9.6: Modeling

Mathematical Model

A mathematical model is a mathematical function that 'fits' or describes real-world data.

We will be choosing between four types of functions and then making a prediction using the function.

Linear
Quadratic
Exponential
Power

Quadratic

$y = 4.2x^2 - 2.7x + 3$

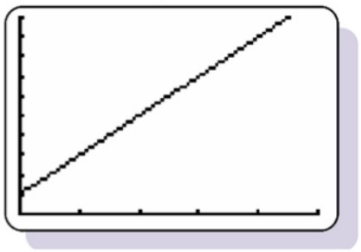
predict y when $x = 3$

$\hat{y} = 32.7$

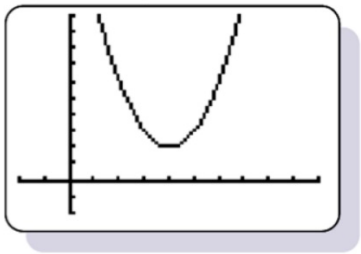
- **Linear:** $y = a + bx$ *or* $y = ax + b$
- **Quadratic:** $y = ax^2 + bx + c$

- **Exponential:** $y = ab^x$
- **Power:** $y = ax^b$

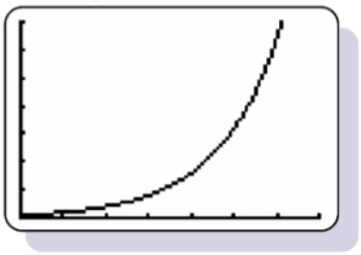
Linear: $y = 1 + 2x$



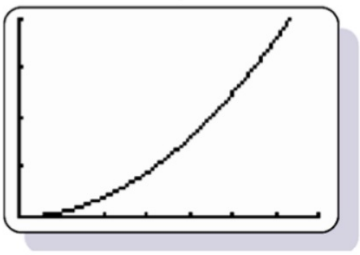
Quadratic: $y = 2x^2 - 8x + 9$



Exponential: $y = 2^x$



Power: $y = x^2$



- **Look for a Pattern in the Graph:** Examine the graph of the plotted points and compare the basic pattern to the known generic graphs.
- **Find and Compare Values of R^2:** Select functions that result in larger values of R^2, because such larger values correspond to functions that better fit the observed points.
- **Think:** Use common sense. Don't use a model that lead to predicted values known to be totally unrealistic.

1 Quadratic : $ax^2 + bx + c$

$$y = 2x^2 + 1x$$

Predict y when $x = 10$

$$y = 210$$

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Linear : .9199
Quad : .996
Exp. .99986
Pwr : .921

$y = a \cdot b^x$

$y = 2.95(1.34)^x$

predict y when $x = 9$

$\hat{y} = 41.09$

HW question #5 (there are 20 years!)
For data with years, convert to 'counting' numbers.

x	*1980*	*1981*	*1982*
y	*16*	*24*	*20*

Year 1980 will be year 1; Year 1981 will be year 2
etc.