

## Unit 2 - Polynomials

Sep. 20/2016

### Polynomial Functions

Consider the familiar functions:

linear:	$y = ax + b$	1
quadratic:	$y = ax^2 + bx + c$	2

We can continue this pattern:

cubic:	$y = ax^3 + bx^2 + cx + d$	3
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quartic:	$y = ax^4 + bx^3 + cx^2 + dx + e$	4
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quintic:	$y = ax^5 + bx^4 + cx^3 + dx^2 + ex + f$	5
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In general, a polynomial function in standard form is:

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$$

where  $\{a_0, a_1, \dots, a_n \in \mathbb{R}\}$  and  $\{n \in \mathbb{N}\}$

Sep 11-10:08 PM

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$$

notes:

- (1)  $a_n$  is the leading coefficient
- (2) the degree of a polynomial is the value of the highest exponent
- (3) a polynomial in standard form has descending powers of x

Recall:

first differences are constant for a LINEAR  
second differences are constant for a QUADRATIC

Higher-order finite differences can be used to identify other polynomials from data points.

For an order-N polynomial, the Nth difference will be constant.

Domain is always  $\{x \in \mathbb{R}\}$

Range varies according to graph (parent + transformations).

Sep 16-8:34 PM

## Finite Differences

$$y = ax + b$$

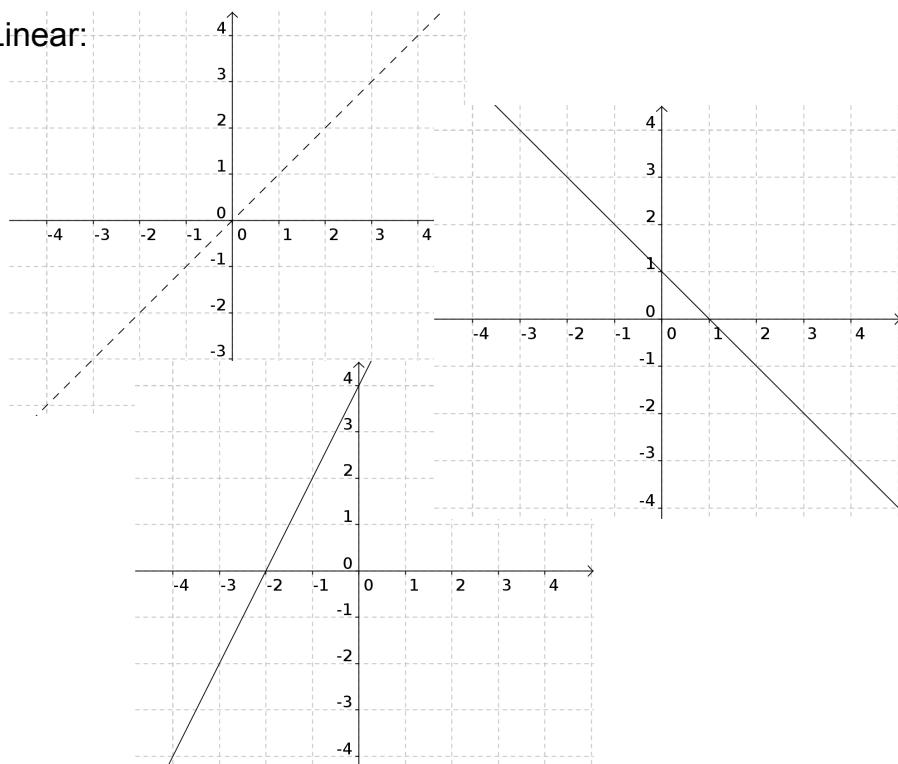
$x$	$y$	$\Delta y$

$$y = ax^2 + bx + c$$

$x$	$y$	$\Delta y$	$\Delta^2 y$

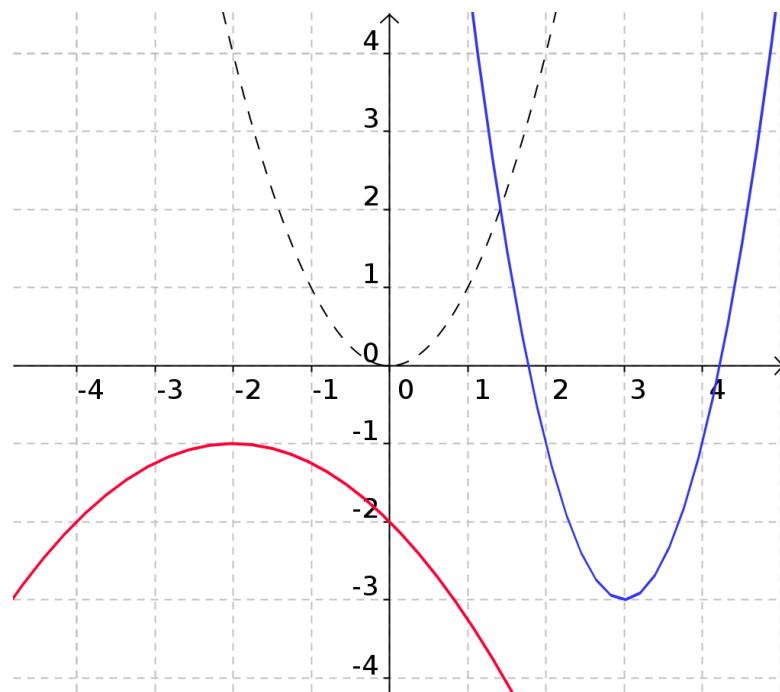
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Linear:



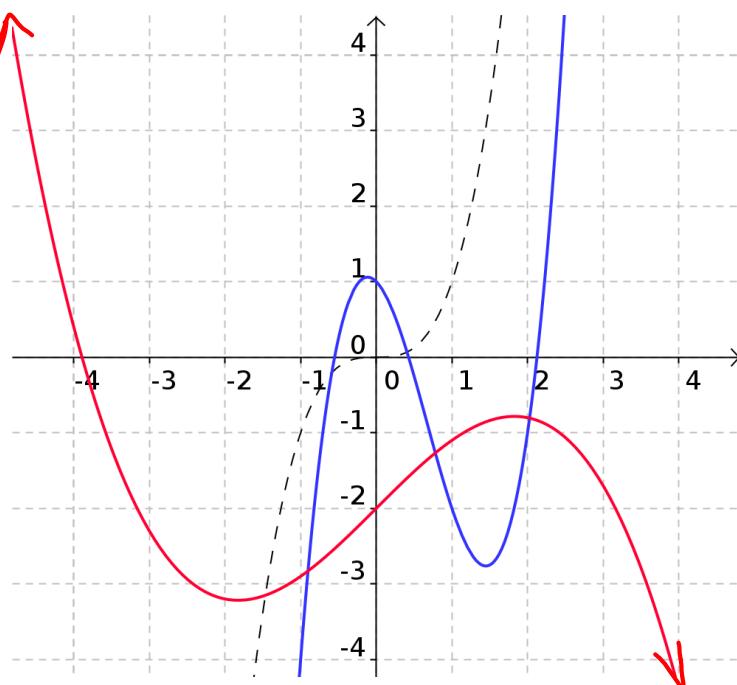
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Quadratic:



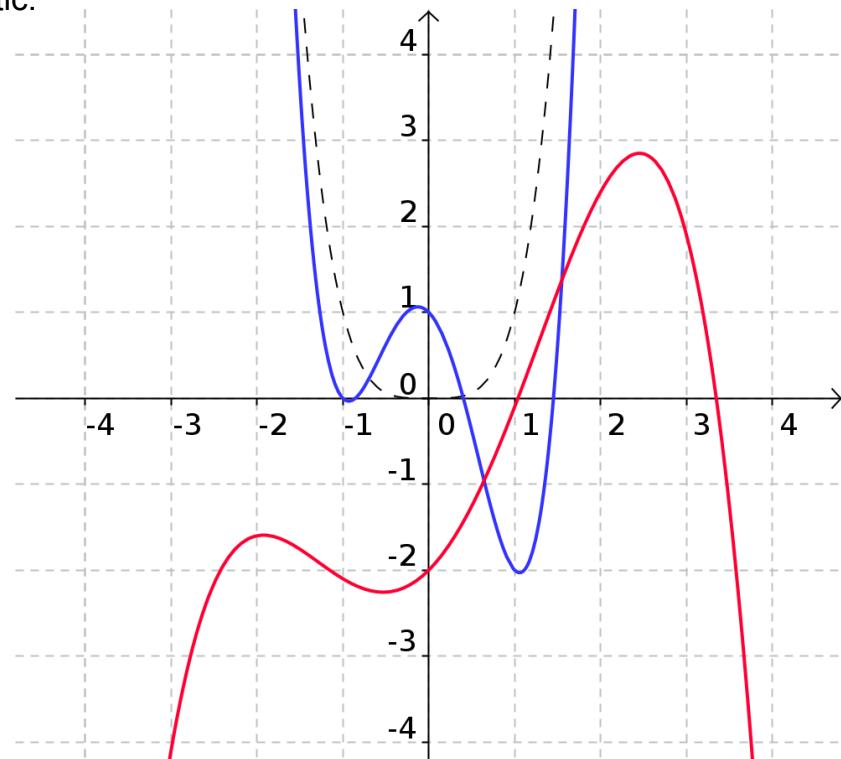
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Cubic:



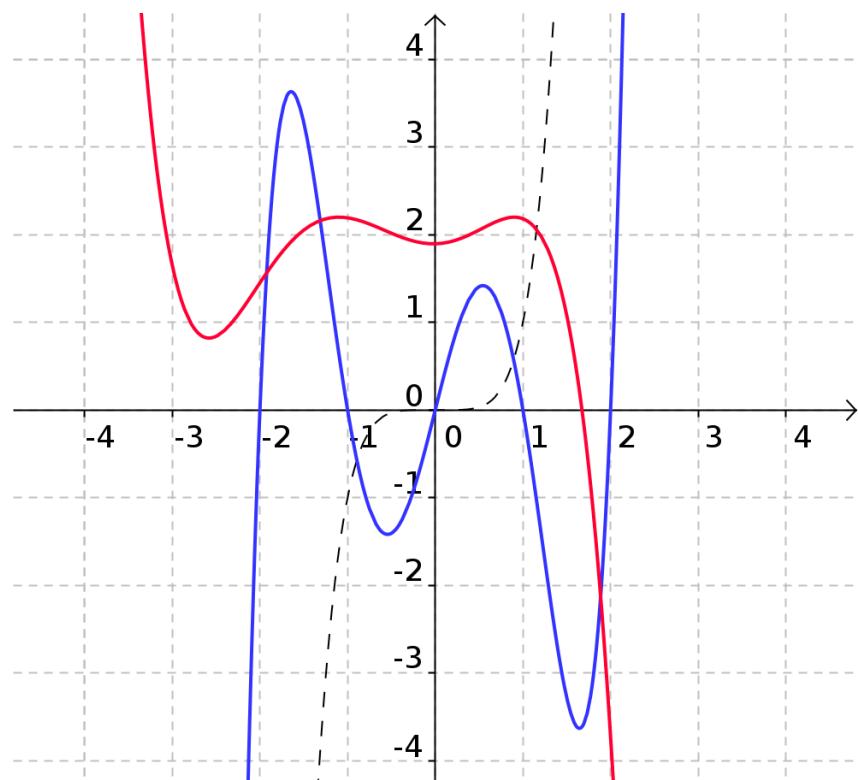
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Quartic:



Sep 16-9:21 PM

Quintic:



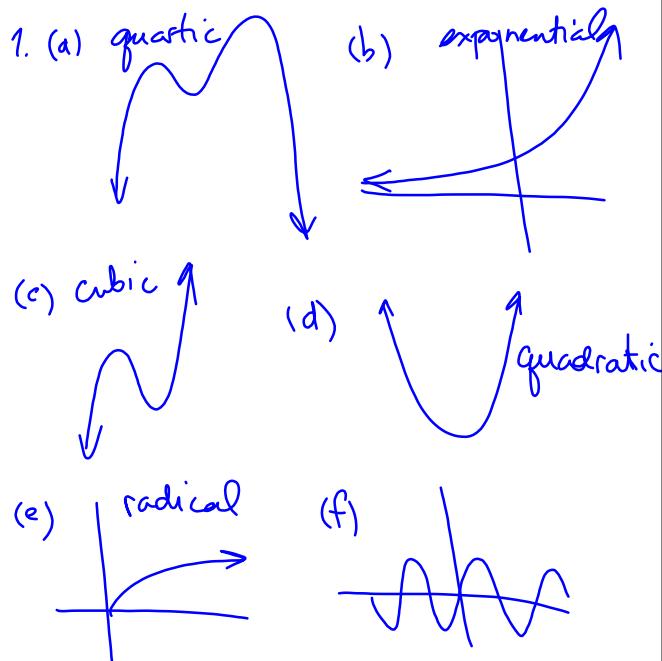
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Assigned Work:

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1. 5

2e 3d



Sep 9-9:41 PM

2(e)

$$y = \frac{x^2 - 4x + 1}{x + 2}$$

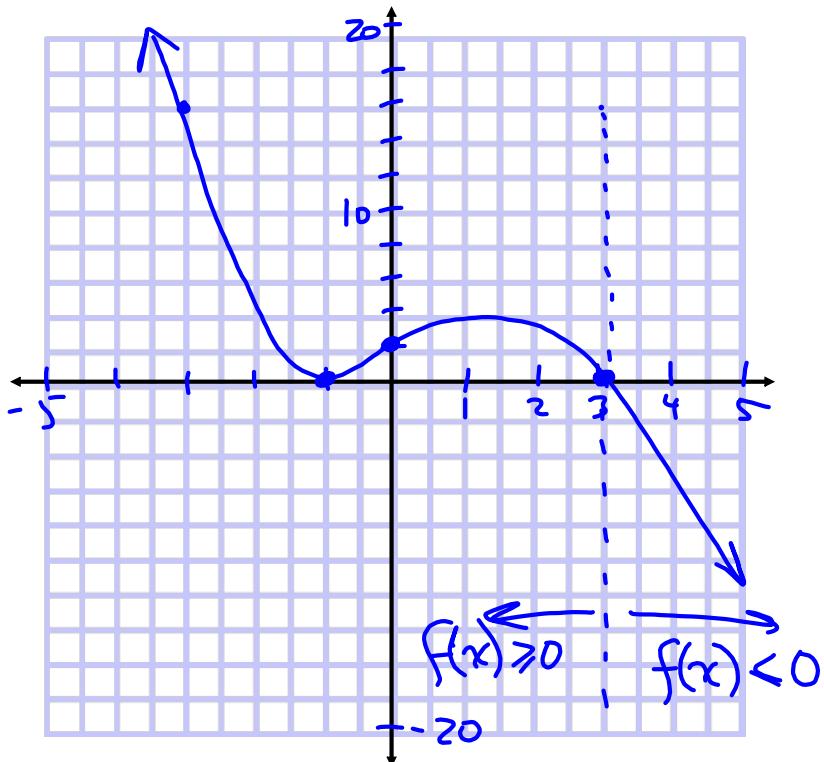
$$y = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$$

3(d)

x in	y out	$\Delta y$	$\Delta^2 y$	$\Delta^3 y$
0	200			
1	204	> 4		
2	232	> 28	> 24	
3	308	> 76	> 48	> 24
4	456	> 148	> 72	> 24
5	700	> 244	> 96	> 24
6	1064	> 364	> 120	> 24

Sep 23-12:41 PM

5.



Sep 23-12:48 PM