

Introduction to Exponential Functions

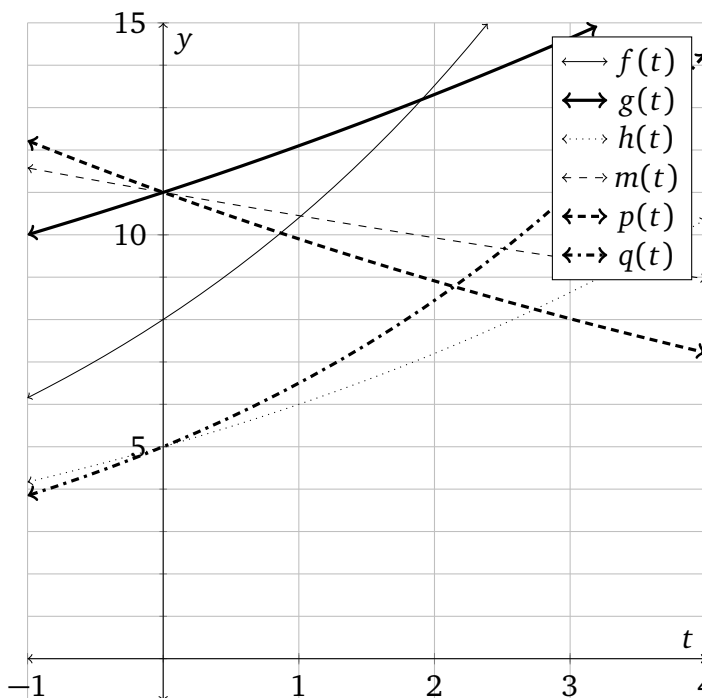
In these exercises, we will practice with the basic vocabulary, formulas, and graph shapes for exponential functions.

1. Write a formula for an exponential function to model these situations.

- a) You have an overdue library book. The initial fine was \$0.50, but that fine collect 1% interest each week. What are the relative growth rate and the growth factor per week? Write a formula for the the function that computes your debt to the library t weeks after the due date.
- b) A bucket of 8 nonnative fish was dumped into a lake, and the population of these fish begins to double each month. What are the relative growth rate and the growth factor per month? Write a formula for the the function that computes the population t months after the dumping.
- c) The rain forest square mileage is shrinking by 15% per decade. What is the relative growth rate and the growth factor per decade? Write a formula that computes the square mileage of rain forest t decades from now, assuming that right now the square footage is A_0 .
- d) A stock initially valued at \$50 increases by 10% each month for 10 months, and then decreases by 10% each month for 10 months. How much is it worth now? (Hint: first consider an exponential growth function, see where you are 10 months later, and then reset the initial value and consider an exponential *decay* function.)
- e) Assume that inflation makes prices rise by 3.5% per year. If a dozen eggs cost \$2 in 2000, what will a dozen eggs cost in 2020? (Assume that inflation is the only factor influencing price change.) What is the one-decade inflation rate?

2. Without using a graphing calculator, match each exponential function with its graph. Use what you can see in the formulas about growth factors and initial values.

- (a) $5(1.3)^t$
- (b) $5(1.2)^t$
- (c) $8(1.3)^t$
- (d) $11(0.9)^t$
- (e) $11(0.95)^t$
- (f) $11(1.1)^t$



3. Here are some exponential functions. Identify the initial value, the growth factor per unit t , and the relative growth rate per unit t . In the case of the relative growth rate, express it as a percentage.

a) $Q(t) = 50.3(1.183)^t$

b) $g(x) = 0.0123(1.0004)^x$

c) $h(t) = 22(0.813)^t$

d) $M(t) = 1145\left(\frac{3}{8}\right)^t$

4. The value V of an investment in year t is given by $V = 2500(1.0325)^t$. Describe this investment to a person on the street in everyday English. (What was the initial investment, and what yearly interest rate is the investment earning?)
5. When you drink a cup of coffee, you ingest about 100mg of caffeine. Every hour, approximately 16% of the caffeine is removed from your body through metabolic processes. Write a formula for the amount of caffeine in your body t hours after you drink a cup. How much is left after 3 hours? About how long until there is only 10mg left in your body? (Use a calculator to help.) What is the one-day decay rate for caffeine in your body?