Warm Up:

Determine by composition whether $f(x) = 3(x - 1)^2$ and $g(x) = \sqrt{\frac{x}{3}} + 1$ are inverses for $x \geq 0$.

$\sqrt{\frac{3(x-1)^2}{3}} + 1$

$\sqrt{(x-1)^2} + 1$

$x - 1 + 1$

x

$3\left(\sqrt{\frac{x}{3}} + 1 - 1\right)^2$

$3\left(\frac{x}{3}\right)$

x

9-6 Modeling Real-World Data

Objectives

Apply functions to problem situations.

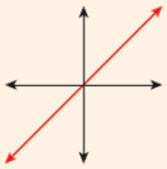
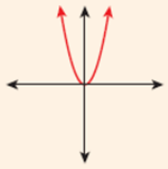
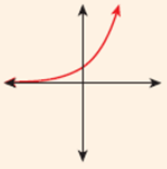
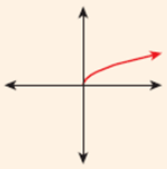
Use mathematical models to make predictions.

9-6 Modeling Real-World Data

Much of the data that you encounter in the real world may form a pattern. Many times the pattern of the data can be modeled by one of the functions you have studied. You can then use the functions to analyze trends and make predictions. Recall some of the parent functions that you have studied so far.

9-6 Modeling Real-World Data

Families of Functions

Family	Linear	Quadratic	Exponential	Square Root
Rule	$f(x) = x$	$f(x) = x^2$	$f(x) = b^x, b > 0$	$f(x) = \sqrt{x}$
Graph				
Constant Differences or Ratios	Constant first differences between *y*-values for evenly spaced *x*-values	Constant second differences between *y*-values for evenly spaced *x*-values	Constant ratios between *y*-values for evenly spaced *x*-values	Constant second differences between *x*-values for evenly spaced *y*-values

Holt Algebra 2
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9-6 Modeling Real-World Data

Helpful Hint

Because the square-root function is the inverse of the quadratic function, the constant differences for x- and y-values are switched.

We will need to decide which function to use. For that go through the following checks that we have already learned...

1) Is the first difference constant?
Yes:Linear
No, go to 2.

2) Is the second difference constant?
Yes:Quadratic
No, go to 3.

3) Is the ratio constant? Yes:Exponential

Use constant differences or ratios to determine which parent function would best model the given data set.

Time (yr)	5	10	15	20	25
Height (in.)	58	93	128	163	198

35 35 35 35

Linear parent function

$y = x$

Time (yr)	4	8	12	16	20
Population	10,000	9,600	9,216	8,847	8,493

400 384 369 354

16 15 15

$\frac{9600}{10000} = \frac{9216}{9600} = \frac{8847}{9216}$

.96 .96 .96

Exp. function

Time (s)	1	2	3	4	5
Height (m)	132	165	154	99	0

Use constant differences or ratios to determine which parent function would best model the given data set.

	x	12	48	108	192	300
	y	10	20	30	40	50
			10	10	10	10

$a = .134$
$b = 12.35$

$y = .13x + 12.35$

x	21	22	23	24
y	243	324	432	576

81 108 144

27 36

$\frac{324}{243} = 1.3$

$\frac{432}{324} = 1.3$

$\frac{576}{432} = 1.3$

Exp Reg

$y = .578(1.3)^x$

A printing company prints advertising flyers and tracks its profits. Write a function that models the given data.

Flyers Printed	100	200	300	400	500	600
Profit ($)	10	70	175	312	500	720

Write a function that models the given data.

x	12	14	16	18	20	22	24
y	110	141	176	215	258	305	356

Quadratic

$.5x^2+2.5x+8$

When data are not ordered or evenly spaced, you may to have to try several models to determine which best approximates the data. Graphing calculators often indicate the value of the *coefficient of determination*, indicated by r^2 or R^2. The closer the coefficient is to 1, the better the model approximates the data.

Find each regression and choose the one with the best r-value.

The data shows the population of a small town since 1990. Using 1990 as a reference year, write a function that models the data.

Year	1990	1993	1997	2000	2002	2005	2006
Population	400	490	642	787	901	1104	1181

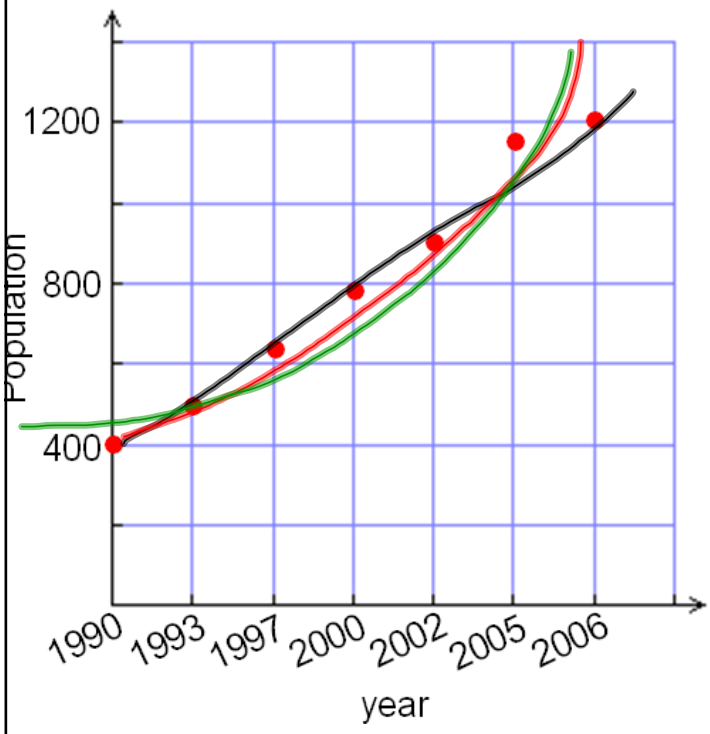
$r = .9888$ Lin

$r = .9998$ Quad

$r = .9999$ Exp

Exponential

$y = 1.07^x$



Write a function that models the data.

Fertilizer/Acre (lb)	11	14	25	31	40	50
Yield/Acre (bushels)	245	302	480	557	645	705

$r = .982$ Lin

$r = .999$ Quad

$r = .952$ Exp

$y = -.2x^2 + 23.9 + 5.3$

Make up 5 data points of your own...
Find the equation that best fits the data.

Homework:

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