Section 5.1

(96) Use $f(x) = 3x + 1$ and $g(x) = \frac{1}{1-x}$ to evaluate each expression symbolically.

(a) $(f+g)(2)$

(b) $(f \cdot g)(-1)$

(c) $(f/g)(1)$

(d) $(f \circ g)(4)$

(97) Use the table to evaluate each expression, if possible.

x	0	1	2	3
$f(x)$	4	3	0	1
$g(x)$	3	2	1	0

(a) $(f+g)(0)$

(b) $(f \cdot g)(1)$

(c) $(f/g)(2)$

(d) $(f \circ g)(3)$

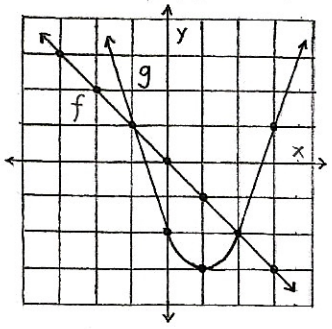
(98) Use the graph to evaluate each expression.

(a) $(f+g)(0)$

(b) $(f \cdot g)(1)$

(c) $(f/g)(2)$

(d) $(f \circ g)(3)$



(99) For $f(x) = \frac{3}{x-1}$ and $g(x) = \frac{1}{4x}$:

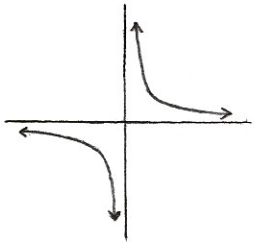
(a) Find $(f+g)(x)$, $(f \cdot g)(x)$ and $(f/g)(x)$.

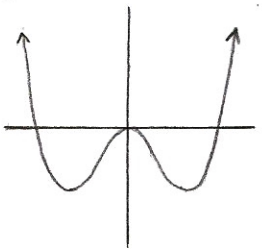
(b) Find the domains in (a).

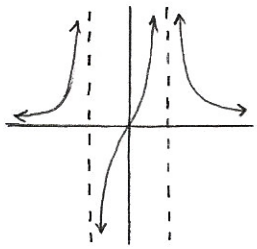
(100) Use the functions in Exercise 99 to find $(f \circ g)(x)$ and its domain.

Section 5.2

(101) Use the horizontal line test to determine whether the function is one-to-one.

(a) 

(b) 

(c) 

(102) Determine if f is one-to-one. Justify your answer.

(a) $f(x) = x^3 + 1$ (b) $f(x) = x^3 - 2x$ (c) $f(x) = x^{2/3}$

(103) Use the graph in Exercise 98 to evaluate:

(a) $f^{-1}(2)$

(b) $f^{-1}(-2)$

(c) $(f^{-1} \circ g)(3)$

(d) $(f \circ f^{-1})(-1)$

(104) Find $f^{-1}(x)$ for the given function.

(a) $f(x) = \dfrac{2x-1}{3}$ (b) $f(x) = 1 - 5x^3$

(105) For $f(x) = \dfrac{2}{x-5}$: (a) find $f^{-1}(x)$ and (b) identify the domain and range of f^{-1}.

Section 5.3

(106) Sketch a graph of $y = f(x)$.

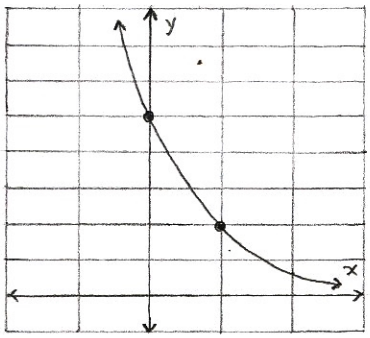
(a) $f(x) = 4^x$ (b) $f(x) = \left(\frac{1}{4}\right)^x$

(107) Find C and a so that $f(x) = Ca^x$ satisfies the given conditions.

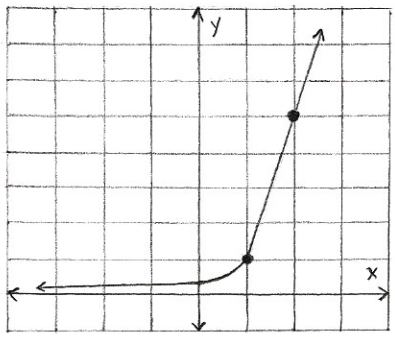
(a) $f(0) = \frac{3}{2}$, $f(-1) = 12$ (b) $f(1) = 18$, $f(-1) = 2$

(108) Use the graph of $y = Ca^x$ to determine values for C and a.

(a)



(b)



(109) Use the compound interest formula to approximate the future value of each amount.

(a) \$1,500 at 1.2% compounded monthly for 10 years.

(b) \$20,000 at 5% compounded daily for 25 years.

(c) \$20,000 at 5% compounded continuously for 25 years.

(110) The half-life for a Facebook post is 90 minutes (1.5 hrs). Write an exponential function F that gives the percentage of engagements remaining on a typical Facebook link after t hours. Estimate this percentage after 5 hours.

Section 5.4

In Exercises 111-112, convert the given equation as indicated.

(111) $\log_a(x-1) = 3$ (to exponential form)

(112) $a^{10x} = 2$ (to logarithmic form)

In Exercises 113-115, solve each logarithmic equation <u>algebraically</u>. *Round to 4 decimal places when appropriate.*

(113) $\log_3 x = 4$ (114) $\log 4x = 1$ (115) $\ln x = -3$

In Exercises 116-118, solve each exponential equation <u>algebraically</u>. *Round to 4 decimal places when appropriate.*

(116) $2^x = 7$ (117) $10^{4x} = 3$ (118) $e^x = 0.9$

(119) For $f(x) = \ln(x+1) - 2$, find its vertical asymptote, domain, two "identity" points and all intercepts. Then sketch the graph.

(120) The barometric air pressure in inches of mercury at a distance of x miles from the eye of a severe hurricane is modeled by $f(x) = 0.48 \ln(x+1) + 27$.

(a) Evaluate $f(10)$ and interpret your result.

(b) At what distance from the eye is the air pressure 27.5 inches of mercury?

Section 5.5

(121) Combine as a single logarithm and, if possible, simplify.

(a) $\frac{1}{2}\ln x + 3\ln y - 2\ln z$ (b) $\log(x^2-9) - \log(x-3)$

(122) Express in terms of sums and differences of logarithms.

(a) $\log\left(\frac{x^3y^9}{z}\right)^{2/3}$ (b) $\ln\frac{\sqrt{x+1}}{(x-3)^2}$

(123) The function describing loudness is $D(x) = 160 + 10\log x$, where x is the intensity of the sound (in watts/m^2) and $D(x)$ is the loudness (in decibels). According to the National Institute of Deafness and Other Communication Disorders, prolonged exposure to sounds of 85 dB or more can cause damage to your hearing. What is the intensity of the noise? Round your answer to 8 decimal places.

Section 5.6

In Exercises 124-127, solve the given equation algebraically.

(124) $3^{2x+1} = 3^{5-x}$

(125) $3^{2x+1} = e^x$

(126) $\ln(3-2x) = 2\ln x$

(127) $\log_9 2x + \log_9(x-\frac{5}{2}) = \frac{1}{2}$

(128) Solve the following reducible quadratic equations. Express answers in exact form.

(a) $e^{2x} - 7e^x + 10 = 0$ (b) $\ln^2 x + 2\ln x - 8 = 0$

(129) \$10,000 is invested at an interest rate of 7.25% per year, compounded continuously.

(a) Find the doubling time.

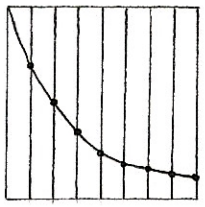
(b) How long will it take for the investment to grow to \$12,000?

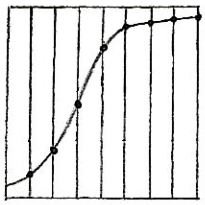
(130) The percentage P of radioactive carbon-14 remaining in a fossil after t years is $P(t) = 100\left(\frac{1}{2}\right)^{t/5700}$. Suppose scientists discover bone fragments that had lost 80% of their carbon-14. How old were the bone fragments at the time of the discovery?

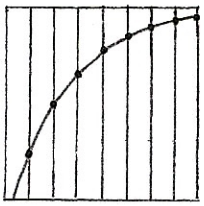
(Hint: Remaining carbon-14 is 100% - 80% = 20%.)

Section 5.7

(131) Decide whether the exponential, logarithmic or logistic model best describes the following fitted scatterplots.

(a) 

(b) 

(c) 

(132) Make a scatterplot of the data. Then find an exponential, logarithmic or logistic function f that best models the data. *(Hint: Use R^2 when deciding between the exponential and logarithmic models.)*

(a)

x	0	1	2	3	4
y	0.7	7.5	14.3	15	15.1

(b)

x	1	2	3	4	5
y	9	5.5	3.5	2.1	1

(133) In a town whose population is 3500, a disease creates an epidemic. The number of people N infected t days after the disease has begun is given by the function:

$$N(t) = \frac{3500}{1 + 19.9\,e^{-0.6t}}.$$

(a) How many are initially infected with the disease ($t = 0$)?

(b) Find the number of infected after 2 days and 7 days.

(c) When will 90% of the population be infected?

(134) Near New Guinea there is a relationship between the number of bird species found on an island and the size of the island. The table lists the number of species of birds y found on an island with an area of x square kilometers.

x (km^2)	0.1	1	10	100	1000
y (species)	10	15	20	25	30

(a) Find a function f that models the data. Write it down.

(b) Predict the number of bird species on an island of 5000 km^2.

(c) If there are 50 bird species on an island, how many square kilometers would you expect the island to be?

(135) The Center for Unexplained Phenomena tracks UFO sightings worldwide. The following table represents sightings for selected years since 1950.

x	1950	1965	1980	1995	2010
f(x)	2500	833	270	93	31

(a) Find an exponential or logarithmic function f that models the data, where $x = 1$ corresponds to 1950, $x = 2$ corresponds to 1965, and so on. Justify your answer. Round to 2 decimal places.

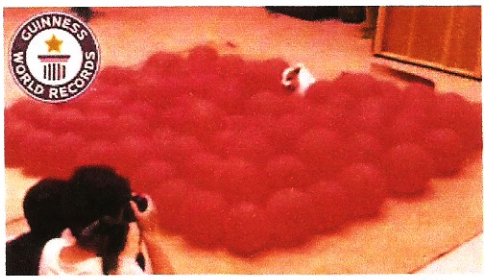
(b) During what year did sightings total 100?

(c) Extrapolate sightings in 2025.

(135+)

The Balloon Popping Dog*

In 2014 a Jack Russell Terrier from California named Twinkie set a world record for the fastest time to pop 100 balloons by a dog



video.chemeketa.edu/media/1_jzdpcq9n

See other file for active link.

Your goal is to create a mathematical model for how quickly Twinkie pops balloons and then use it to make predictions.

To help with that, this video syncs a counter and a timer with the dog's progress.

You should begin with the following:

1. A table of data. Use the video to collect a sufficient number of data points.
2. A graphical representation of your data. Clearly label both axes.
3. * A mathematical model that you think fits the data best. Include a brief explanation of why, out of all the functions we've learned about, you chose that specific type of function. Give the equation for your model and describe what each variable represents.

Then address each of these questions:

4. How many balloons does your model predict Twinkie can pop in 1 minute? 5 minutes? 10 minutes?
5. Using your model, how long would it take Twinkie to pop 500 balloons? 5000 balloons? 50000 balloons?
6. How confident are you in your model? Are the results reasonable? Explain.

Please show your work on a separate piece of paper, using complete sentences when appropriate.

* Include power regression (PwrReg) in your analysis.