Estimate the Canadian rural community LTE population coverage and the rate of change in the coverage in 2021 and interpret your results.