https://selldocx.com/products/test-bank-applied-calculus-6e-hugheshallett

1. $f(x)$ is the age of Antarctic ice (in hundreds of years) at a depth of x meters below the surface. Is f increasing or decreasing?

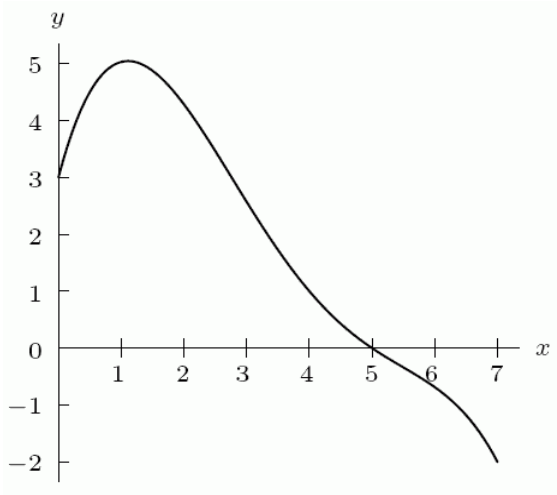
Ans: increasing

Learning Objectives: Understand the properties and terminology of functions: input/output, function notation, intercepts, increasing/decreasing. difficulty: easy
section: 1.1

2. A graph of $y = f(x)$ is given in the following figure.

A. What is $f(0)$ (to the nearest whole number)?

B. What is the range of the function?



Part A: A. 3

Part B: B. $-2 \le y \le 5$

Learning Objectives: Understand the properties and terminology of functions: input/output, function notation, intercepts, increasing/decreasing. difficulty: easy
section: 1.1

3. From the following table,

   A. Find $f(4)$

   B. Find the value(s) of x for which $f(x) = 0$. If there is more than one, list them in increasing order, separated by commas.

x	1	2	3	4	5	6
$f(x)$	0	3	7	6	4	0

Ans: A. 6
B. 1, 6
Learning Objectives: Understand the properties and terminology of functions: input/output, function notation, intercepts, increasing/decreasing.
difficulty: medium section: 1.1

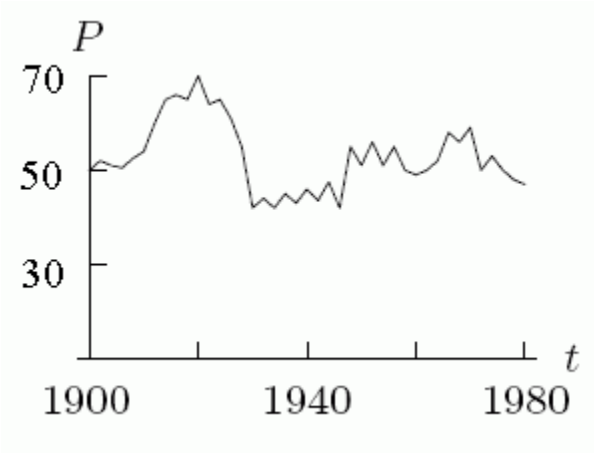
4. Let $y = f(x) = 2x^2 - 1$.

   A. Find the value of y when x is zero.

   B. Find $f(3)$.

Ans: A. –1
B. 17
Learning Objectives: Understand the properties and terminology of functions: input/output, function notation, intercepts, increasing/decreasing.
difficulty: medium section: 1.1

5. The empirical function $P = g(t)$ graphed below represents the population P of a city (in thousands of people) at time t. The _____ of the function is from 1900 to 1980, and the _____ of the function is from approximately 35,000 to 70,000 people.



Ans: domain
range
Learning Objectives: Understand the properties and terminology of functions: input/output, function notation, intercepts, increasing/decreasing.
difficulty: medium section: 1.1

6. Could the following table represent a linear function? Answer yes or no.

t	0	1	2	3
d	0	15	30	45

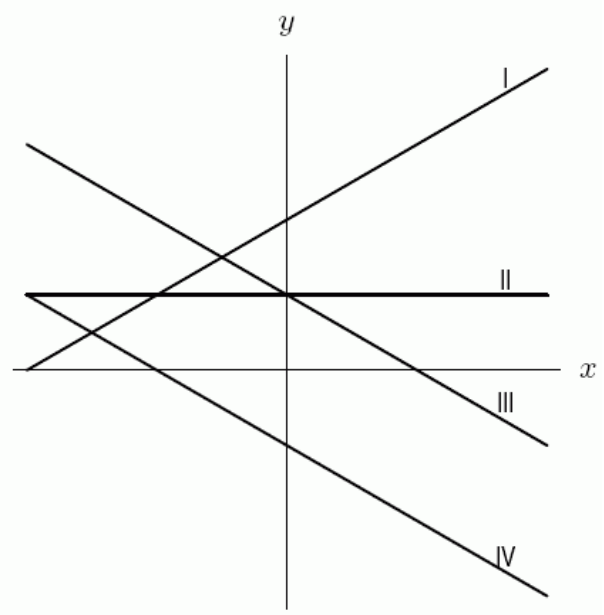
Ans: yes
Learning Objectives: Build linear functions from data, words, or graphs.
difficulty: easy section: 1.2

7. A. Which two lines in the following figure have the same slope? Enter your answer as "I and II," etc.

   B. Which two lines have the same y-intercept?

   C. Which line has the largest slope?

   D. Which line has the largest y-intercept?



Ans: A. III and IV
B. II and III
C. I
D. I
Learning Objectives: Interpret properties of linear functions: slope, intercepts.
difficulty: easy section: 1.2

8. The average weight in pounds of American men in their sixties (in 1979) as a function of their heights in inches is given in the following table. The formula that expresses the weight w in terms of the height h is given by $w =$ _____+_____h

height (h)	68	69	70	71	72	73
weight (w)	164	170	176	182	188	194

Part A: –244
Part B: 6
Learning Objectives: Build linear functions from data, words, or graphs.
difficulty: medium section: 1.2

9. Suppose that $y = f(t)$ is the distance in miles traveled in t hours by a car moving at 70 miles per hour. Give a formula for the function $f(t)$.

Ans: $f(t) = 70t$

Learning Objectives: Build linear functions from data, words, or graphs.
difficulty: easy section: 1.2

10. Find the value for b in the following table of values for the linear function f.

x	0	5	10	15	20
$f(x)$	10	15	a	b	c

Ans: 25

Learning Objectives: Build linear functions from data, words, or graphs.
difficulty: easy section: 1.2

11. Find a formula for the linear function f.

.

x	0	100	200	300	400
$f(x)$	10	20	?	?	?

A) $f(x) = 0.1x + 10$

B) $f(x) = 100x + 10$

C) $f(x) = 20x + 10$

D) $f(x) = 0.2x + 10$

Ans: A Learning Objectives: Build linear functions from data, words, or graphs.
difficulty: easy section: 1.2

12. A car is worth \$15,000 when it is 1 year old, and it is worth \$8,000 when it is three years old.

A. Write the value of the car, V (in dollars), as a function of the age of the car, a (in years). Assume this is a linear function.

B. How much does the car depreciate in value each year?

C. How much was the car worth when it was first purchased?

Ans: A. $V = 18,500 - 3500a$

B. \$3500

C. \$18,500

Learning Objectives: Interpret properties of linear functions: slope, intercepts.
difficulty: medium section: 1.2

13. The equation of the line through the points (1, 2) and (–1, –4) is:

Ans: $y = -1 + 3x$

Learning Objectives: Understand the properties and terminology of functions: input/output, function notation, intercepts, increasing/decreasing.
difficulty: medium section: 1.2

14. The bill for electricity is $200 when 55 kilowatt hours are used and $300 when 95 kilowatt hours are used.

A. The base cost (without using any electricity) is $_____.

B. Each additional kilowatt hour used costs $_____.

Ans: A. 62.50 B. 2.50

Learning Objectives: Interpret properties of linear functions: slope, intercepts.
difficulty: medium section: 1.2

15. A school library opened in 1980. In January of 2000, they had 33,000 books. One year later, they had 33,240 books. Assume they acquire the same number of books at the start of each month.

A. How many books did they have in January of 2003?

B. How many books did they have in July of 1980?

Ans: A. 33,720
B. 28,320

Learning Objectives: Build linear functions from data, words, or graphs.
difficulty: easy section: 1.2

16. A school library opened in 1980. In January of 2000, they had 16,000 books. One year later, they had 16,840 books. Assuming they acquire the same number of books at the start of each month, give a linear formula for the number of books, N, in the library as a function of the number of years, t, the library has been open.

Ans: $N = -800 + 840t$

Learning Objectives: Build linear functions from data, words, or graphs.
difficulty: easy section: 1.2

17. A furniture moving company charges a fixed amount plus a charge for each pound that they move. A person who shipped 60 pounds of furniture was charged $280, while someone else was charged $610 to ship 170 pounds.

A. Write a function that represents the moving cost, C, in terms of pounds, x, and fixed cost.

B. Suppose the company changes their rates. They increase the per pound charge by $1 but cut the fixed amount they charge by half. What is the new function that represents the new moving cost, D?

C. Will someone who ships 170 pounds pay more or less with the new rates than they would have with the original rates?

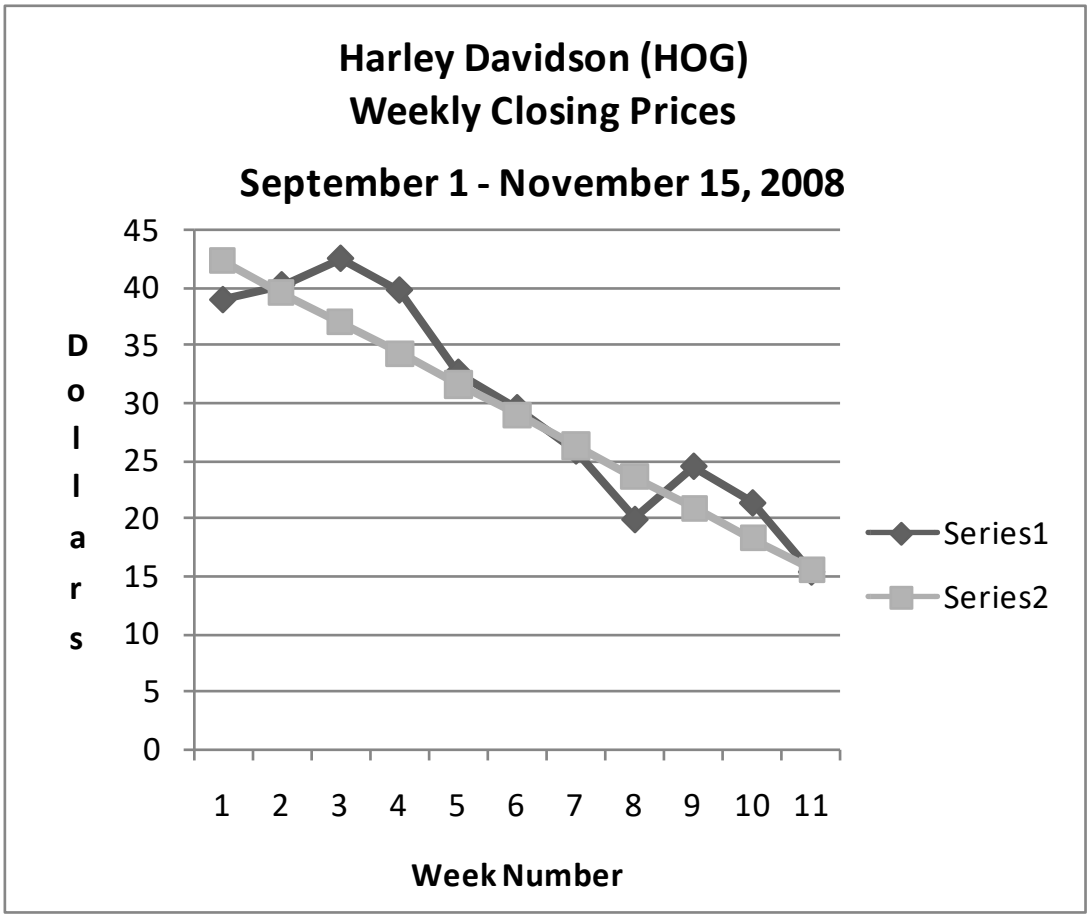
Ans: A. $C = 100 + 3x$

B. $D = 50 + 4x$

C. more

Learning Objectives: Build linear functions from data, words, or graphs.
difficulty: medium section: 1.2

18. Harley Davidson (ticker symbol HOG) stock prices dropped sharply in late 2008. Series 1 in the graph below shows the actual prices at the end of each week. The trend over time is approximately linear; and the graph of a possible linear model is given by Series 2. Based on the data given, find the linear model and use it to approximate the stock's price on November 30, 2008, assuming the current trend continued.



Ans: $y = -2.5x + 45$ and \$12.00, but answers will vary slightly.
Learning Objectives: Build linear functions from data, words, or graphs.
difficulty: easy section: 1.2

19. The height (in inches) and weight (in pounds) of 8 students is given in the following table. Find a regression line for this data and use it to estimate the weight of a person who is 5 feet 1 inches tall. Round to the nearest pound.

Height (inches)	64	68	62	70	69	65	73	71
Weight (pounds)	110	150	115	185	160	125	200	170

Ans: 95
Learning Objectives: Build linear functions from data, words, or graphs.
section: 1.2

20. Do you expect the average rate of change in the number of smart phones in the U.S. since 2000 to be positive or negative?

Ans: positive

Learning Objectives: Understand interpretations of average rate of change on an interval: increasing/decreasing, concavity, slope of secant line, average velocity.
difficulty: easy section: 1.3

21. The population of Los Angeles, California was 2,811,801 in 1970 and was 3,448,613 in 1994. The average rate of change in the population of Los Angeles between 1970 and 1994 was _____ people per year.

Ans: 26,534

Learning Objectives: Find and give units for average rate of change of a function on an interval. difficulty: easy section: 1.3

22. The following table gives the number of students taking an applied calculus course at a community college. Find the change in the number of students taking the course between 2001 and 2004.

Year	1998	1999	2000	2001	2002	2003	2004
students	311	358	383	440	496	574	631

Ans: 191

Learning Objectives: Find and give units for average rate of change of a function on an interval. difficulty: easy section: 1.3

23. The following table gives the number of students taking an applied calculus course at a community college.

A. Find the average rate of change in the number of students taking the course between 2000 and 2004 (in students per year).

B. If the average rate of change continues at the same rate as between 2000 and 2004, in which year will the number of students taking the course first exceed 900?

Year	1998	1999	2000	2001	2002	2003	2004
students	312	360	384	439	487	566	636

Ans: A. 63B. 2009

Learning Objectives: Find and give units for average rate of change of a function on an interval. difficulty: medium section: 1.3

24. The number of reported offenses of violent crime in the U.S. between 1983 and 1996 is given in the following table.

    A. Find the average rate of change between 1983 and 1992 (to the nearest integer).

    B. Find the average rate of change between 1992 and 1996 (to the nearest integer).

Year	Reported offenses
1983	1,258,090
1984	1,273,280
1985	1,328,800
1986	1,489,170
1987	1,484,000
1988	1,566,220
1989	1,646,040
1990	1,820,130
1991	1,911,770
1992	1,932,270
1993	1,926,020
1994	1,857,670
1995	1,798,790
1996	1,682,280

Ans: A. 74,909
B. –62,498
Learning Objectives: Find and give units for average rate of change of a function on an interval. difficulty: medium section: 1.3

25. The total sales of household computers in the U.S., as measured by sales to retail consumer dealers, in millions of dollars, was 2,385 in 1984 and 16,585 in 1997.

    A. Find the average rate of change in sales between 1984 and 1997 (in millions of dollars, to the nearest tenth).

    B. Use your answer to estimate total sales in 2000 (in millions of dollars, to the nearest tenth).

Ans: A. 1092.3
B. 19,861.9
Learning Objectives: Find and give units for average rate of change of a function on an interval. difficulty: medium section: 1.3

26. The distance $d = f(t)$ in feet that a golf ball will fall in t seconds if dropped from a very high tower is given by the formula $f(t) = 16t^2$. Make and label a table or a graph of values of *f(t)* giving distances fallen for the time period $0 \le t \le 8$. Using your table or graph, the change in the height of the golf ball between times $t = 5$ and $t = 7$ is _____ feet, and the average rate of change in the height of the golf ball between times $t = 5$ and t = 7 is____ feet per second.

Part A: 384
Part B: 192

Learning Objectives: Find and give units for average rate of change of a function on an interval. difficulty: medium section: 1.3

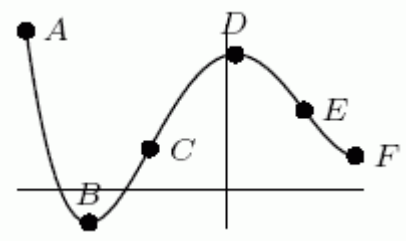
27. Values for *g(x)* are given in the following table. Does it appear that *g(x)* is concave up or concave down?

x	1	2	3	4	5	6
g(x)	–100	–90	–81	–73	–66	–60

Ans: concave down

Learning Objectives: Understand interpretations of average rate of change on an interval: increasing/decreasing, concavity, slope of secant line, average velocity. difficulty: easy section: 1.3

28. Consider the following graph. Between point A and point B, the graph is: (mark all that apply)



A) decreasing
B) increasing
C) concave up
D) concave down

Ans: A, C Learning Objectives: Understand interpretations of average rate of change on an interval: increasing/decreasing, concavity, slope of secant line, average velocity. difficulty: easy section: 1.3

29. Find the average rate of change of $s(t) = -9.8t^2 + 80t - 14$ between $t = 1$ and $t = 3$. Round to two decimal places.

A) 40.80
B) 81.60
C) 120.8
D) 43.92

Ans: A Learning Objectives: Find and give units for average rate of change of a function on an interval. difficulty: medium section: 1.3

30. The table gives information about the number of cases of pancreatic cancer diagnosed in the United States.

Year	1997	2002	2004
Number of cases	27,000	30,300	31,860

a) Find the average rate of change in number of cases from 1997 to 2002.

b) Find the average rate of change in number of cases from 2002 to 2004.

c) Is the average rate of change increasing or decreasing?

Ans: A) 660 cases per year

B) 780 cases per year

C) increasing

Learning Objectives: Find and give units for average rate of change of a function on an interval. difficulty: medium section: 1.3

31. Values of a linear cost function are given in the following table. Find a formula for the cost function.

q	0	100	200	300
$C(q)$	140	225	310	395

Ans: $C(q) = 0.85q + 140$

Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: hard section: 1.4

32. A textbook company had fixed costs of \$15,000 and variable costs of \$20 for a certain book. The company sells the books for \$30 each. Find a formula for the profit function, $\pi(q)$.

Ans: $\pi(q) = 10q - 15,000$

Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: medium section: 1.4

33. A textbook company had fixed costs of \$15,000 and variable costs of \$20 for a certain book. The company sells the books for \$40 each. What is the break-even point for the company (to the nearest book)?

Ans: 750

Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: hard section: 1.4

34. A \$3000 pump depreciates linearly . It is worth \$2200 in 4 years. Find a formula for the value of the pump, *V*, as a function of time, *t* (in years) since it was purchased.

Ans: $V(t) = 3000 - 200t$

Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: medium section: 1.4

35. A \$2000 pump depreciates linearly. It is worth \$1200 in 4 years. How many years will it be before the pump is worth nothing?

Ans: 10

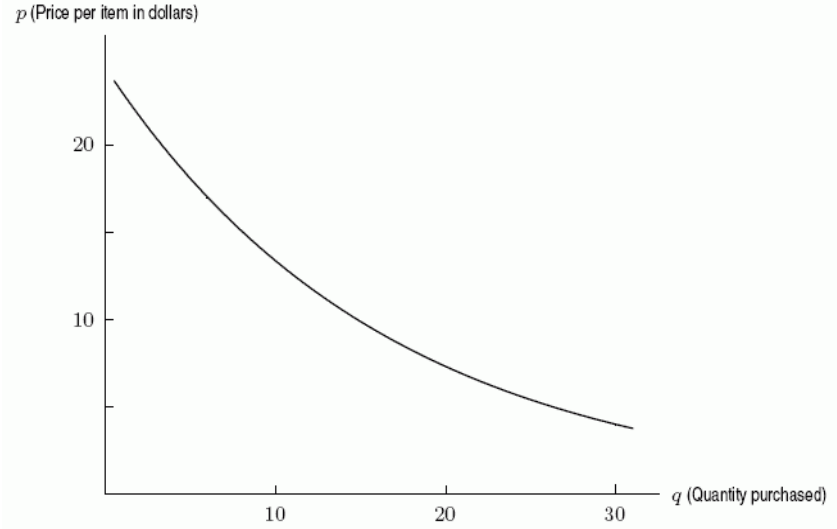
Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: medium section: 1.4

36. A premium ice cream company finds that at a price of \$5.50, demand for their ice cream cones is 2500. For each \$0.25 increase in price, the demand decreases by 50. Graph the revenue function and find the price that will maximize revenue.

Ans: \$9.00

Learning Objectives: Understand economic applications to supply and demand, taxation, budget constraints. difficulty: medium section: 1.4

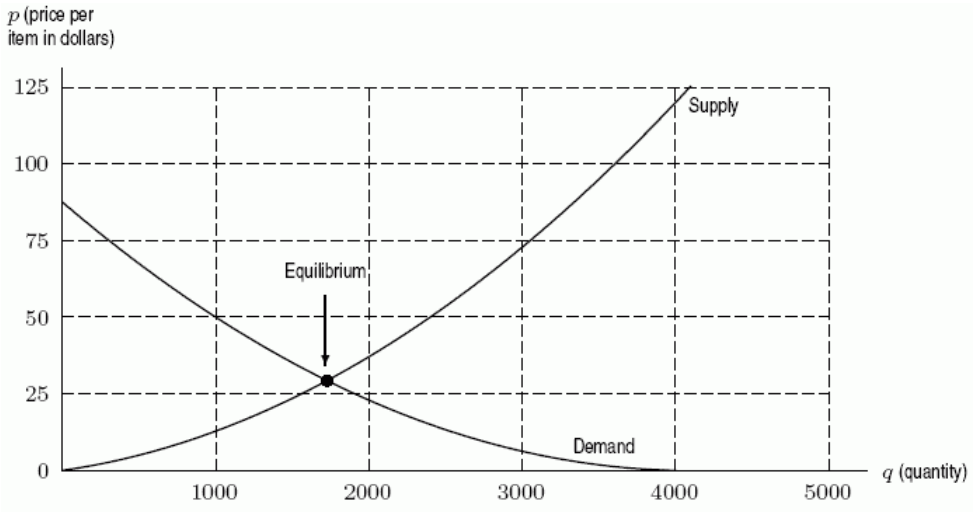
37. The following graph shows the quantity of goods purchased by consumers at various prices. If the price is $15 per item, how many items do consumers purchase?



A) 5
B) 8
C) 12
D) 15

Ans: B Learning Objectives: Understand economic applications to supply and demand, taxation, budget constraints. difficulty: easy section: 1.4

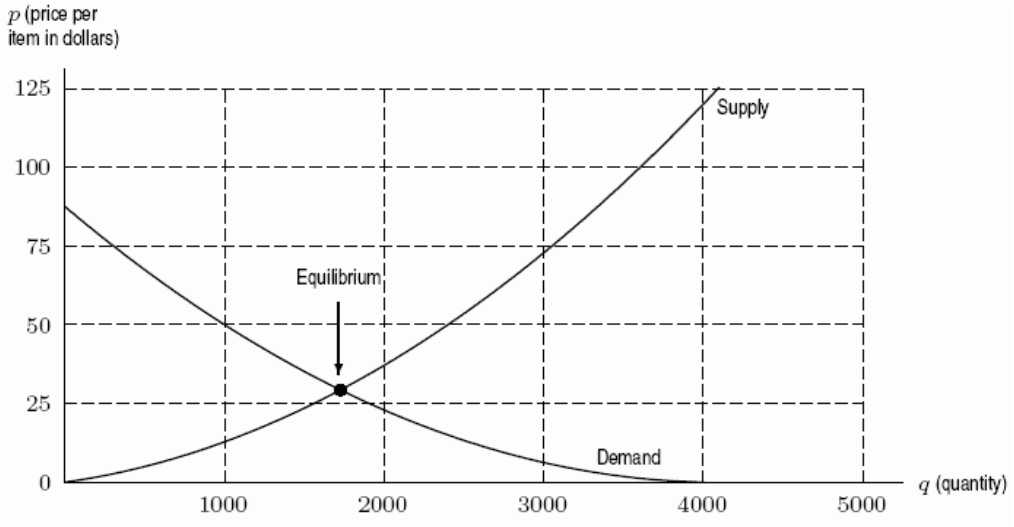
38. The following figure gives both supply and demand curves for a certain product. If the price is $50 per item, how many items will the consumers buy?



A) 1000
B) 2400
C) 1700
D) 4000

Ans: A Learning Objectives: Understand economic applications to supply and demand, taxation, budget constraints. difficulty: easy section: 1.4

39. The following figure gives both supply and demand curves for a certain product. If the price is $75 per item, would you expect the market pressures to push the price higher or lower?



A) higher
B) lower

Ans: B Learning Objectives: Understand economic applications to supply and demand, taxation, budget constraints. difficulty: easy section: 1.4

40. Suppose that $S(q)$ is the price per unit (in dollars) of widgets which will induce producers to supply *q* thousand widgets to the market, and suppose that $D(q)$ is the price per unit at which consumers will buy *q* thousand units. Which is larger, S(150) or S(100)?

A) S(100)
B) S(150)

Ans: B Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: easy section: 1.4

41. Suppose that $S(q)$ is the price per unit (in dollars) of widgets which will induce producers to supply *q* thousand widgets to the market, and suppose that $D(q)$ is the price per unit at which consumers will buy *q* thousand units. If $D(150) = 10$ and $S(100) = 10$, what do you predict about the future selling price of widgets (currently at $10)?

A) It will rise.
B) It will fall.

Ans: A Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: medium section: 1.4

42. A teenager has $36 to spend at a carnival on both food and rides. Food costs (on average) $4 per item, and rides cost (on average) $2 each. Let *f* be the number of food items purchased and *r* be the number of rides purchased. What is the equation of the teenager's budget constraint?

A) $36 = 4f - 2r$

B) $36 = 2f + 4r$

C) $36 = 4f + 2r$

D) $36(f + r) = 4 + 2$

Ans: C Learning Objectives: Understand economic applications to supply and demand, taxation, budget constraints. difficulty: medium section: 1.4

43. Production costs for manufacturing t-shirts consist of a fixed cost of $12,000 plus variable costs of $2 per shirt. Each t-shirt sells for $7 dollars. Find the total profit, $\pi(q)$, as a function of the number of shirts produced, *q*.

A) $\pi(q) = 2q - 12,000$

B) $\pi(q) = 7q - 12,000$

C) $\pi(q) = 9q - 12,000$

D) $\pi(q) = 5q - 12,000$

Ans: D Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: medium section: 1.4

44. Production costs for manufacturing T-shirts consist of a fixed cost of $18,000 plus variable costs of $4 per shirt. Each T-shirt sells for $12 dollars. What is the marginal cost?

A) $4

B) $12

C) $8

D) $18,000

Ans: A Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: medium section: 1.4

45. Production costs for manufacturing T-shirts consist of a fixed cost of $18,000 plus variable costs of $2 per shirt. Each T-shirt sells for $8 dollars. How many T-shirts must be sold for the company to break even?

A) 2,250

B) 3,000

C) 9,000

D) 5,625

Ans: B Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: medium section: 1.4

46. The demand and supply curves for a certain product are given in terms of price, p, by
$$D(p) = 310 - 11p \quad \text{and} \quad S(p) = 4p - 110.$$
What is the equilibrium price?

A) \$7
B) \$2
C) \$28
D) \$200

Ans: C Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: hard section: 1.4

47. The demand and supply curves for a certain product are given in terms of price, p, by
$$D(p) = 380 - 8p \quad \text{and} \quad S(p) = 6p - 110.$$
What is the equilibrium quantity?

A) 35
B) 100
C) 2
D) 270

Ans: B Learning Objectives: Understand economic applications to supply and demand, taxation, budget constraints. difficulty: hard section: 1.4

48. The cost of producing q items in a tortilla factory is given by $C(q) = 3000 + 0.71q$ dollars. The revenue from sales of q items is $R(q) = 0.89q$ dollars.

A. For what values of q does the tortilla factory make a profit?

B. Write a formula for profit as a function of q.

Ans: A. $q > 16{,}667$ items

B. $\pi(q) = 0.18q - 3000$ dollars

Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: medium section: 1.4

49. A population is growing according to the formula $P = 400(1.065)^t$, where P is the population at year t. What is the initial population?

A) 507
B) 426
C) 107
D) 400

Ans: D Learning Objectives: Understand and interpret the components of exponential functions: percent growth/decay rate, base, initial quantity.
difficulty: easy section: 1.5

50. A population is growing according to the formula $P = 325(1.05)^t$, where P is the population at year t. What is the annual growth rate?

A) 3.25%
B) 3.41%
C) 5%
D) 10.25%

Ans: C Learning Objectives: Understand and interpret the components of exponential functions: percent growth/decay rate, base, initial quantity.
difficulty: medium section: 1.5

51. A population is growing according to the formula $P = 250(1.07)^t$. What is the population in year 9?

A) 460
B) 2,408
C) 7,013
D) 252

Ans: A Learning Objectives: Understand and interpret the components of exponential functions: percent growth/decay rate, base, initial quantity.
difficulty: easy section: 1.5

52. A population is growing according to the formula $P = 250(1.05)^t$, where P is the population in year t. How many years will it take for the population to exceed 1000?

A) 151
B) 28
C) 29
D) 150

Ans: C Learning Objectives: Understand and interpret the components of exponential functions: percent growth/decay rate, base, initial quantity.
difficulty: hard section: 1.5

53. A town has 2400 people initially. Find the formula for the population of the town, P, in terms of the number of years, t, if the town grows by 70 people a year.

A) $P = 2400 + 70t$

B) $P = 2400(70)^t$

C) $P = 2400(0.7)^t$

D) $P = 2400 + (0.7)^t$

Ans: A Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

54. A town has 1200 people initially. Find the formula for the population of the town, P, in terms of the number of years, t, if the town grows at an annual rate of 8% a year.

A) $P = 1200 + 8t$

B) $P = 1200(0.08)^t$

C) $P = 1200(1.08)^t$

D) $P = 1000 + (1.08)^t$

Ans: C Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

55. A town has 2400 people initially. Find the formula for the population of the town, P, in terms of the number of years, t, if the town shrinks by 70 people a year.

A) $P = 2400 - 70t$

B) $P = 2400(0.3)^t$

C) $P = 2400(0.7)^t$

D) $P = 2400 - (0.7)^t$

Ans: A Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

56. A town has 800 people initially. Find the formula for the population of the town, P, in terms of the number of years, t, if the town shrinks at an annual rate of 13% a year.

A) $P = 800 - 13t$

B) $P = 800(-0.13)^t$

C) $P = 800(0.87)^t$

D) $P = 800 - (0.87)^t$

Ans: C Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

57. The following table gives values of three functions. Which one(s) could possibly be linear? Select all that apply.

x	-2	-1	0	1	2
$f(x)$	12	17	24	27	34
$g(x)$	16	24	36	54	81
$h(x)$	37	32	27	22	17

A) $f(x)$
B) $g(x)$
C) $h(x)$

Ans: C Learning Objectives: Build linear functions from data, words, or graphs.; Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.2; 1.5

58. The following table gives values of three functions. Which one(s) could possibly be exponential? Select all that apply.

x	-2	-1	0	1	2
$f(x)$	12	18	26	30	38
$g(x)$	16	24	36	54	81
$h(x)$	37	31	25	19	13

A) $f(x)$
B) $g(x)$
C) $h(x)$

Ans: B Learning Objectives: Build linear functions from data, words, or graphs.; Determine a formula for an exponential function from data, graphs, or words. difficulty: easy section: 1.2; 1.5

59. A population of rabbits is growing. In 2005, there were 10,000,000 rabbits, and the population was increasing at a rate of 20% per decade. What is the predicted rabbit population in 2016? Round to the nearest rabbit.

Ans: 12,220,793

Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

60. A population of rabbits is growing. In 2006, there were 10,000,000 rabbits, and the rate of increase was 10% per decade. Find $P(t)$, the formula to predict the population t years after 2006.

A) $P(t) = 10,000,000(1.1)^{\frac{t}{10}}$

B) $P(t) = 10,000,000(1.1)^{t}$

C) $P(t) = 10,000,000(0.1)^{\frac{t}{10}}$

D) $P(t) = 10,000,000(0.1)^{t}$

Ans: A Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

61. Identify the function defined in the following table as potentially linear, exponential, or neither.

x	0	2	4	6	8
$f(x)$	4.25	6.8	10.88	17.408	27.8528

A) exponential

B) neither

C) linear

Ans: A Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: easy section: 1.5

62. You were the housing minister in the year 1996 for a country with 30 million people. You were asked to predict the population 15 years from 1996 as part of a 15 year master plan for housing. Census records show that the population was 22.684 million in 1986 and 26.087 million in 1991. What was your best prediction of the population 15 years from 1996?

A) 45.626 million

B) 40.974 million

C) 41.739 million

D) 52.470 million

Ans: A Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

63. Find a formula for the exponential function partially defined in the following table. Round any constants to 3 decimal places.

x	0	1	2	3	4
$f(x)$	10	20	?	?	?

Ans: $f(x) = 10(2)^x$

Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: hard section: 1.5

64. Using the table, find the value of a if f is linear.

x	0	10	20
$f(x)$	50	150	a

Ans: 250

Learning Objectives: Build linear functions from data, words, or graphs. difficulty: easy section: 1.2

65. Using the table, find the value of a if f is exponential.

x	0	10	20
$f(x)$	50	200	a

Ans: 800

Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

66. The following tables shows values for two functions. Which one could be exponential?

t	-2	-1	0	1
$f(t)$	250	300	360	432

t	2	3	4	5
$g(t)$	500	750	1500	4500

A) $f(t)$

B) $g(t)$

Ans: A Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: easy section: 1.5

67. The following table shows values for an exponential function, $f(t)$. Find a formula for $f(t)$. Table entries are rounded to two decimal places.

t	-2	-1	0	1
$f(t)$	151.11	226.67	340.00	510.00

Ans: $f(t) = 340(1.5)^t$

Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

68. A bar of soap starts out weighing 125 grams. Write a formula for the quantity S grams of soap remaining after t days if the decrease is 5 grams per day.

Ans: $S = 125 - 5t$

Learning Objectives: Build linear functions from data, words, or graphs. difficulty: medium section: 1.2

69. A bar of soap starts out at 100 grams. Write a formula for the quantity S grams of soap remaining after t days if the decrease is 5% per day

Ans: $S = 100(0.95)^t$

Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

70. A photocopy machine can reduce copies to 90% or 70% of their original size. By copying an already reduced copy, further reductions can be made. Write a formula for the size of the image, N, after the original image of size a has been reduced n times with the copy machine set on 90% reduction.

Ans: $N = a(0.9)^n$

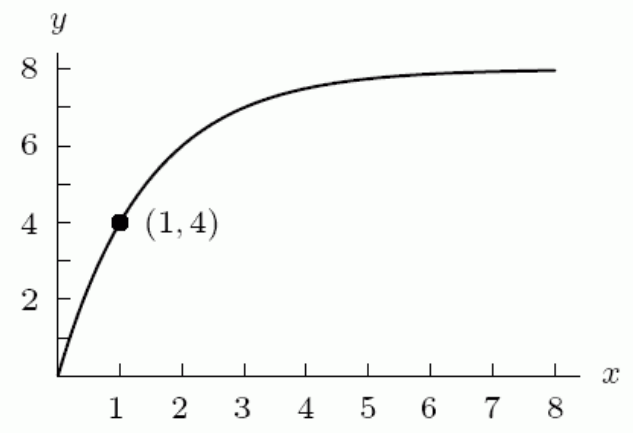
Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

71. A photocopy machine can reduce copies to 90% or 70% of their original size. By copying an already reduced copy, further reductions can be made. Which will be larger, an image that has been reduced on the 90% setting 10 times, or the same image after being reduced 3 times on the 70% setting?

A) The image reduced on the 90% setting
B) The image reduced on the 70% setting

Ans: A Learning Objectives: Understand and interpret the components of exponential functions: percent growth/decay rate, base, initial quantity. difficulty: hard section: 1.5

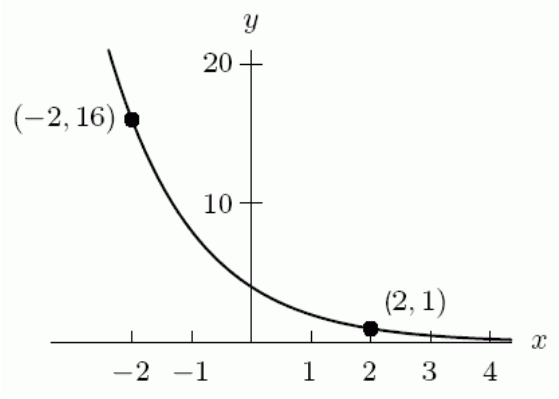
72. Which could be a possible formula for the following figure? Assume a and b are positive constants.



A) $a(1-b^{-x})$
B) $a(1-b^{x})$
C) $a(b^{-x})$
D) $a(b^{x})$

Ans: A Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: hard section: 1.5

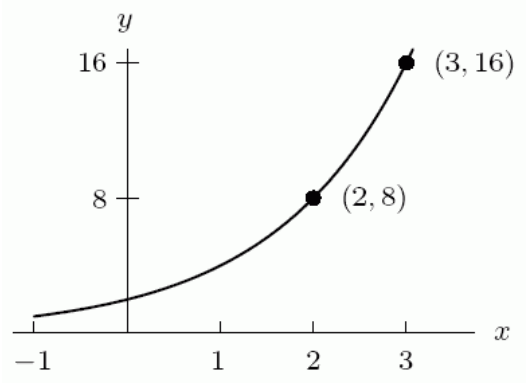
73. Which could be a possible formula for the following figure? Assume a and b are positive constants.



A) $a(1-b^{-x})$
B) $a(1-b^{x})$
C) $a(b^{-x})$
D) $a(b^{x})$

Ans: C Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

74. Which could be a possible formula for the following figure? Assume *a* and *b* are positive constants.



A) $a(1-b^{-x})$

B) $a(1-b^{x})$

C) $a(b^{-x})$

D) $a(b^{x})$

Ans: D Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: hard section: 1.5

75. Does $P=11(1.08)^{t}$ represent exponential growth or decay?

Ans: growth

Learning Objectives: Understand and interpret the components of exponential functions: percent growth/decay rate, base, initial quantity. difficulty: easy section: 1.5

76. Does $P=8.6e^{-0.07t}$ represent exponential growth or decay?

Ans: decay

Learning Objectives: Understand and interpret the components of exponential functions: percent growth/decay rate, base, initial quantity. difficulty: easy section: 1.5

77. Joe invested $10,000 in the stock market, while Sam invested $20,000. Joe's investment increased by 6% per year for 10 years. Sam's investment decreased in value by 12% per year for 5 years and then increased by 12% per year for the next 5 years. What was Joe's investment worth after 10 years? Round to the nearest dollar.

Ans: $17,908

Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: hard section: 1.5

78. A bakery has 800 pounds of flour. If they use 5% of the available flour each day, how many pounds do they have left after 9 days? Round to the nearest pound.

Ans: 504

Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1.5

79. A substance has a half-life of 56 years. What percent of the original amount of the substance will remain after 20 years? Round to the nearest percent.

Ans: 78%

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1.7

80. Solve $6 \cdot 3^t = 3 \cdot 2^t$ for t. Round to 3 decimal places.

Ans: –1.710

Learning Objectives: Use the natural logarithm to solve equations. difficulty: medium section: 1.6

81. Solve $6 \cdot (2.1)^x = a \cdot e^{kx}$ for both a and k. Round to 3 decimal places.

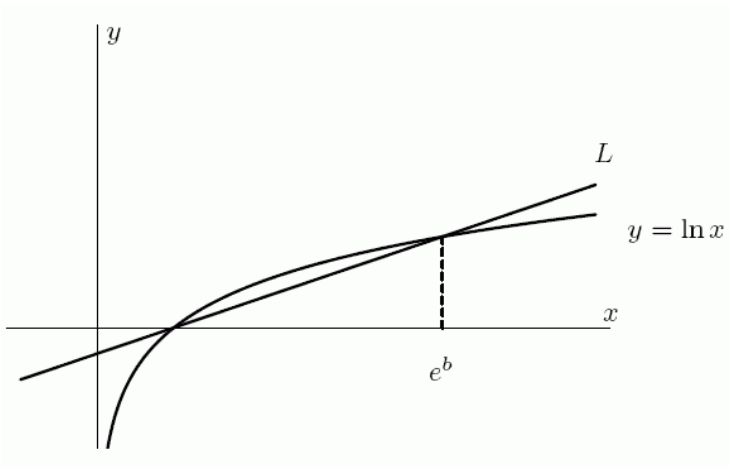
a=_____ k=_____

Part A: 6

Part B: 0.742

Learning Objectives: Use the natural logarithm to solve equations. difficulty: hard section: 1.6

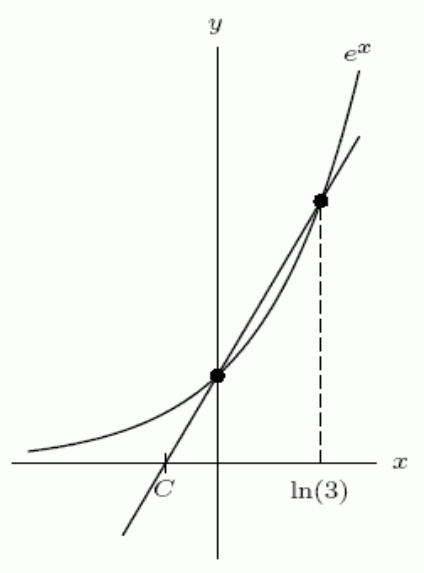
82. Find an equation for the line L shown. Your answer will contain the positive constant b.



Ans: $y = \dfrac{b}{e^b - 1}(x - 1)$

Learning Objectives: Use the natural logarithm to solve equations. difficulty: hard section: 1.6

83. Find the equation of the line in the following figure.



Ans: $y = \dfrac{2}{\ln 3}x + 1$

Learning Objectives: Use the natural logarithm to solve equations. difficulty: medium section: 1.6

84. Solve $90 \cdot 14^t = 40 \cdot 12^t$ for t. Round to two decimal places.

Ans: –5.26

Learning Objectives: Use the natural logarithm to solve equations.
difficulty: medium section: 1.6

85. Use logarithms to solve the equation $20(1.06)^x = 100$. Round to two decimal places.

Ans: 27.62

Learning Objectives: Use the natural logarithm to solve equations.
difficulty: medium section: 1.6

86. What interest rate, compounded annually, is equivalent to a 9% rate compounded continuously? Round to two decimal places.

Ans: 9.42%

Learning Objectives: Understand and interpret the forms of exponential functions and convert from base 'a' to base 'e' and vice versa. difficulty: hard section: 1.6

87. The following functions represent exponential growth or decay. Which ones represent continuous growth or decay? Select all that apply.

A) $P = 3.2(0.97)^t$

B) $P = 7.1(1.12)^t$

C) $P = 26e^{0.04t}$

D) $P = 6e^{-0.02t}$

Ans: C, D Learning Objectives: Understand and interpret the forms of exponential functions and convert from base 'a' to base 'e' and vice versa. difficulty: easy section: 1.6

88. The function $P = 6\,\mathrm{e}^{-0.02t}$ represents exponential growth or decay.

A. What is the initial quantity?

B. What is the initial growth or decay rate?

Part A: A. 6

Part B: B. 2%

Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

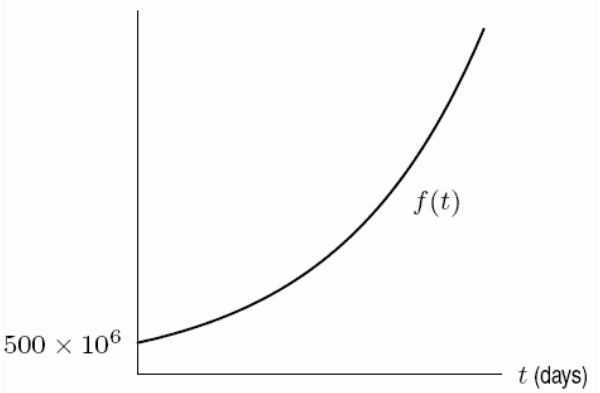
89. The number of bacteria in milk grows at a rate of 11% per day once the milk has been bottled. When milk is put in the bottles, it has an average bacteria count of 500 million per bottle.

A. Write an equation for $f(t)$, the number of bacteria t days after the milk was bottled.

B. Graph $f(t)$. Label the axes and intercepts.

Part A: A. $f(t) = 500,000,000(1.11)^t$

Part B: B.



Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

90. The number of bacteria in milk grows at a rate of 11% per day once the milk has been bottled. When milk is put in the bottles, it has an average bacteria count of 500 million per bottle. Suppose milk cannot be safely consumed if the bacteria count is greater than 3 billion per bottle. Under this model, how many days would the milk be safe to drink once it has been bottled?

Ans: 17

Learning Objectives: Understand and use the concepts of present value and future value. difficulty: hard section: 1.7

91. Write the function $a(t) = 20(1.1)^t$ in the form Ae^{kt}. Round k to 3 decimal places.

Ans: $20e^{0.095t}$

Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

92. Write the function $b(t) = 10e^{1.6t}$ in the form $P_0(a)^t$. Round *a* to 3 decimal places.

Ans: $10(4.953)^t$

Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

93. Simplify the expression $8e^{\ln(a^2)}$ as much as possible.

Ans: $8a^2$

Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

94. Solve $7^x = 12$ for *x* using logs. Round to 3 decimal places.

Ans: 1.277

Learning Objectives: Use the natural logarithm to solve equations. difficulty: easy section: 1.6

95. Solve $5e^{x+5} = 7e^{9x}$ using logs. Round your answer to 3 decimal places.

Ans: 0.583

Learning Objectives: Use the natural logarithm to solve equations. difficulty: medium section: 1.6

96. What is the doubling time of prices which are increased by 13% per year? Round to the nearest hundredth of a year.

Ans: 5.67 years

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1.7

97. If the size of a bacteria colony doubles in 6 hours, how many hours will it take for the number of bacteria to be 5 times the original amount? Round to 3 decimal places.

Ans: 13.932

Learning Objectives: Understand and interpret the forms of exponential functions and convert from base 'a' to base 'e' and vice versa. difficulty: medium section: 1.6

98. Tornados are classified in several ways. A tornado's classification on the Fujita Scale as F1 through F5 is most commonly cited. Another classification of tornados is by path length, given by the formula $\mathrm{P}l = 2\log(L)+1$ where L is the length of the tornado's path length, in miles. The Binger, Oklahoma tornado of 1981 was an F4 whose path was 16 miles in length. What was its P*l* classification?

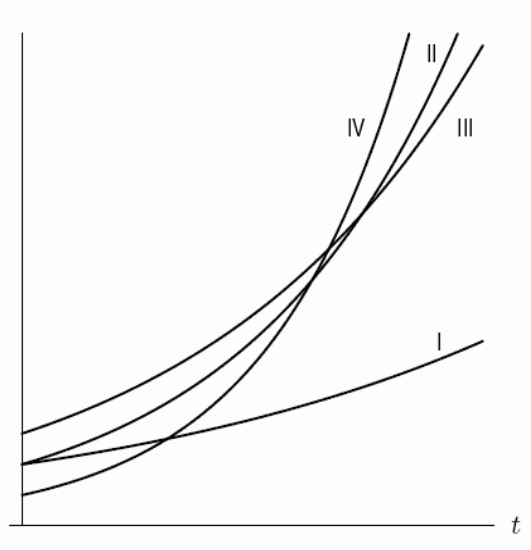
A) P1
B) P2
C) P3
D) P4
E) P5

Ans: C Learning Objectives: Use the natural logarithm to solve equations.
difficulty: easy section: 1.6

99. Use your calculator to find all of the solutions to the equation $2^x = x^2$. Round your answers to 2 decimal places.

Ans: x = -.77, x = 4
Learning Objectives: Use the natural logarithm to solve equations.
difficulty: medium section: 1.6

100. Each of the curves in the following figure represents the balance in a bank account at time *t* after a single deposit at time *t* = 0. Assuming continuously compounded interest, which curve represents the smallest initial deposit?



Ans: IV
Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

101. You win the lottery and are offered a choice of $90,000 now or $20,000 at the end of each year for five years. Assuming a 5% annual interest rate and ignoring taxes, which is the better option?

A) The first
B) The second

Ans: A Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

102. The population $P = f(t)$ of the United States in millions t years after 1790 during the period from 1790 to 1860 was given approximately by the exponential formula $f(t) = 3.9e^{0.0298t}$. What was the annual percent growth rate of the US during this time period?

Ans: 3%

Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

103. The population $P = f(t)$ of the United States in millions t years after 1790 during the years from 1790 to 1860 was given approximately by the exponential formula $f(t) = 3.9e^{0.0298t}$. What was the approximate doubling time for the population? Round to the nearest year.

Ans: 23 years

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1.7

104. A standard cup of coffee contains about 100 mg of caffeine, and caffeine leaves the body at a rate of about 17% an hour. How many mg of caffeine are left in the body after 6 hours if this rate is hourly? Round to 2 decimal places.

Ans: 32.69

Learning Objectives: Understand and use the concepts of present value and future value. difficulty: medium section: 1.7

105. A standard cup of coffee contains about 100 mg of caffeine, and caffeine leaves the body at a rate of about 17% an hour. How many mg of caffeine are left in the body after 6 hours if this rate is continuous? Round to 2 decimal places.

Ans: 36.06

Learning Objectives: Understand and use the concepts of present value and future value. difficulty: easy section: 1.7

106. A clean up of a polluted lake will remove 4% of the remaining contaminants every year. How many years will it take to reduce the quantity of contaminants to 1/10 of its present level? Round to the nearest tenth.

Ans: 56.4

Learning Objectives: Understand and use the concepts of present value and future value. difficulty: medium section: 1.7

107. A new species, introduced into an environment in which it has no natural predators, grows exponentially with continuous growth rate k=0.095 per year. There are initially 45 individuals introduced. Write the formula for $N(t)$, the number of individuals after t years and use it to find how many years will it take for the population to reach 300 individuals. Round to 2 decimal places.

Ans: 19.97

Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

108. The population of Nicaragua was 3.6 million in 1990 and growing at 3.4% per year. Let P be the population in millions, and let t be the time in years since 1990. Express P as a function of t. Select all that apply.

A) $P = 3.6(1.034)^t$

B) $P = 3.6e^{0.0334t}$

C) $P = 3.6e^{1.034t}$

D) $P = 3.6(0.966)^t$

Ans: A, B Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

109. The population of Nicaragua was 3.6 million in 1990 and growing at 3.4% per year. How many years does it take for the population of Nicaragua to increase by 60%? Round to 2 decimal places.

Ans: 14.06

Learning Objectives: Understand and use the concepts of present value and future value. difficulty: medium section: 1.7

110. An exponentially decaying substance was weighed every hour and the results are given below. If the formula $Q = Q_0 e^{-kt}$ gives the weight of the substance, Q, at time t in hours since 9 am, then Q_0=_____ and k=_____. Round k to 2 decimal points.

Time	Weight (in grams)
9 am	10
10 am	8.958
11 am	8.025
12 noon	7.189
1 pm	6.440

Part A: 10
Part B: 0.11
Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

111. An exponentially decaying substance was weighed every hour and the results are given below. What is the half-life of the substance? Round to the nearest tenth.

Time	Weight (in grams)
9 am	10.000
10 am	8.958
11 am	8.025
12 noon	7.189
1 pm	6.440

Ans: 6.3 hours
Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: easy section: 1.7

112. In 1992, the Population Crisis Committee wrote:

"Large cities in developing countries are growing much faster than cities in the industrialized world ever have. London, which in 1810 became the first industrialized city to top 1 million, now has a population of 11 million. By contrast, Mexico City's population stood at only a million just 50 years ago and now it is 20 million."

Assume that the percentage growth rates of London and Mexico City were constant over the last two centuries. How many times greater is Mexico City's percentage growth rate than London's? Round to the nearest tenth.

Ans: 4.7
Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

113. Is the function described by the following table of values exponential?

x	5.2	5.3	5.4	5.5	5.6
$f(x)$	27.8	30.58	33.638	37.0018	40.70198

Ans: yes
Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: easy section: 1.7

114. A quantity growing exponentially according to the formula $Q(t) = Q_0 9^t$ has a doubling time of $\frac{\ln 2}{\ln 9}$.

A) True
B) False

Ans: A Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1.7

115. Which is worth more after 10 years: $1200 invested at 10% annual interest or $1500 invested at 8% annual interest?

A) The 8% investment
B) The 10% investment

Ans: A Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1.7

116. Suppose $1200 is invested at 10% annual interest and $1500 is invested at 8% annual interest. After how many years will the investments be equal? Round to the nearest whole number.

Ans: 12
Learning Objectives: Understand and use the concepts of present value and future value. difficulty: hard section: 1.7

117. A cigarette contains about 0.4 mg of nicotine. The half-life of nicotine in the body is about 2 hours. How many hours does it take, after smoking a cigarette, for the level of nicotine in a smoker's body to be reduced to 0.1 mg? Round to 2 decimal places.

Ans: 4.00
Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: easy section: 1.7

118. If $f(x) = e^{x+6}$, find and simplify the average rate of change $\dfrac{f(3+h)-f(3)}{h}$.

A) 1
B) $e^9 - e^3$
C) $\dfrac{e^{x+h}}{h}$
D) $\dfrac{e^9(e^h - 1)}{h}$

Ans: D Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1.7

119. In the book One Grain of Rice, a girl receives a reward that starts with one grain of rice on day one, two grains on day two, four on day three and eight on day four. Each day, she receives double the number of grains of rice. How many grains of rice does she receive on the 20th day?

A) 400
B) 1,048,576
C) 2,782,184
D) 40

Ans: B Learning Objectives: Understand and use the concepts of present value and future value. difficulty: easy section: 1.7

120. Lisinopril is an ACE inhibitor derived from the venom of a Brazilian pit viper frequently used in the treatment of hypertension. Because of Lisinopril's relatively long half-life of 12 hours, patients need to take a dose just once per day. A patient takes his first dose, 20 mg, at 6 pm on Saturday.

a) How many hours does it take for the amount of Lisinopril in the patient's body to decrease to 17 mg? Round to two decimal places.

b) How many milligrams remain in the patient's body right before he takes his next 20 mg at 6 pm on Sunday? Round to two decimal places

Ans: a) 2.81 hours
b) 5.00 milligrams
Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1.7

121. If the size of a bacteria colony doubles in 8 hours, how many hours will it take for the number of bacteria to be 11 times the original amount? Round to 2 decimal places.

Ans: 27.68

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1.7

122. Bank *A* offers 12% interest, compounded yearly, and Bank *B* offers 11.1% interest, compounded continuously. Which bank should you choose if you have $1000 to invest for 10 years?

Ans: Bank A

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1.7

123. You have $500 invested in an account earning 7.2% interest compounded annually. How many years will it take to triple your money? Round to the nearest tenth of a year.

Ans: 15.8

Learning Objectives: Understand and use the concepts of present value and future value. difficulty: medium section: 1.7

124. You have $500 invested in an account earning 7.6% interest compounded annually. Suppose the interest rate were compounded monthly instead, that is you earned $\frac{7.6}{12}$ % interest each month. How much interest would you then earn for a year?

Ans: $39.35

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: easy section: 1.7

125. A bank pays 6% annual interest. If $1000 is deposited in this bank account, find the amount in the account after 5 years if the interest is compounded weekly.

Ans: $1349.63

Learning Objectives: Understand and use the concepts of present value and future value. difficulty: easy section: 1.7

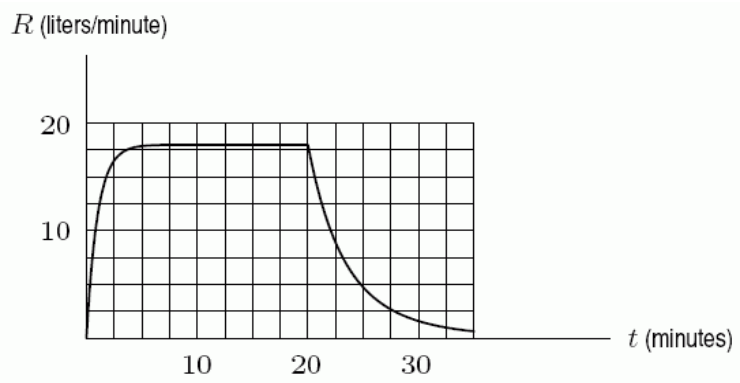
126. Use the following table to find $f(g(3))$.

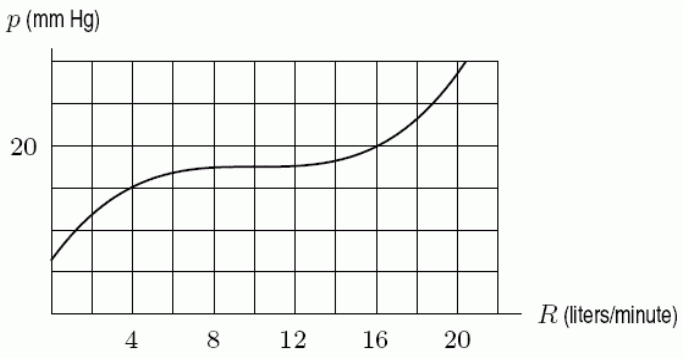
x	0	1	2	3	4
$f(x)$	2	4	6	3	5
$g(x)$	5	3	2	1	0

Ans: 4

Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: medium section: 1.8

127. One of the graphs below shows the rate of flow, R, of blood from the heart in a man who bicycles for 20 minutes, starting at $t = 0$ minutes. The other graph shows the pressure, p, in the artery leading to a man's lungs as a function of the rate of flow of blood from the heart. Estimate $p(R(25))$.





A) 15 mm Hg
B) 11 mm Hg
C) 19 mm Hg
D) 7 mm Hg

Ans: A Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: easy section: 1.8

128. Given the function $m(z) = z^2$, find and simplify $m(z+h) - m(z)$.

Ans: $2zh + h^2$

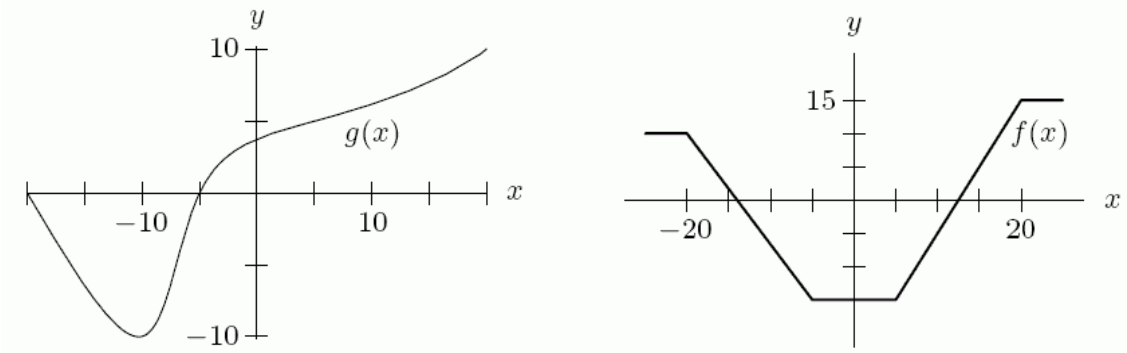
Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: medium section: 1.8

129. Let $f(x) = 9x + 1$ and $g(x) = x^2 + 6$. What is $f(g(x))$?

A) $9x^2 + 55$
B) $81x^2 + 18x + 7$
C) $x^2 + 9x + 7$
D) $9x^3 + x^2 + 54x + 6$
E) $9x^3 + 54x + 1$

Ans: A Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: easy section: 1.8

130. The graphs of $y = f(x)$ and $y = g(x)$ are given in the following figure. Estimate $g(f(5))$.



A) –7
B) –15
C) −10
D) 15

Ans: A Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: easy section: 1.8

131. What is the equation for the graph obtained by shifting the graph of $y = x^3$ vertically upward by 7 units, followed by vertically stretching the graph by a factor of 5?

A) $5x^3 + 35$

B) $5x^3 + 7$

C) $35x^2 + 7$

D) $5x^3 + 105x^2 + 735x + 1715$

Ans: A Learning Objectives: Understand stretches and shifts of graphs both analytically and graphically. difficulty: easy section: 1.8

132. What is the equation for the graph obtained by shifting the graph of $y = x^3$ vertically upward by 2 units, followed by vertically stretching the graph by a factor of 5, followed by reflecting the graph across the *x*-axis?

A) $-5x^3 - 10$

B) $-5x^3 - 2$

C) $10x^2 + 2$

D) $-5x^3 - 30x^2 - 60x - 40$

Ans: B Learning Objectives: Understand stretches and shifts of graphs both analytically and graphically. difficulty: medium section: 1.8

133. If the graph of $y = f(x)$ shrinks vertically by a factor of 1/2, then shifts vertically by 6 units, then stretches vertically by a factor of 3, the resulting graph is the same as the original graph.

A) True

B) False

Ans: B Learning Objectives: Understand stretches and shifts of graphs both analytically and graphically. difficulty: medium section: 1.8

134. Given the equation $q(x) = x^3$, find and simplify $q(2x + a) + q(x)$.

Ans: $9x^3 + 12ax^2 + 6a^2x + a^3$

Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: easy section: 1.8

135. Given the equation $q(x) = x^3$, find and simplify $q(x^2) + q(x + a)$.

Ans: $x^6 + x^3 + 3ax^2 + 3a^2x + a^3$

Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: easy section: 1.8

136. The cost of shipping r grams of material is given by the function $C = f(r) = 300 + 2r$. Find a formula for the inverse function, $r(C)$.

A) $r = (C - 300)/2$

B) $r = 300 + 2C$

C) $r = -300 - 2C$

D) $r = \dfrac{1}{300 + 2C}$

Ans: A Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: medium section: 1.8

137. For $g(x) = 4x^2 + 4x$ and $h(x) = 2x - 1$, find and simplify $h(g(x))$.

Ans: $8x^2 + 8x - 1$

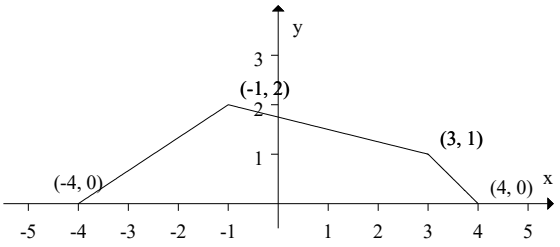
Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: easy section: 1.8

138. For $g(x) = 5x^2 + 2x$ and $h(x) = 5x - 1$, find and simplify $g(h(x))$.

Ans: $125x^2 - 40x + 3$

Learning Objectives: Find and/or evaluate composite functions given by formulas, graphs or tables. difficulty: easy section: 1.8

139. Use the function in the graph to complete the table of values.



	-4	-1	3	4
f(x)	0	2	1	0
f(x) + 4				
-f(x)				
-f(x) + 8				

Ans:

	-4	-1	3	4
f(x)	0	2	1	0
f(x) + 4	4	6	5	4
-f(x)	0	-2	-1	0
-f(x) + 8	8	6	-9	8

Learning Objectives: Understand stretches and shifts of graphs both analytically and graphically. difficulty: easy section: 1.8

140. Which of the following are power functions? Select all that apply.

A) $y = \dfrac{2}{3x}$

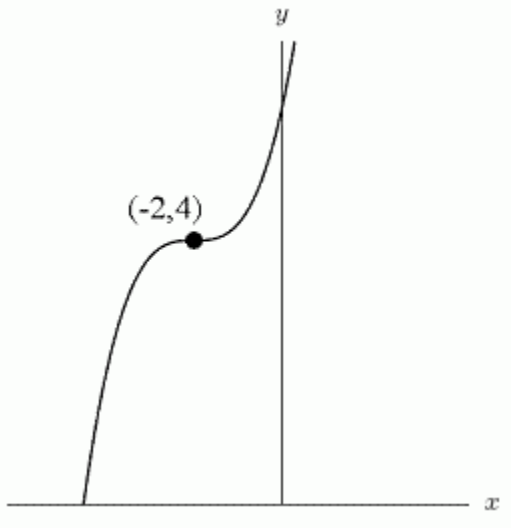
B) $y = 3 \cdot 2^x$

C) $y = 3 + \sqrt{x}$

D) $y = (2\sqrt{x})^3$

Ans: A, D Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: easy section: 1.9

141. Use shifts of power functions to find a possible formula for the following graph.



A) $y = (x+2)^3 + 4$

B) $y = (x-2)^3 + 4$

C) $y = (x+4)^3 + 2$

D) $y = (x+4)^3 - 2$

Ans: A Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: easy section: 1.9

142. Simplify $(4)^{-2}$, leaving your answer as a fraction where appropriate.

Ans: 1/16

Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: easy section: 1.9

143. The following table gives the values for $y = f(x)$. It is possible that *y* could be inversely proportional to *x*.

x	1	2	3	4
y	3	1.5	1	0.75

A) True

B) False

Ans: A Learning Objectives: Write and interpret a function describing a proportional relationship. difficulty: easy section: 1.9

144. Write a function that represents the following situation. The gravitational force, *F,* between two bodies is inversely proportional to the square of the distance, *d*, between them.

A) $F = kd^2$

B) $F = k\left(\frac{1}{d^2}\right)$

C) $F^2 = k\left(\frac{1}{d}\right)$

D) $F^2 = kd$

Ans: B Learning Objectives: Write and interpret a function describing a proportional relationship. difficulty: hard section: 1.9

145. The number of species, *S*, on an island is proportional to the square root of the area, *A*, of the island. An island which has an area of 25 square miles contains 30 species. How many species would be expected on an island of 9 square miles?

Ans: 18

Learning Objectives: Write and interpret a function describing a proportional relationship. difficulty: medium section: 1.9

146. Poiseuille's law says that the rate of flow, *F*, of a gas through a cylindrical pipe is proportional to the fourth power of the radius of the pipe, *r*. If the rate of flow is 400 cm^3/sec in a pipe of radius 2 cm for a certain gas, how many cm^3/sec flow through a pipe with a 6 cm radius? Round to 2 decimal places.

Ans: 32,400.00

Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1.9

147. A new music company wants to start selling collections of digital downloads. The profit π (in thousands of dollars) is $\pi(p) = 120p - 4p^2$, where *p* is the price of a collection (in dollars). Use a graphing calculator to graph $\pi(p)$, and use the graph to answer the following.

A. What is the maximum profit that can be obtained?

B. What is the price of a collection of downloads when the maximum profit is obtained?

Part A: A. $900.00

Part B: B. $15.00

Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1.9

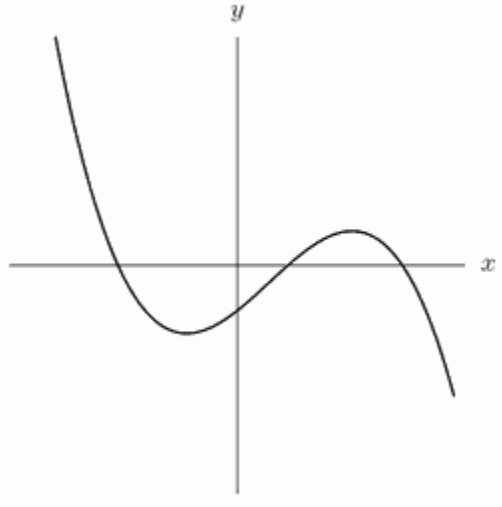
148. A ball is thrown at time $t = 0$ and its height above ground t seconds after it is thrown is given by $f(t) = -16t^2 + 160t + 6$ feet. Use a graphing calculator to graph $f(t)$, and use the graph to answer the following.

A. How high does the ball go?

B. How long is it in the air?

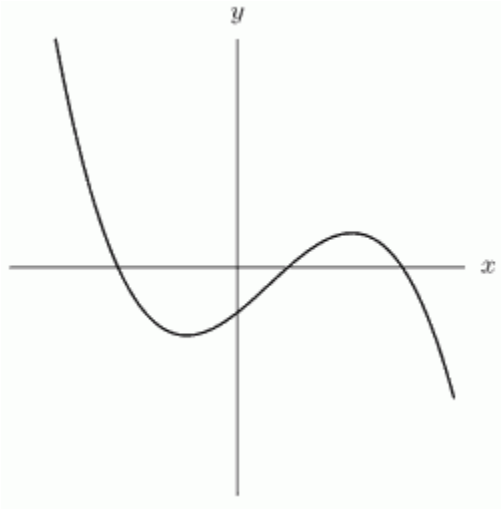
Part A: A. 406 feet
Part B: B. 10 seconds
Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1.9

149. In the following graph, the leading coefficient is _____(positive/negative)



Ans: negative
Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: easy section: 1.9

150. In the following graph, the minimum degree is _____.



Ans: 3
Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: easy section: 1.9

151. Write a formula representing the function that says: The area of a circle is proportional to the square of its radius.

Ans: A=(pi)r^2
Learning Objectives: Write and interpret a function describing a proportional relationship. difficulty: easy section: 1.9

152. The illumination, I, of a candle is inversely proportional to the square of its distance, d, from the object it illuminates. Write a formula that expresses this relationship.

Ans: $I = \frac{k}{D^2}$
Learning Objectives: Write and interpret a function describing a proportional relationship. difficulty: easy section: 1.9

153. Coulomb's law says that the electrical force between two charged objects is directly proportional to the product of the quantity of charge on the objects and inversely proportional to the square of the distance between the objects. Let q_1 and q_2 be the charge on the two objects. Let *d* be the distance between the objects and F be the electrical force between them. Translate Coulomb's Law into mathematical symbols.

A) $F = \dfrac{q_1 q_2}{d^2}$

B) $F = \dfrac{kd}{(q_1 - q_2)^2}$

C) $F = \dfrac{k(q_2 - q_1)^2}{d^2}$

D) $F = \dfrac{kq_1 q_2}{d^2}$

Ans: D Learning Objectives: Write and interpret a function describing a proportional relationship. difficulty: easy section: 1.9

154. As $x \to \infty$, the function $f(x) = -17x^4 \to$ _____.

A) $-\infty$

B) ∞

C) neither of these

Ans: A Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1.9

155. As $x \to \infty$, the function $f(x) = 5x^7 \to$ _____.

A) ∞

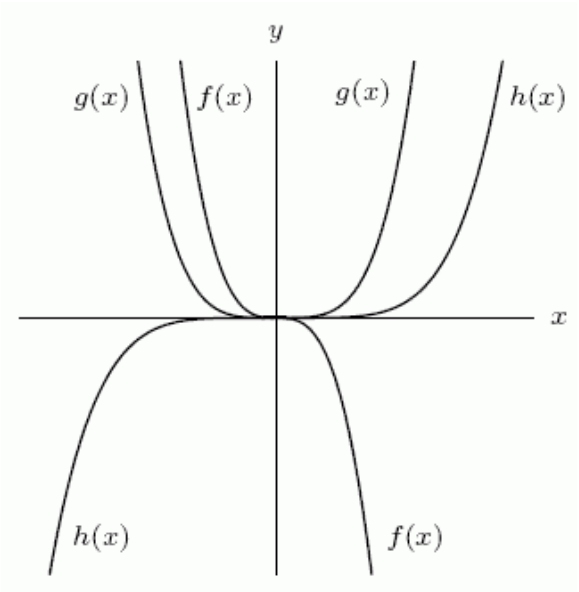
B) $-\infty$

C) neither of these

Ans: A Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1.9

156. Sketch global pictures of the functions $f(x) = -100x^3$, $g(x) = 28x^4$, and $h(x) = 2x^5$ on the same set of axes. Label each function on both ends so it is obvious which is which.

Ans:



Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1.9

157. Of the functions $f(x) = -100x^3$, $g(x) = 28x^4$, and $h(x) = 2x^5$, which has the largest value as $x \to \infty$?

A) $f(x) = -100x^3$

B) $g(x) = 28x^4$

C) $h(x) = 2x^5$

Ans: C Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: easy section: 1.9

158. As $x \to -\infty$, the function $f(x) = 5 + 24x + 78x^3 - 17x^4 \to$ _____.

A) $-\infty$

B) ∞

C) neither of these

Ans: A Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1.9

159. As $x \to -\infty$, the function $f(x) = 5x^5 - 30x^4 + 2x^2 - 8x + 100 \to$ _____.

A) $-\infty$
B) ∞
C) neither of these

Ans: A Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: easy section: 1.9

160. Assume that the function shown in the following table is periodic. What is the amplitude of the function?

x	1	2	3	4	5	6	7	8	9
$f(x)$	-2	0	-2	-4	-2	0	-2	-4	-2

Ans: 2

Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1.10

161. Assume that the function shown in the following table is periodic. What is $f(12)$?

x	1	2	3	4	5	6	7	8	9
$f(x)$	-2	0	-2	-4	-2	0	-2	-4	-2

Ans: –4

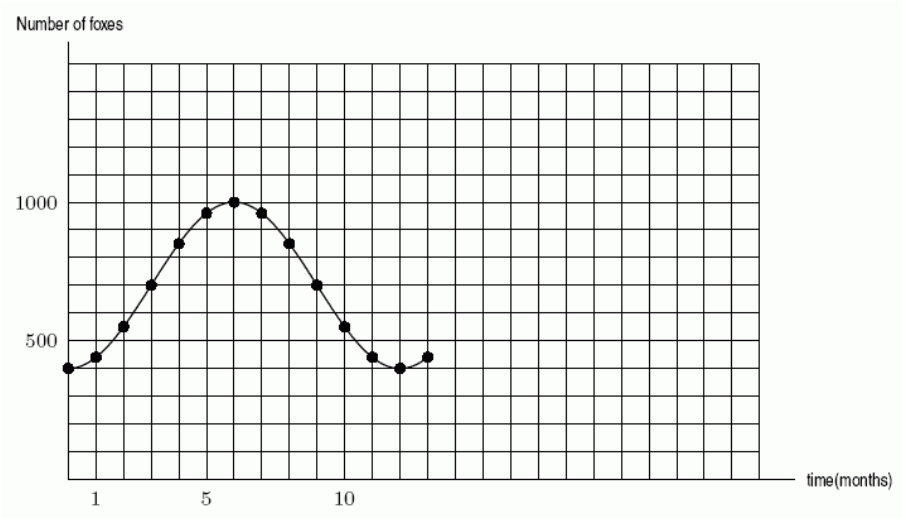
Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1.10

162. At high tide, the water level is 6 feet below a certain pier. At low tide, the water level is 18 feet below the pier. Assuming sinusoidal behavior, let $f(t)$ = the water level relative to the pier, at time t (in hours). At $t = 0$ the water is -12 feet and falling until it reaches the first low tide at $t = 3$. Give a formula for $f(t)$.

Ans: $-6\sin\left(\frac{\pi}{6}\right)t - 12$

Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: medium section: 1.10

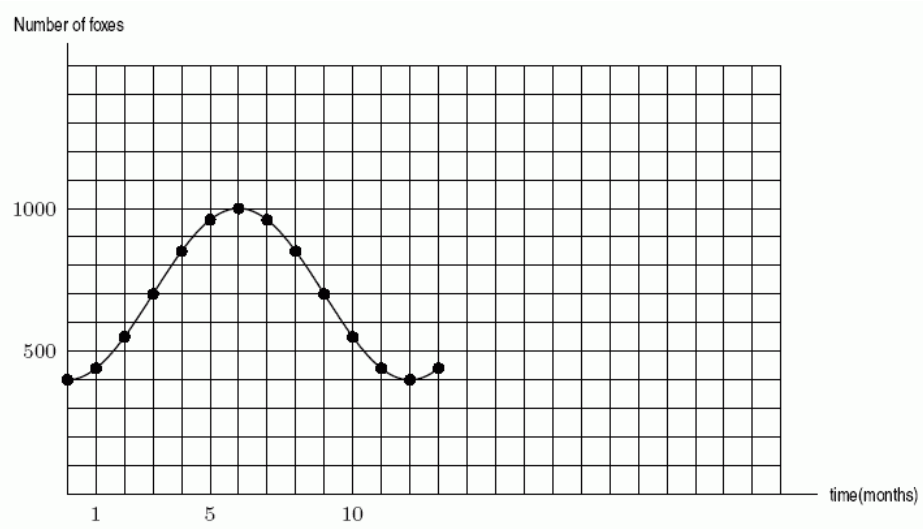
163. In nature, the populations of two animals, one of which preys upon the other (such as foxes and rabbits) are observed to oscillate with time, and are found to be well approximated by trigonometric functions. The population of foxes is shown in the graph below. Find the period.



Ans: 12

Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1.10

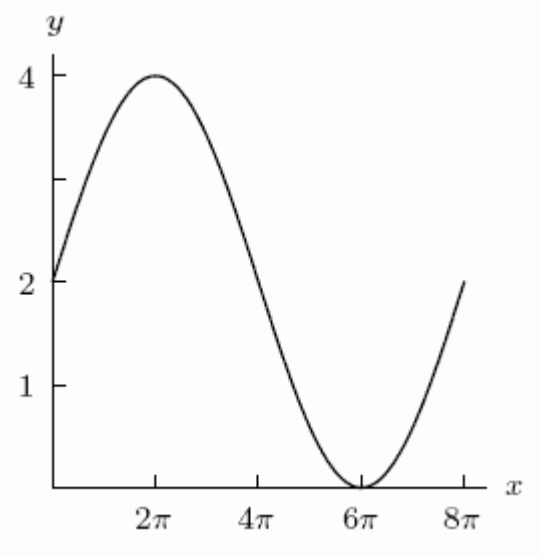
164. In nature, the populations of two animals, one of which preys upon the other (such as foxes and rabbits) are observed to oscillate with time, and are found to be well approximated by trigonometric functions. The population of foxes is shown in the graph below. How many foxes will there be in 15 months?



Ans: 700

Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: medium section: 1.10

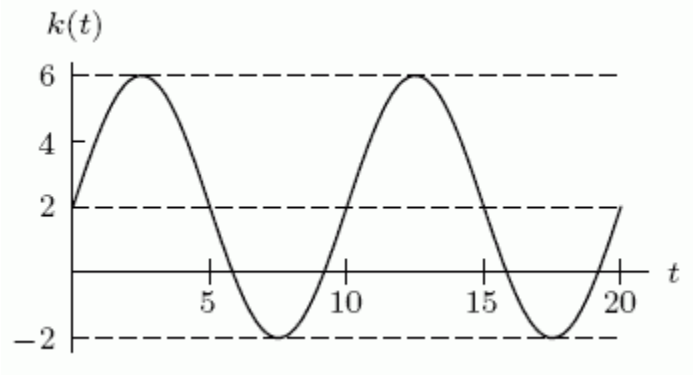
165. If $y = A\sin Bx + C$ defines the function graphed in the following figure, then A =_____, B =_____, and C =_____.



Part A: 2
Part B: 1/4
Part C: 2

Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: medium section: 1.10

166. If $k(t) = A\sin B\pi t + C$ defines the function graphed in the following figure, then A =_____, B =_____, and C =_____.



Part A: 4
Part B: 1/5
Part C: 2

Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: medium section: 1.10

167. The size of a bird population on an island can be described by a sinusoidal graph. The number of birds on the island decreased from a maximum of 20,000 in 1943 to a minimum of 12,000 in 1989, and then began increasing again. In what year will the population begin decreasing again?

Ans: 2035

Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1.10

168. The size of a bird population on an island can be described by a sinusoidal graph. The number of birds on the island decreased from a maximum of 20,000 in 1943 to a minimum of 12,000 in 1989, and then began increasing again. Find a function that describes this behavior and use it to estimate the number of birds on the island in 2012. Round to the nearest whole number.

Ans: 16,000

Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: medium section: 1.10

169. What value of B would you use if $\sin Bt$ was to model a periodic function with period 1 year where t is measured in months? Round to 4 decimal places.

Ans: 0.5236

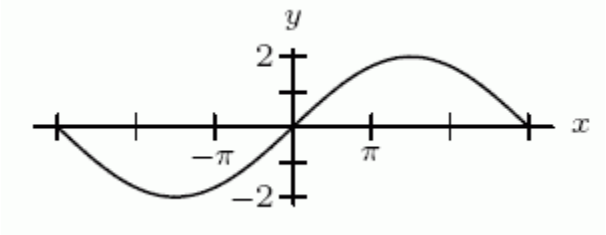
Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1.10

170. What value of B would you use if $\sin Bt$ was to model a periodic function, where t is measured in hours and the period is 1 day? Round to 4 decimal places.

Ans: 0.2618

Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1.10

171. Give a formula for the following sinusoidal function as a transformation of $f(t) = \sin(t)$.



A) $f(t) = -2\sin(3t)$

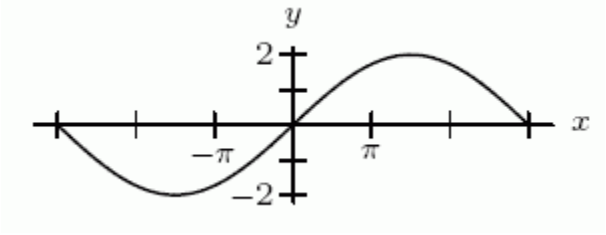
B) $f(t) = -2\sin\left(\frac{t}{3}\right)$

C) $f(t) = 2\sin(3t)$

D) $f(t) = 2\sin\left(\frac{t}{3}\right)$

Ans: D Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: easy section: 1.10

172. Give a formula for the following sinusoidal function as a transformation of $f(t) = \cos(t)$.



A) $f(t) = 2\cos\left(3t + \frac{9\pi}{2}\right)$

B) $f(t) = 2\cos\left(3t - \frac{9\pi}{2}\right)$

C) $f(t) = 2\cos\left(\frac{t}{3} + \frac{9\pi}{2}\right)$

D) $f(t) = 2\cos\left(\frac{t}{3} - \frac{9\pi}{2}\right)$

Ans: D Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: medium section: 1.10

173. Temperature in Town A oscillates daily between $30°$ F at 4am and $60°$ F at 4pm. If $H = A\cos(B\pi(t+C)) + D$ is a formula for the temperature in Town A in terms of time, where time is measured in hours from 4 am, then A =_____, B =_____, C =_____, and D =_____.

Part A: -15
Part B: 1/12
Part C: 0
Part D: 45

Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: medium section: 1.10

174. Temperatures in a room oscillate between the low of $-10°$ F (at 5am) and the high of $50°$ F (reached at 5pm). If $H = A\cos(B\pi t) + C$ is a formula for the temperature in the room in terms of time from 5am, then A =_____, B =_____, and C =_____.

Part A: –30
Part B: 1/12
Part C: 20

Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: medium section: 1.10

175. Consider the function $g(t) = 5 + \cos 6t$. If its period is $k\pi$, what is k?

Ans: 1/3

Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1.10

176. Consider the functions $f(x) = 5 + \sin 3x$ and $g(x) = 3\sin x$. Which has a larger vertical intercept?

A) $f(x)$
B) $g(x)$

Ans: A Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1.10

177. Sketch a well-labeled graph of a periodic function such that :
-- $f(0) = 1{,}050$
-- the period is 12
-- the amplitude is 550.
Then write a few sentences illustrating how such a function might apply to a grasshopper population.

Ans: Answers will vary. The graph of $f(t) = 1{,}050 + 550\sin(\frac{\pi}{6}t)$ is one such periodic function. One story: At the start of a 12-month experiment about grasshopper populations, there are 1,050 grasshoppers. Over the first three months, the grasshopper population increases to a maximum of 1600, then returns to its initial population at mid-year. The low point of the population is after 9 months and is 500.
Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: medium section: 1.10

178. Consider the function $f(\theta) = 30 + 95\cos(21.991\theta)$. Select all true statements about this function from the list below. Answers are rounded to two decimal places.

A) The period of the function is 0.29.
B) The amplitude of the function is 95.
C) The vertical shift of the function is 30.
D) The period of the function is 0.23.
E) The amplitude of the function is 30.
F) The vertical shift of the function is 95.

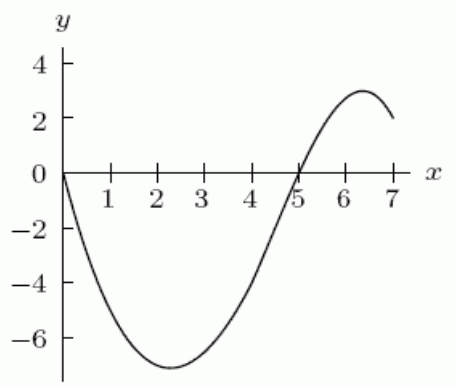
Ans: A, B, C Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1.10

179. Write an equation of a periodic function with amplitude 35, vertical shift 50, period 2π, and horizontal translation (phase shift) 2 units to the right.

A) $f(t) = 50 + 35\cos(t - 2)$
B) $f(t) = 35 + 50\sin(t + 2)$
C) $f(t) = 35\cos(50t + 2)$
D) $f(t) = 50\sin(2t - 35)$
E) None of the above.

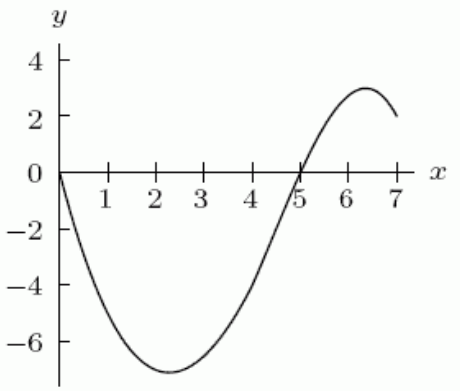
Ans: A Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: easy section: 1.10

180. The graph of $y = f(x)$ is shown in the following figure. The _____ of $f(x)$ is $0 \le x \le 7$, and the _____ of $f(x)$ is $-7 \le y \le 3$.



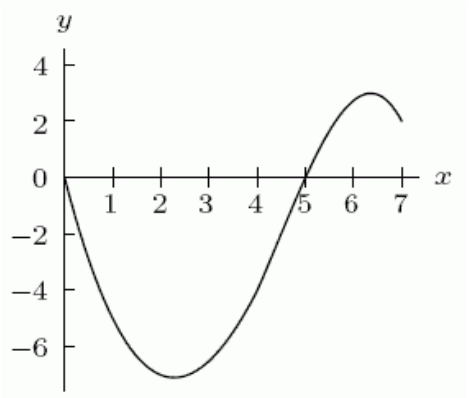
Ans: domain
range
Learning Objectives: Find a formula for a periodic function given by graphs, tables, or words. difficulty: medium section: 1 review

181. The graph of $y = f(x)$ is shown in the following figure. Estimate $f(1)$ (to the nearest integer).



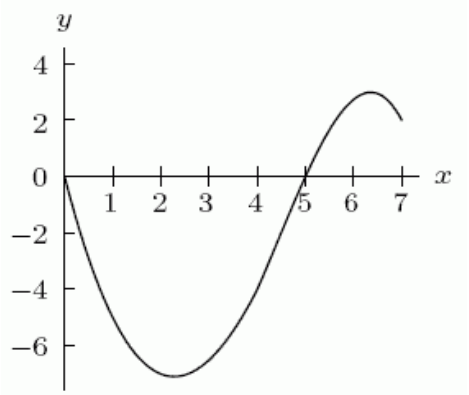
Ans: –5
Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1 review

182. The graph of $y = f(x)$ is shown in the following figure. Is the graph increasing or decreasing at $x = 3$?



Ans: increasing
Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1 review

183. The graph of $y = f(x)$ is shown in the following figure. Is the graph concave down or concave up at $x = 4$?



Ans: concave up
Learning Objectives: Interpret periodic functions: amplitude, period, vertical shift, value at a point. difficulty: easy section: 1 review

184. As $x \to \infty$, $f(x) = -x^3 \to$ _____.
A) $-\infty$
B) ∞
C) 0
Ans: A Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1 review

185. As $x \to \infty$, $f(x) = x^{-4} \to$ _____.

A) $-\infty$
B) ∞
C) 0

Ans: C Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1 review

186. As $x \to \infty$, $f(x) = 370 - 5x^2 - 80x^3 + 10x^4 \to$ _____.

A) ∞
B) $-\infty$
C) 0

Ans: A Learning Objectives: Write and interpret power functions given by tables, graphs, or words. difficulty: medium section: 1 review

187. As $x \to -\infty$, $f(x) = e^x \to$ _____.

A) ∞
B) 0
C) $-\infty$

Ans: B Learning Objectives: Understand and interpret the components of exponential functions: percent growth/decay rate, base, initial quantity. difficulty: medium section: 1 review

188. The following table gives values for three different functions. Find a formula for the linear one.

t	$f(t)$	$g(t)$	$h(t)$
-1	15	21.4	1000
0	9	24.1	600
1	5	26.8	360
2	4	29.5	216

Ans: $g(t) = 24.1 + 2.7t$

Learning Objectives: Build linear functions from data, words, or graphs. difficulty: easy section: 1 review

189. The following table gives values for three different functions. Find a formula for the exponential one.

t	$f(t)$	$g(t)$	$h(t)$
-1	15	21.4	1500
0	9	24.1	600
1	5	26.8	240
2	4	29.5	96

Ans: $h(t) = 600(0.4)^t$

Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: medium section: 1 review

190. The following table gives values for three different functions. One of the functions is neither linear nor exponential. Is that function increasing or decreasing?

t	$f(t)$	$g(t)$	$h(t)$
-1	15	21.7	1200
0	9	24.1	600
1	5	26.5	300
2	4	28.9	150

Ans: decreasing

Learning Objectives: Build linear functions from data, words, or graphs.; Determine a formula for an exponential function from data, graphs, or words.
difficulty: medium section: 1 review

191. A company has cost and revenue functions given in dollars by $C(q) = 500 + 7q$ and $R(q) = 12q$. What is the effect on the break even point of doubling the fixed costs?

A) The break even point is cut in half.
B) The break even point is doubled.

Ans: B Learning Objectives: Understand cost, revenue, and profit functions and break even points. difficulty: medium section: 1 review

192. Write a formula for the population, *P*, as a function of time, *t*, if the population starts at 9000 and grows by 125 people each year.

Ans: $P = 9000 + 125t$

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: easy section: 1 review

193. Write a formula for the population, P, as a function of time, t, if the population starts at 6000 and grows by 10% each year.

Ans: $P = 6000(1.1)^t$

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: easy section: 1 review

194. Give a possible formula for the function shown in the following table.

x	0	1	2	3	4	5
$f(x)$	–7	–4	–1	2	5	8

Ans: $f(x) = 3x - 7$

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: easy section: 1 review

195. Give a possible formula for the function shown in the following table.

x	0	1	2	3	4	5
$g(x)$	0	–2	–8	–18	–32	–50

Ans: $g(x) = -2x^2$

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: easy section: 1 review

196. Give a possible formula for the function shown in the following table.

x	0	1	2	3	4	5
$h(x)$	------	4	2	1.33333	1	0.8
				3		

Ans: $h(x) = 4/x$

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: easy section: 1 review

197. One of the following tables of data is linear and the other one is exponential. The formula for the linear one is $y = ax + b$. Find the values of *a* and *b* to two decimal places.

x	0	0.50	1.00	1.50	2.00
y	3.12	2.67	2.28	1.95	1.66

x	0	0.50	1.00	1.50	2.00
y	2.71	3.94	5.17	6.40	7.63

A. a=_____

B. b=_____

Part A: 2.46
Part B: 2.71

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1 review

198. One of the following tables of data is linear and the other one is exponential. The formula for the exponential one is $y = c(d)^x$. Find the values of *c* and *d* to two decimal places.

x	0	0.50	1.00	1.50	2.00
y	3.12	2.70	2.34	2.03	1.76

x	0	0.50	1.00	1.50	2.00
y	2.71	3.44	4.17	4.90	5.63

A. c=_____

B. d=_____

Part A: 3.12
Part B: 0.75

Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: medium section: 1 review

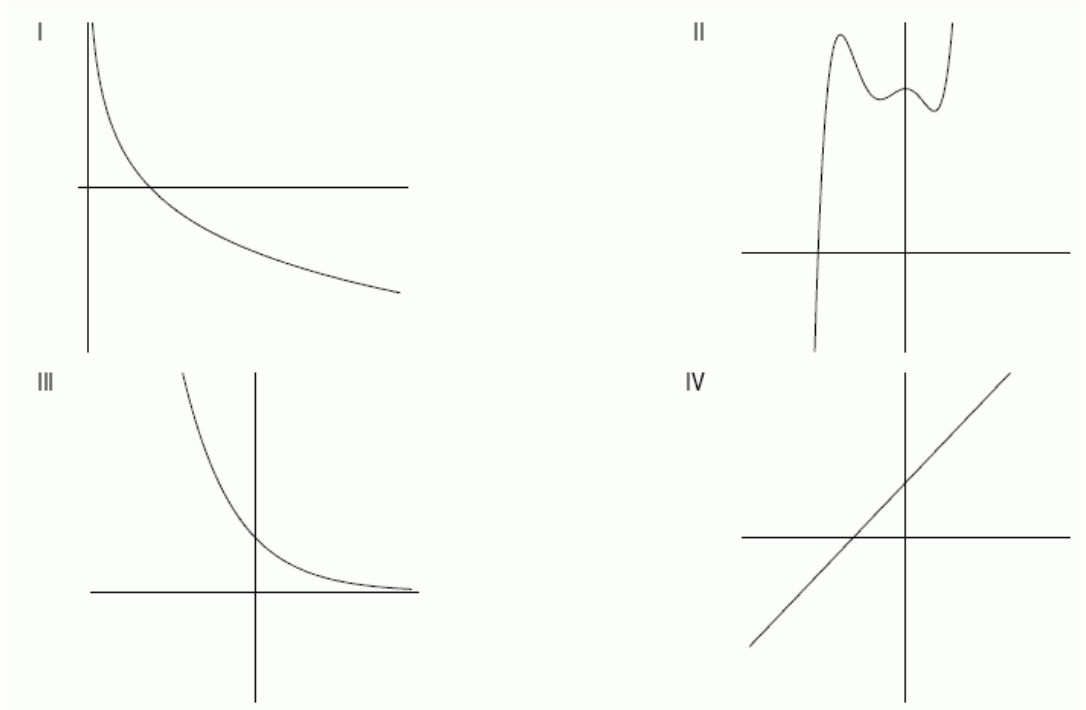
199. Write the Roman numeral of the graph that corresponds to each function.

A. $\ln(e^x)+1$

B. $-2\ln x$

C. e^{-x}

D. $x^5+2x^4-x^3-2x^2+5$



Part A: A. IV
Part B: B. I
Part C: C. III
Part D: D. II

Learning Objectives: Use the natural logarithm to solve equations. difficulty: easy
section: 1 review

200. Of the three functions below, one is a quadratic, one is a cubic, and one is a periodic function. Which one is $h(x)$?

x	0.2	0.4	0.6	0.8	1.2
$f(x)$	-0.42	-0.65	0.96	-0.15	0.84

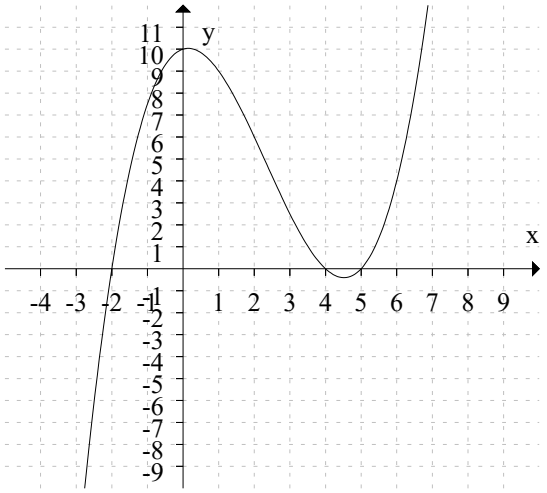
x	1.3	1.7	2.5	3.0	3.5
$g(x)$	0.41	0.81	0.65	-0.10	-1.35

x	0.5	1.2	1.8	2.0	2.2
$h(x)$	-1.13	0.13	0.03	0.00	0.05

A) cubic
B) periodic
C) quadratic

Ans: A Learning Objectives: Use the natural logarithm to solve equations.
difficulty: medium section: 1 review

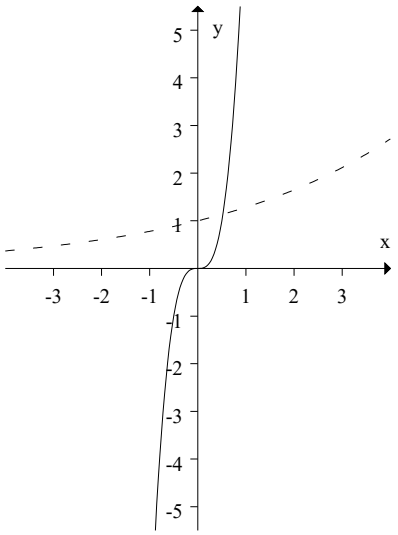
201. Write in factored form the equation of the polynomial graphed below. All key features are shown.



Ans: $p(x) = \frac{1}{4}(x+2)(x-4)(x-5)$

Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1 review

202. The solid curve below is a portion of the graph of $f(x) = 8x^3$ and the dashed curve is a portion of the graph of $g(x) = e^{0.25x}$. The domain of both functions is all real numbers. Which of the following statements are true. Select all that apply.



A) At x = 1, $f(x) > g(x)$.

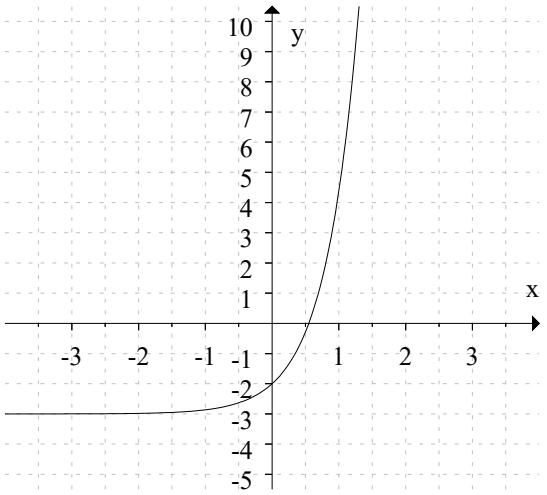
B) For all x > 1, $f(x) > g(x)$.

C) As $x \to -\infty, g(x) \to 0$.

D) There is only one value of x for which $f(x) = g(x)$.

Ans: A, C, D Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1 review

203. Using base e and transformations, find a formula for the exponential function shown in the graph below.



Ans: The answer should be close to $f(x) = e^{2x} - 3$.
Learning Objectives: Build, solve, and interpret exponential functions given data, graphs or words. difficulty: medium section: 1 review

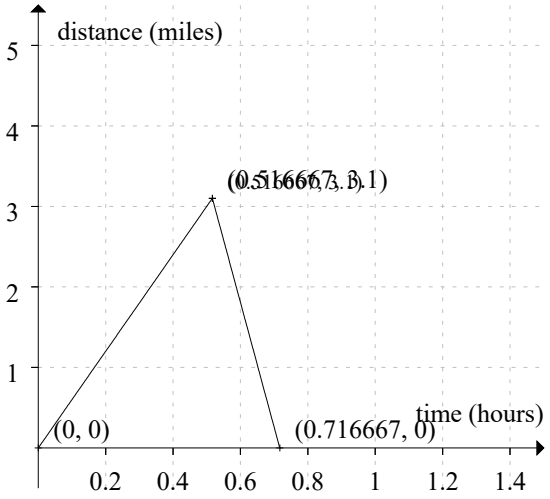
204. Delia runs 3.1 miles from home to the park at 6 mph, jumps on her bike and returns home in 12 minutes.

a) Sketch a well-labeled graph of Delia's distance from home as a function of time.

b) Find the slope of each segment of the graph and interpret their meaning.

c) What does it mean to say that Delia's velocity on the way home is inversely proportional to the time she takes to ride home?

Ans:



The slope of the first segment is 6 miles per hour; her velocity on the way to the park. The slope of the second segment is -15.5 miles per hour; her velocity on the way home. The faster Delia goes, the less time it takes for her to get back home. In formula form, rate = d/t.

Learning Objectives: Determine a formula for an exponential function from data, graphs, or words. difficulty: hard section: 1 review

205. The elimination half-life of aspirin in plasma is estimated to be between 15 and 20 minutes. Assuming the lower estimate of 15 minutes, how long will it take a dose of 81 mg to decrease to $^2/_3$ the original amount (54 mg) in the plasma?

A) 1.4 minutes
B) 9.7 minutes
C) 12 minutes
D) 8.8 minutes

Ans: D Learning Objectives: Understand and interpret properties of exponential models: doubling time, half-life. difficulty: hard section: 1 review

206. Find the equation of the line passing through the points (0, –4) and (7, –3). Then determine if the line is increasing or decreasing.

Ans: $y = 0.14x + (–4.00)$, increasing

Learning Objectives: Find and give units for average rate of change of a function on an interval. difficulty: medium section: 1 review