A Quick Guide to Recognizing Linear, Quadratic, and Exponential Functions

1. Tables

Important Note: The Input Values MUST be equally spaced

Linear Function
Output difference is constant

Input	Output	
1	1	
		3-1=2
2	3	
		5-3=2
3	5	
		2
4	7	
		2
5	9	
		2
6	11	
		2
7	13	

Quadratic Function
First difference is linear
Second difference is constant

Input	Output		
1	3		
		6	
2	9		4
		10	
3	19		4
		14	
4	33		4
		18	
5	51		4
		22	
6	73		

Exponential Function
Output ratios are constant

Input	Output	
1	3	
		6/3=2
2	6	
		12/6=2
3	12	
		24/12=2
4	24	
		48/24=2
5	48	
		96/48=2
6	96	

2. Explicit Equations

Important note: There are many different forms of both the explicit and recursive equations for the same function.

Linear: Terms are constants or constant times a variable. Examples: $y = mx + b$, $2 \cdot (H - 1) = T$, $y - 3 = 7x + 8$, and Output = 2 x Input – 1.

Quadratic: Terms include constant times the square of the input variable and can also include linear terms as above. Examples: Area = (side)^2, $y = ax^2 + bx + c$, and $h = \frac{1}{2} \cdot n \cdot (n-1) = \frac{1}{2}n^2 - \frac{1}{2}n$.

Exponential: A constant times a base raised to a variable exponent. Examples: $y = 2^x$, $K = 3 \cdot 2^P$, Balance = 1000 x $(1.005)^{\text{months}}$.

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3. Recursive Equations

Linear: Initial Row = ____ (fill in blank with a number); Next Row = Previous Row + ___ (fill in blank with a number)

Example: In the first table, the initial output value is 1, and we add 2 to get the next value. More formally: $f(1)=1, \quad f(n+1)=f(n)+2$

Quadratic: Initial Row = ____ (fill in blank with a number); Next Row = Previous Row + ___ (fill in blank with a linear function)

Example: In the second table on the other page, the output value in the initial row is 3, and we add 4 x (Input) +2 to get the next value. More formally: $f(1)=3, \quad f(n+1)=f(n)+4n+2$

Exponential: Initial Row = ____ (fill in blank with a number); Next Row = Previous Row x ___ (fill in blank with a number)

Example: In the third table on the other page, the output value in the initial row is 3, and we multiply by 2 to get the next value. More formally: $f(1)=3, \quad f(n+1)=2\cdot f(n)$.

4. Graphs

Note 1: You cannot tell for sure whether a function is quadratic or exponential just from the graph. There are other functions whose graphs look like quadratics and exponentials.

Note 2: Be careful if the domain (possible input values) is restricted. For example, in many physical problems, it makes no sense to include negative inputs, but this restriction takes away some of the information that might help you identify the shape of the graph.

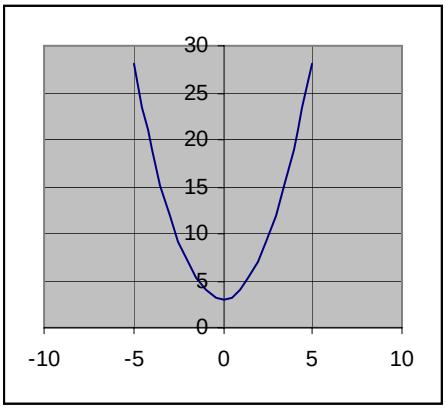
Linear: A straight line

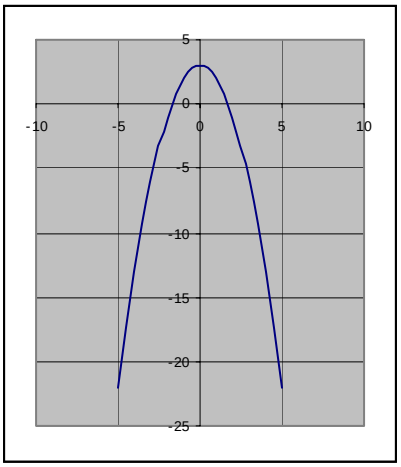
Quadratic: A parabola. Has a maximum or a minimum, and is symmetric about a vertical axis. Often looks "U Shaped," but can be deceptive; for example, if small portions are magnified they can look like straight lines.

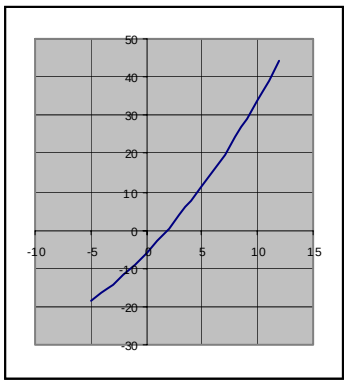
Examples on next page

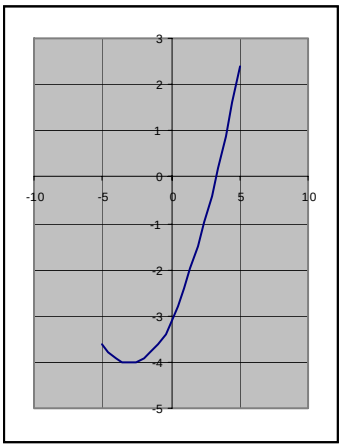
Exponential: Either grows or decays at a rate proportional to the function, so eventually either starts growing very quickly or shrinking to zero very quickly.

Examples on next page

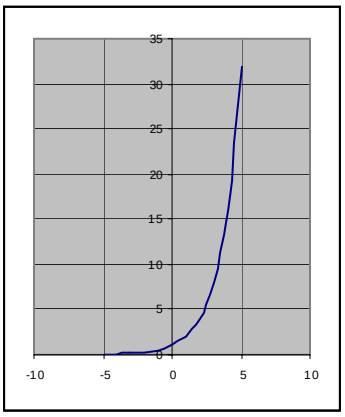


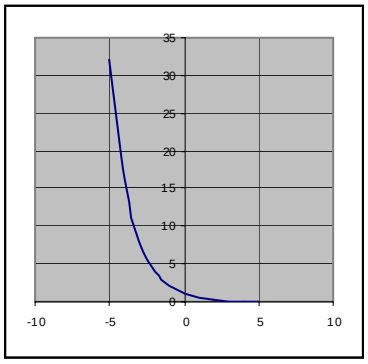


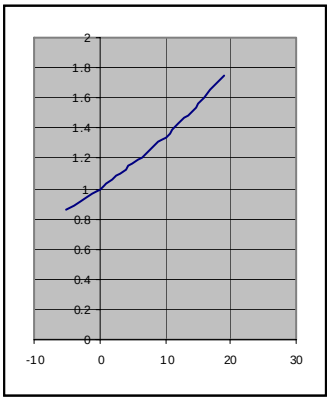




Examples of Quadratic Functions







Examples of Exponential Functions (note the last one hasn't "taken off" yet; note similarities with the third quadratic function).