Name _____ Date _____

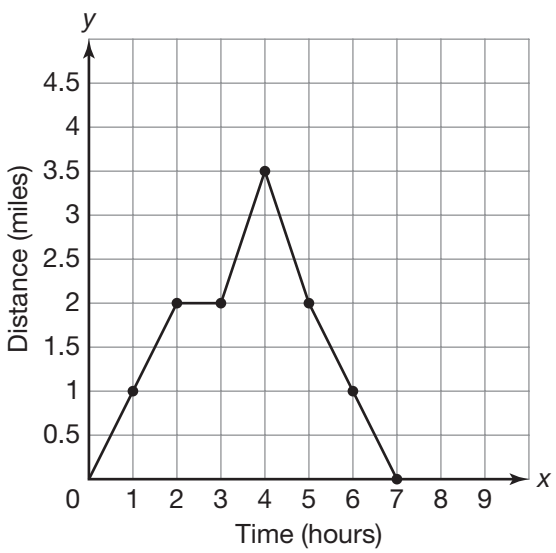
Let's Take a Little Trip

Every Graph Tells a Story

Problem Set

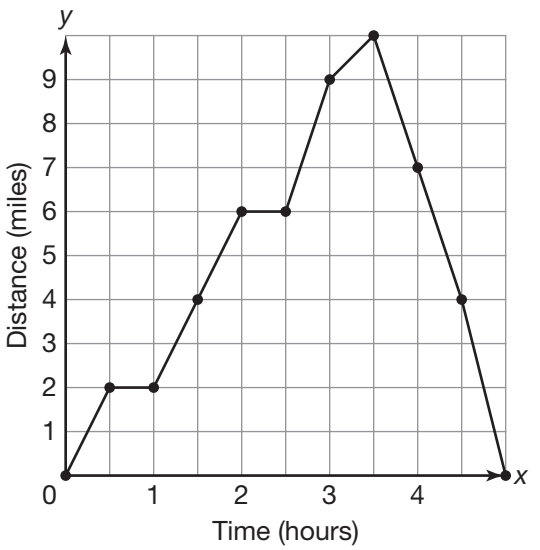
For each graph describe the linear piecewise function in words. Be sure to include the domain and range and how the distance changed from hour to hour.

1. John goes for a walk on the beach early in the morning and returns home later that day.

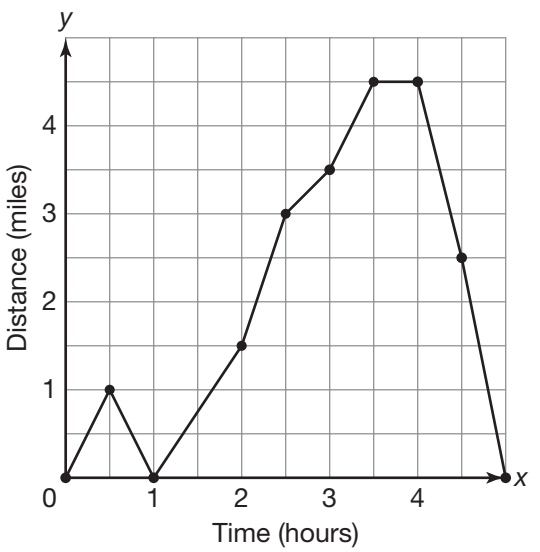


The domain is all times from 0 to 7 hours, which means the trip lasted 7 hours. The range is all distances from 0 to 3.5 miles, which means John went a maximum of 3.5 miles away from home. John traveled 1 mile in each of the first 2 hours. He rested for an hour, and then traveled 1.5 miles in the next hour. At this point he started back toward home. He traveled 1.5 miles in the next hour, and 1 mile in each of the following 2 hours, which brought him back home.

2. Peyton takes her dog for a long run on Saturday, stopping at different places along the way.

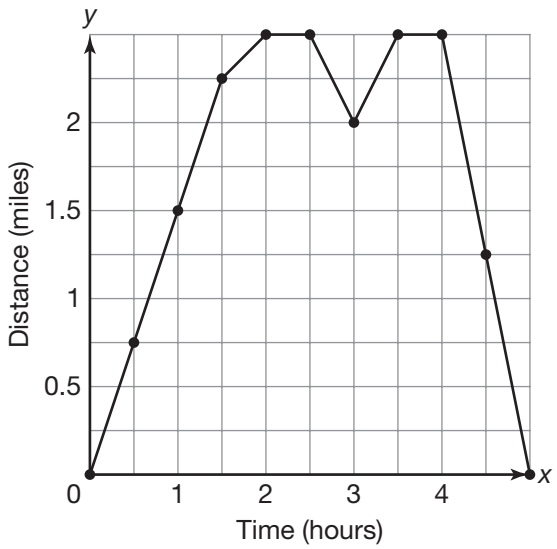


3. Tonya rides her bike to her friend Alexandra's house, stays awhile, and then returns home.

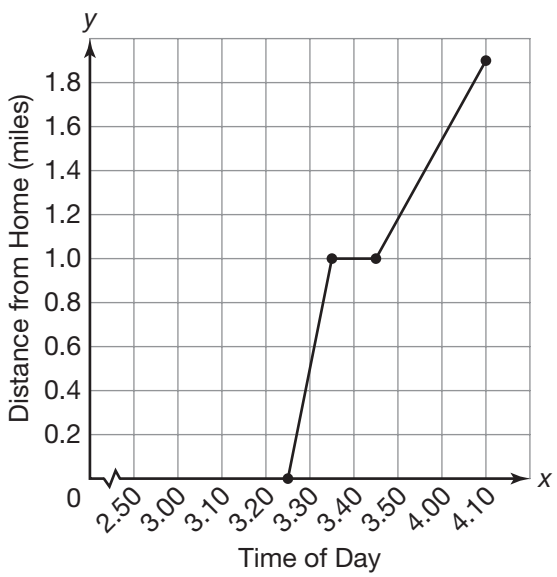


Name _____ Date _____

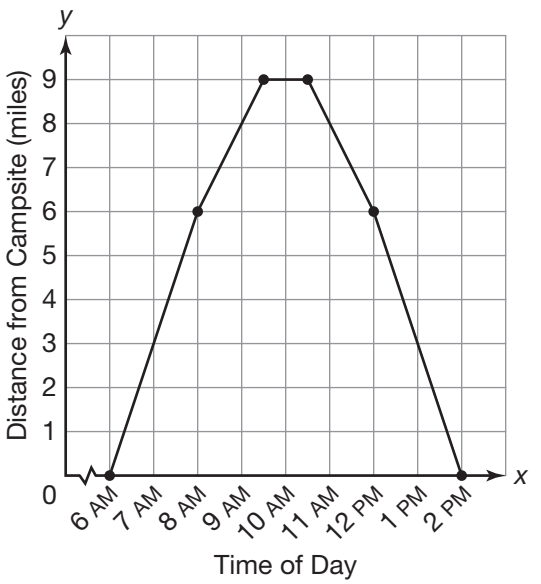
4. Tim walks to his friend Ryan's house, spends some time there, and comes back home.



5. Every Tuesday and Thursday, Kurt walks to the community center after school.

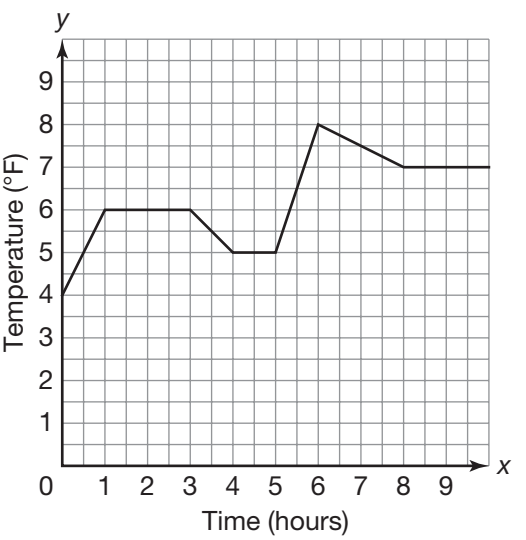


6. Lucy is hiking from her campsite to a waterfall, enjoys the scenery, then returns to the campsite.



11

The graph shows the temperature in a restaurant's freezer during Alicia's 10-hour shift. Interpret the graph to answer each question.



7. State the domain and range as they relate to the problem situation.

The domain, which is from 0 to 10 hours, represents the time of Alicia's shift. The range, which is from 4 to 8°F, represents the temperature in the freezer.

Name _____ Date _____

8. What is the temperature three hours after the start of Alicia's shift?

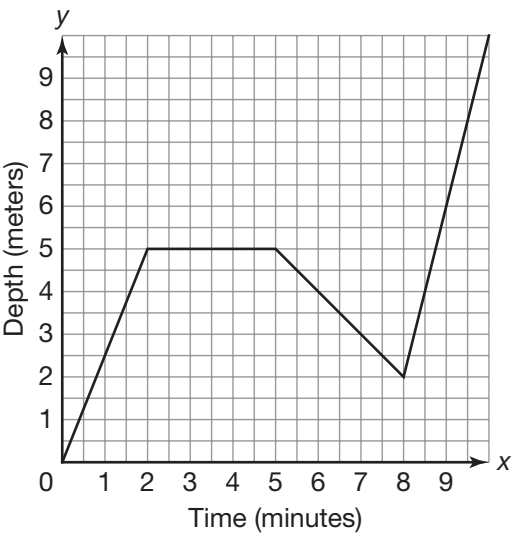
9. At which time(s) in Alicia's shift is the temperature 5°F?

10. During which time period(s) is the temperature in the freezer remaining constant?

11. Identify if the function has any absolute maximum or absolute minimum values and explain what the absolute maximum or absolute minimum means in terms of the problem situation.

12. At which time(s) during Alicia's shift is the temperature changing the fastest? Explain your reasoning.

The graph shows the depth at which a shark swims after a tracking device is attached to its dorsal fin. Interpret the graph to answer each question.



13. Is this relation a function? If so, explain why the relation is a function and identify the function family. If not, explain why the relation is not a function.

The relation is a function because at any time, the shark is exactly one depth. The function is a linear piecewise function.

14. State the domain and range as they relate to the problem situation.

15. What is the shark's depth one minute after the tracking device is installed?

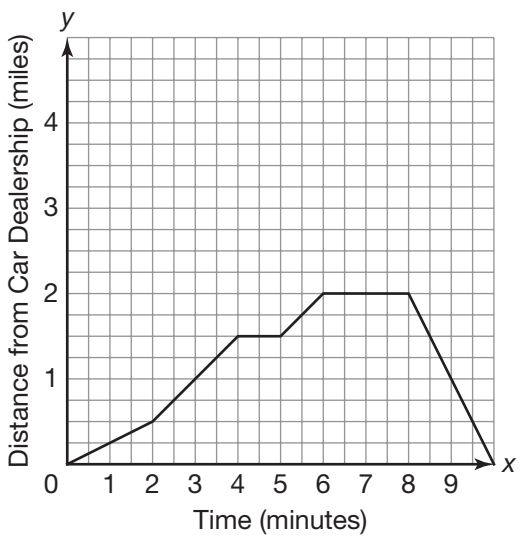
16. How many minutes after the tracking device is installed is the shark's depth 6 meters?

Name _____ Date _____

17. During which time period(s) is the shark swimming toward the surface?

18. What was the shark's speed the first two minutes after the tracking device was attached? Explain your reasoning.

The graph shows Terrence's distance from a car dealership during his 10-minute test drive. Interpret the graph to answer each question.



19. How far from the car dealership is Terrence after 7 minutes?

Terrence is 2 miles from the car dealership after 7 minutes.

20. State the domain and range as they relate to the problem situation.

21. Identify if the relation has any absolute minimum or maximum values. Explain what the absolute minimum or absolute maximum means in terms of this problem situation.

22. At which time(s) is Terrence 1.5 miles from the car dealership?

23. During which time period(s) is Terrence driving the fastest? What is Terrence's average speed during that interval?

24. When is Terrence traveling away from the dealership? When is he traveling toward the dealership? Explain how you know.

Name _____ Date _____

Whodunit? The Function Family Line-Up

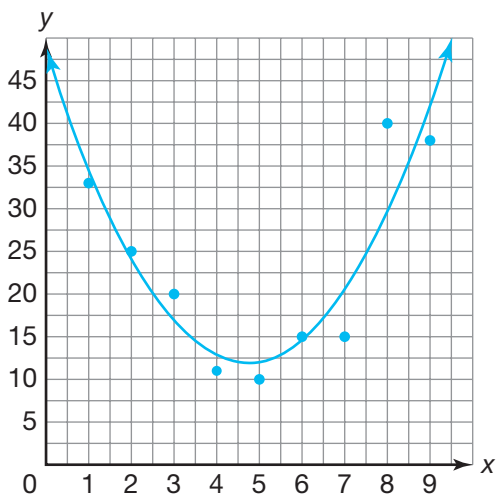
Modeling Data with Curves of Best Fit

Problem Set

Create a scatter plot of each data set on the grid. Sketch a function that best models the data. Describe which function family best represents the function you sketched.

1.

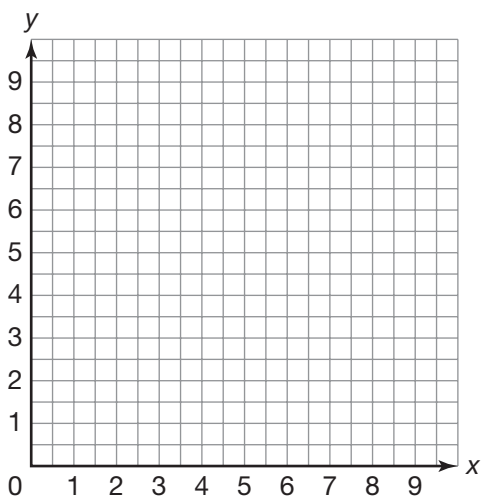
x	*y*
1	33
2	25
3	20
4	11
5	10
6	15
7	15
8	40
9	38



The function belongs to the quadratic function family.

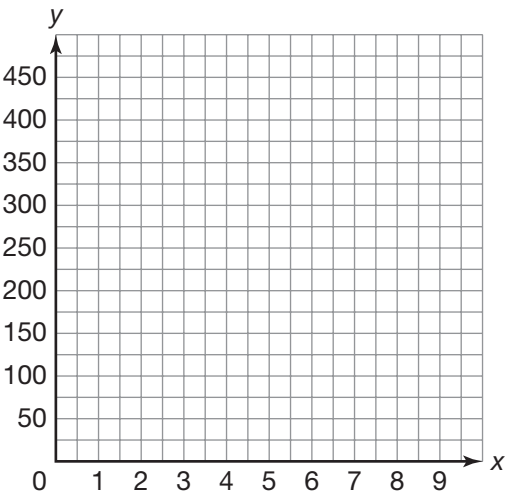
2.

x	*y*
1	1
2	1
3	1.5
4	1
5	2
6	3
7	4.5
8	6
9	9.5



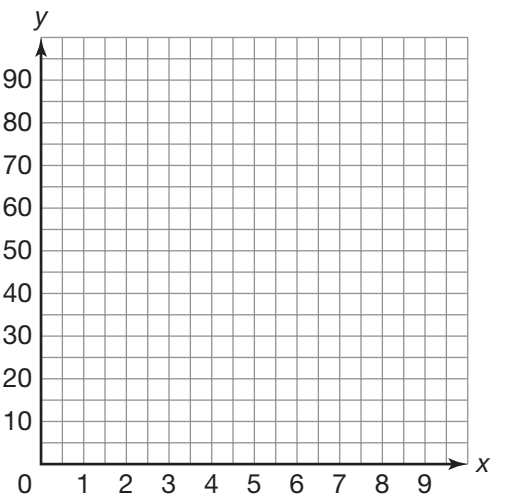
3.

x	y
1	450
2	425
3	350
4	275
5	250
6	250
7	150
8	75
9	25



4.

x	y
0	80
1	50
2	40
3	20
4	15
5	12.5
6	7.5
7	10
8	7.5
9	5

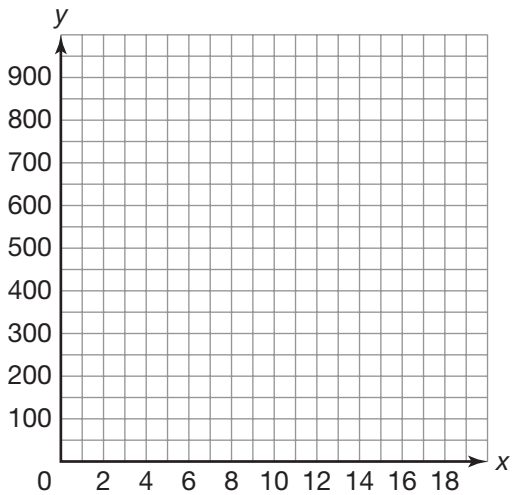


11

Name _____ Date _____

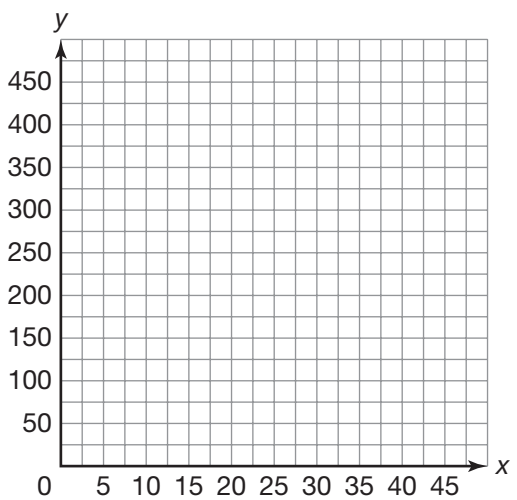
5.

x	y
1	340
2	400
4	360
5	400
6	490
8	470
10	550
12	570
14	680
15	660
18	740



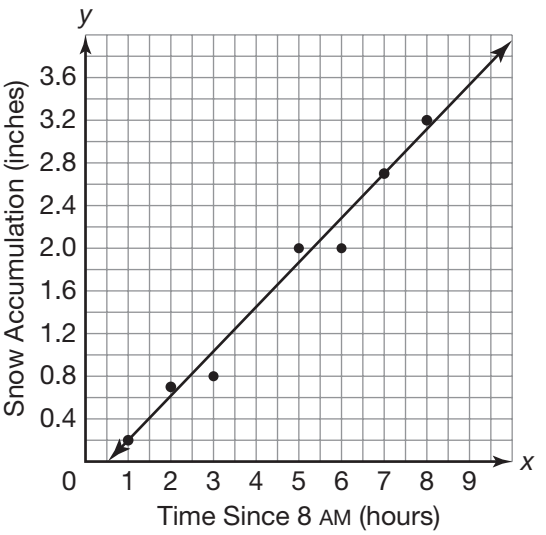
6.

x	y
5	0
10	150
15	325
20	325
25	450
30	450
35	475
40	375
45	400
50	275



11

The graph shows the amount of snow accumulation at Snowy Ridge Ski Resort over a period of time. The function which best fits the data is also displayed. Analyze the graph of the function to answer each question.



11

7. State the domain and range of the function.

The domain of the function is all real numbers. The range of the function is all real numbers.

8. Does the function have an absolute minimum or absolute maximum? If so, identify it and describe what it means in terms of the problem situation. If not, explain why not.

9. Does your function represent continuous or discrete data? Explain your reasoning.

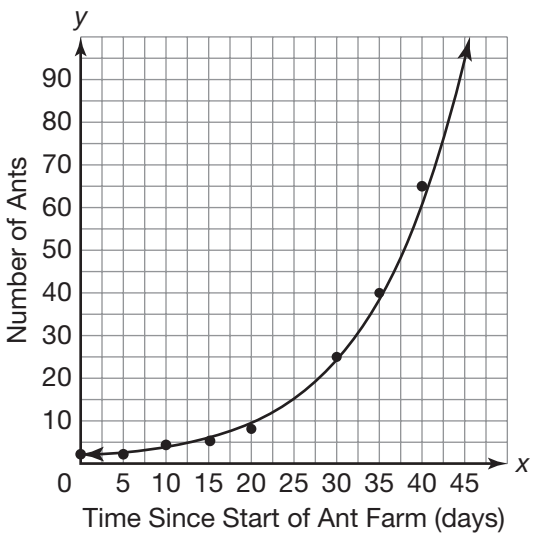
10. According to the function, what was the total amount of snow accumulation at 12 PM?

11. Use the function to predict the total amount of snow accumulation at 6 pm.

Name _____ Date _____

12. The Snowy Ridge Ski Resort can expect to see an increase in skiers when there is 3 or more inches of snow accumulation. Around what time should the ski resort expect to see more skiers?

The graph shows the number of ants in an ant farm since the day it was started. The function which best fits the data is also displayed. Analyze the graph of the function to answer each question.



13. Does the function have an absolute minimum, absolute maximum, or neither? If so, describe what it means in terms of this problem situation.

This function has neither an absolute minimum nor an absolute maximum. However, in terms of the problem situation, the number of ants cannot be negative, so the function can never go below the *x*-axis.

14. State the domain and range of the function.

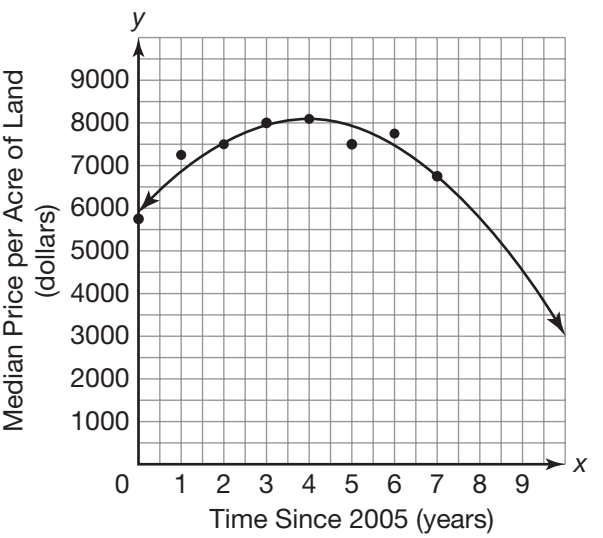
15. Does the function represent continuous or discrete data? Explain your reasoning.

16. According to the function, how many ants were in the ant farm 25 days after it was started?

17. Use the function to predict when the number of ants in the ant farm will reach 100.

18. Use what you know about populations to justify the shape of this graph.

The graph shows the median price of an acre of land in Washington County since 2005. The function which best fits the data is also displayed. Analyze the graph of the function to answer the question.



19. Which function family best represents the function shown?

The quadratic function family best represents the function.

20. What do you notice about the median price of an acre of land between 2005 and 2015?

Name _____ Date _____

21. State the domain and range of the function. Determine the domain and range for the problem situation.

22. Over which interval(s) is the function increasing? Over which interval(s) is the function decreasing?

23. Use the function to predict the median price per acre of land in the year 2015.

24. A Washington County landowner in the year 2012 is contemplating selling her land, but she also thinks it might be worth it to wait a few years. Make a recommendation to the landowner based on the function.

11

Name _____ Date _____

People, Tea, and Carbon Dioxide
Modeling Using Exponential Functions

Problem Set

For each given data set determine the exponential regression equation and the value of the correlation coefficient, *r*. Round all values to the hundredths place.

1.

x	*y*
10	5
20	6
30	8
40	15
50	32
60	70
70	150

$f(x) = 1.88(1.06)^x$

$r \approx 0.98$

2.

x	*y*
0	6000
1	2100
2	750
3	275
4	95
5	40
6	15
7	6
8	4

3.

x	5	10	15	20	25	30	35	40
y	12	10	25	21	45	35	80	120

4.

x	100	200	300	400	500	600	700
y	25.4	10.5	4.5	2.1	0.8	0.3	0.4

5.

x	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1200	585	272	126	42	40	14	12

6.

x	0	100	200	300	400	500	600
y	10	50	110	160	220	290	350

Evaluate each function for the given value of x. Round your answer to the hundredths place.

7. Evaluate $f(x) = 2.45(1.05)^x$ when $x = 6$.

$f(6) = 2.45(1.05)^6$

≈ 3.28

8. Evaluate $f(x) = 55(0.82)^x$ when $x = 10$.

9. Evaluate $f(x) = 200(1.11)^x$ when $x = 20$.

10. Evaluate $f(x) = 10(2)^x$ when $x = 11$.

11. Evaluate $f(x) = 1200(0.99)^x$ when $x = 100$.

12. Evaluate $f(x) = 0.5(1.094)^x$ when $x = 25$.

13. Evaluate $f(x) = 5000(0.485)^x$ when $x = 7$.

14. Evaluate $f(x) = 180(0.35)^x$ when $x = 5$.

15. Evaluate $f(x) = 2.5(1.5)^x$ when $x = 30$.

16. Evaluate $f(x) = 9000(0.95)^x$ when $x = 90$.

Name _____ Date _____

Use a graphing calculator to determine the exponential regression equation that models each situation. Use the equation to make the associated prediction. Round all values to the hundredths place.

17. Tamara deposited $500 into a savings account in 1970. The table shows the value of Tamara's savings account from 1970 to 2010. Predict the account's value in 2020.

Time Since 1970 (years)	0	5	10	15	20	25	30	35	40
Account Value (dollars)	500	650	900	1150	1600	2100	2750	3850	4800

$f(x) = 497.63(1.06)^x$

$f(50) = 497.63(1.06)^{50}$

≈ 9166.42

The account's value will be approximately $9166.42 in 2020.

18. Tamika deposited $1000 into a savings account in 1980. The table shows the value of Tamika's savings account from 1980 to 2010. Predict when the account's value will be $5000.

Time Since 1980 (years)	0	5	10	15	20	25	30
Account Value (dollars)	1000	1200	1480	1800	2200	2720	3250

19. A marine biologist monitors the population of sunfish in a small lake. He records 800 sunfish in his first year, 600 sunfish in his fourth year, 450 sunfish in his sixth year, and 350 sunfish in his tenth year. Predict the population of sunfish in the lake in his sixteenth year.

20. A marine biologist monitors the population of catfish in a small lake. He records 50 catfish in his first year, 170 catfish in his fourth year, 380 catfish in his sixth year, and 1900 catfish in his tenth year. Predict when the population of catfish in the lake will be 6000.

21. Every hour, a scientist records the number of cells in a colony of bacteria growing in her lab. The sample begins with 15 cells. Predict the number of cells in the colony after 7 hours.

Hour	Number of Cells
0	15
1	40
2	110
3	300
4	850

22. Every hour, a scientist records the number of cells in a colony of bacteria growing in her lab. The sample begins with 50 cells. Predict how long it will take the sample to grow to 2000 cells.

Hour	Number of Cells
0	50
1	90
2	160
3	290
4	530

Name _____ Date _____

BAC Is BAD News

Choosing the Best Function to Model Data

Problem Set

Use a graphing calculator to determine the indicated regression equation for each data set. Round to the nearest tenth. Then explain the meaning of each variable in the regression equation.

1. Determine a quadratic regression equation that shows the relationship between the length of time in months that a new television has been for sale and the price of the television in dollars.

Time (months)	0	6	8	12
Price (dollars)	750	530	450	275

$y = -0.5x^2 - 33.6x + 749.9$

x represents the time in months the television has been for sale

y represents the price in dollars of the television

2. Determine a quadratic regression equation that shows the relationship between the number of years since a collector purchased an antique table and the value of the table in dollars.

Time (years)	0	22	50	100
Price (dollars)	25	9755	15,750	8550

3. Determine an exponential regression equation that shows the relationship between the time in months and the population of a town.

Time (months)	1	2	3	4	5
Population	1000	1050	1175	1340	1450

4. Determine an exponential regression equation that shows the relationship between the time in months and the rabbit population in a park.

Time (months)	1	2	3	4
Rabbit Population	4	5	8	12

5. Determine a quadratic regression equation that shows the relationship between a vehicle's mileage in thousands of miles and the cost for repairs in dollars during the vehicle's last inspection.

Mileage (thousands of miles)	50	100	150	200
Cost for Repairs (dollars)	200	350	675	1425

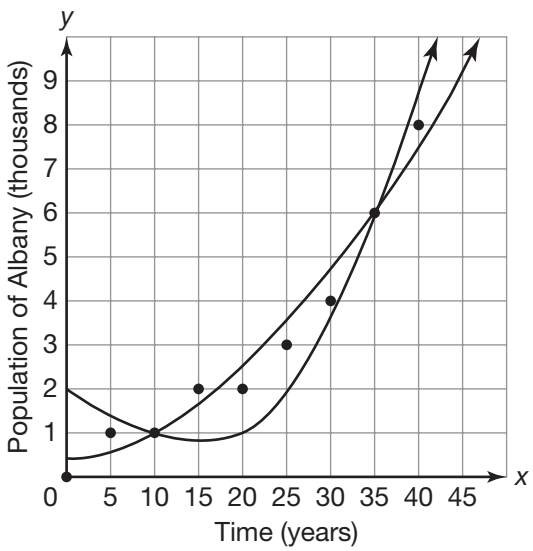
6. Determine an exponential regression equation that shows the relationship between the time in years and the amount of interest on a mortgage in dollars.

Time (years)	1	5	10	15	20
Interest (dollars)	3500	4750	3200	8525	10,450

Name _____ Date _____

Determine which regression equation is the best fit for each set of data points. Explain your reasoning.

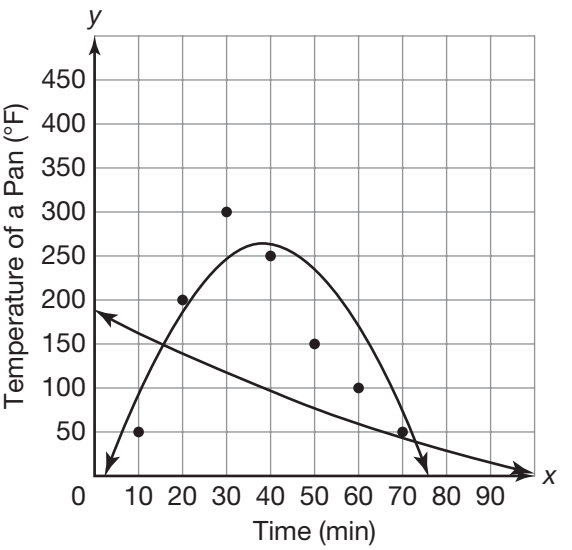
7. The quadratic regression equation is $y = 0.0077056x^2 - 0.161558x + 2.142424$.
The exponential regression equation is $y = (1.0851)(1.045)^x$.



The exponential regression equation fits the data better than the quadratic regression equation. The exponential regression equation is closer to more points in the data set.

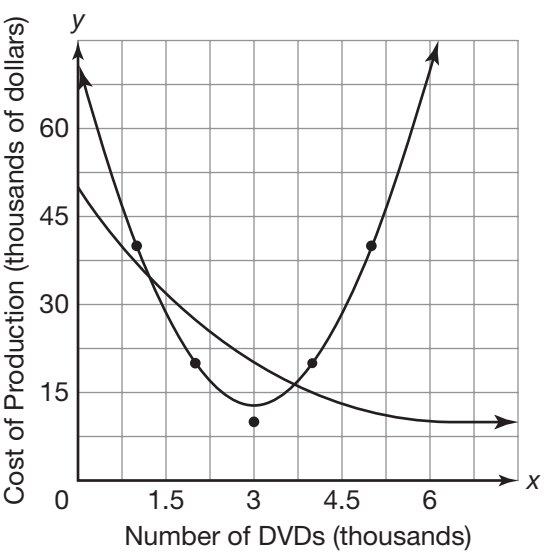
11

8. The quadratic regression equation is $y = -0.220238x^2 + 16.369x - 57.14285$.
The exponential regression equation is $y = (172.2555)(0.9926)^x$.



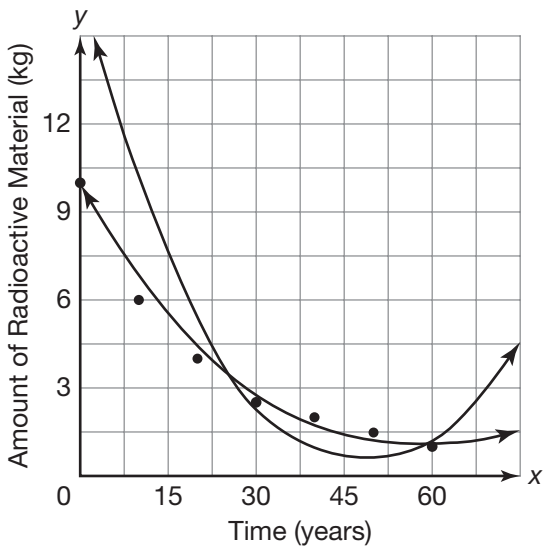
11

9. The quadratic regression equation is $y = 7.42857x^2 - 44.5714x + 78.4$.
The exponential regression equation is $y = (23.202)(1)^x$.

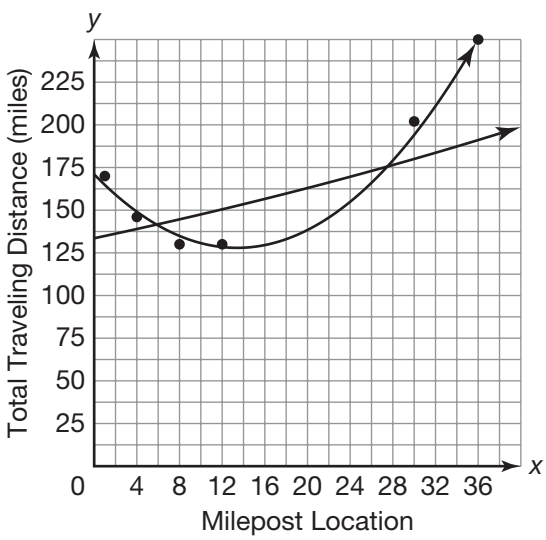


Name _____ Date _____

10. The quadratic regression equation is $y = 0.00205357x^2 + -0.2380357x + 8.05$.
The exponential regression equation is $y = (7.98796)(0.965952)^x$.

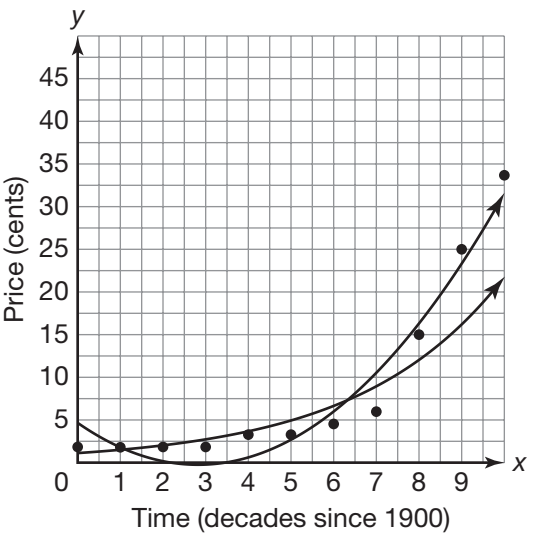


11. The quadratic regression equation is $y = 0.24x^2 - 6.43x + 171$.
The exponential regression equation is $y = (133.56)(1.01)^x$.



12. The quadratic regression equation is $y = 0.617x^2 - 3.48x + 4.66$.

The exponential regression equation is $y = 1.12(1.345562)^x$.



11

Use the given regression equation to answer each question.

13. The height of a ball in feet t seconds after it is projected upward can be modeled by the regression equation $h(t) = -16t^2 + 160t + 5$. What is the height of the ball after 2 seconds?

$h(2) = -16(2)^2 + 160(2) + 5$

$= -16(4) + 320 + 5$

$= -64 + 325$

$= 261$

The height of the ball is 261 feet after 2 seconds.

14. The population of a town after t years can be modeled by the regression equation $p(t) = 15{,}000(1.07)^t$. What will the population of the town be after 5 years?

Name _____ Date _____

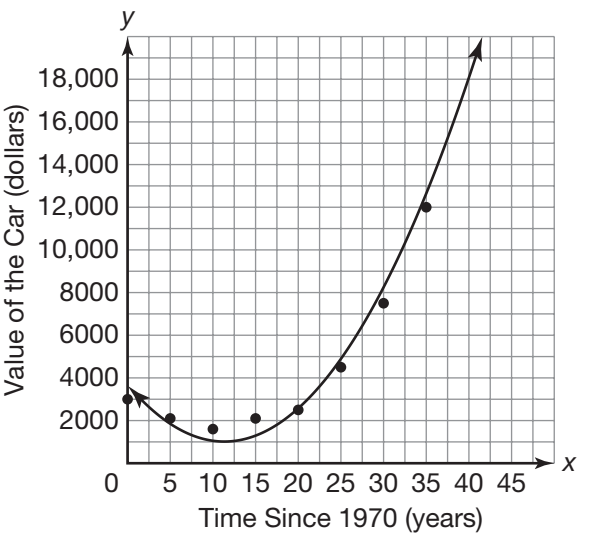
15. A boiling pot of water is removed from a burner. Its temperature in degrees Fahrenheit can be modeled by the regression equation $t(x) = 72 + 140(0.98)^x$, where x represents the number of minutes after the pot is removed from the burner. When does the temperature reach 152 degrees?

16. The balance in a bank account can be modeled by the regression equation $b(t) = 2t^2 - 20t + 400$, where t represents the time in months. When is the balance in the bank account \$382?

17. The population of polar bears in a park after t years can be modeled by the regression equation $p(t) = 350(0.98)^t$. What is the population of the polar bears after 20 years?

18. The height of a rocket in feet t seconds after it is launched can be modeled by the regression equation $h(t) = -16t^2 + 800t + 15$. What is the height of the rocket 40 seconds after it is launched?

Ralph purchased a new 1970 Chevy Nova in the year it was manufactured for $3000. The scatter plot shows the car's value over a period of time since 1970. The quadratic regression equation that best fits the data is $f(x) = 20.77x^2 - 470.98x + 3685.45$, where $f(x)$ represents the value of the car in dollars and x represents the time since 1970 in years. The function is graphed on the grid. Analyze this information to answer each question.



11

19. Discuss the domain and range of the function as they relate to the problem situation.

The domain is all real numbers greater than or equal to 0, because the car did not have a value prior to the year of its manufacture. The range is all real numbers greater than or equal to approximately $1000, because the function's value starts at approximately $3685, and then drops to approximately $1000 before rising from that point onward.

20. Discuss the intervals of increase and decrease as they relate to the problem situation.

21. Discuss the x- and y-intercepts of the function as they relate to the problem situation.

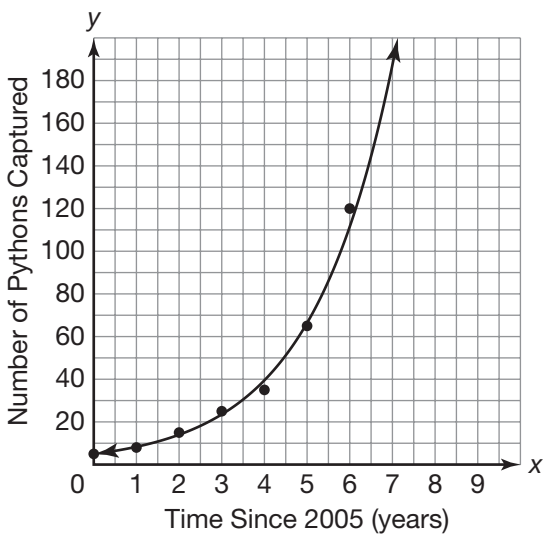
22. Discuss any minimums and maximums as they relate to the problem situation.

Name _____ Date _____

23. Predict the value of the car in 2010.

24. Why do you think the value of this car is best represented by a quadratic function? Do you think this is true of all cars?

The scatter plot shows the number of wild Burmese pythons captured in a Florida county over a period of time. The exponential regression equation that best fits the data is $p(x) = 4.96(1.68)^x$, where p represents the number of wild Burmese pythons captured and x represents the number of years since 2005. The function is graphed on the grid. Analyze this information to answer each question.



25. Discuss any minimums and maximums as they relate to the problem situation.

The function does not have a maximum value. Even though the given exponential function has no minimum value, the function as it relates to the problem has a minimum value of approximately 5 in the year 2005.

26. Discuss the domain and range of the function as they relate to the problem situation.

27. Discuss the intervals of increase and decrease as they relate to the problem situation.

28. Discuss the *x*- and *y*-intercepts of the function as they relate to the problem situation.

11

29. Predict the number of wild Burmese pythons captured in Florida in 2012.

30. Why might the number of wild Burmese pythons captured increase exponentially?