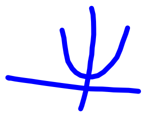
16

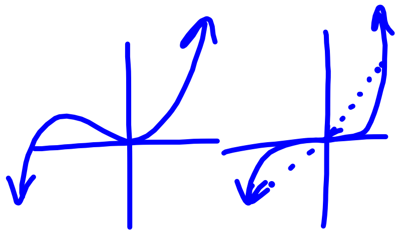
a) $f(x) = ax^2 + bx + c$

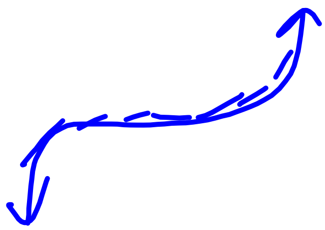
$a \neq 0 \quad b = 0$

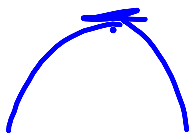


b) $f(x) = ax^3 + bx^2 + cx + d$

$a \neq 0 \;,\; b = c = d = 0$





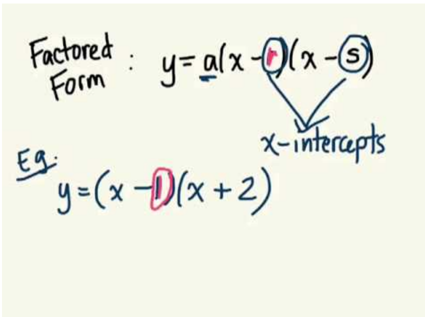


Lesson 3.03 - Polynomials in Factored Form

Learning Goals:

- I can identify properties of polynomial functions when expressed in factored form.
- I can express any polynomial function in its factored form, and then graph it.

$$2x^3+4x^2-5x+2$$



Recall:

- To factor a number (or expression) means to determine the numbers (or expressions) that divide into it with a remainder of zero.

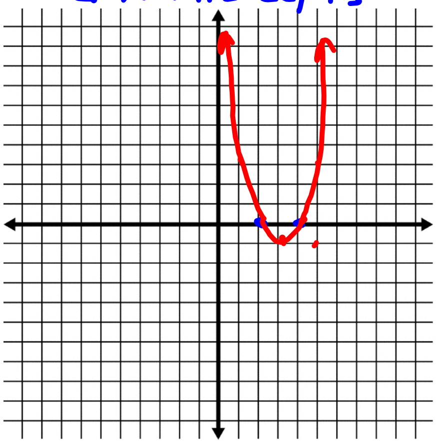
- A prime number is a positive number that has only two unique factors: 1 and itself. Note: the number 1 is not prime.

- The zeros of a function $y=f(x)$ are all real numbers x such that $f(x) = 0$. They correspond to the x--intercepts of the function $y=f(x)$. In the investigation from the last class, you learned that a polynomial function of degree n may have up to n distinct zeros.

$y=x^2-6x+8$

$=(x-2)(x-4)$

$\therefore$ 2 x-intercepts

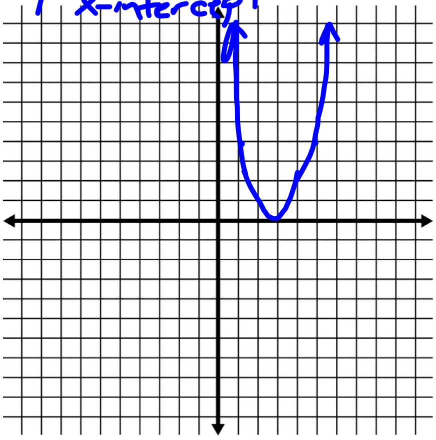


$y=x^2-6x+9$

$=(x-3)(x-3)$

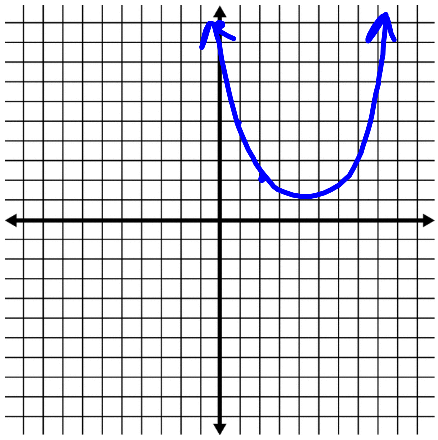
$=(x-3)^2$

1 x-intercept



$y=x^2-6x+10$

no x-intercept



The exponents of each factor, also known as the order, dictates the behaviour of the function at that x-intercept.

If a polynomial function y=f(x) with degree n has less than n distinct zeros, but at least one zero, the function can still be expressed in factored form, but there will not be n distinct factors.

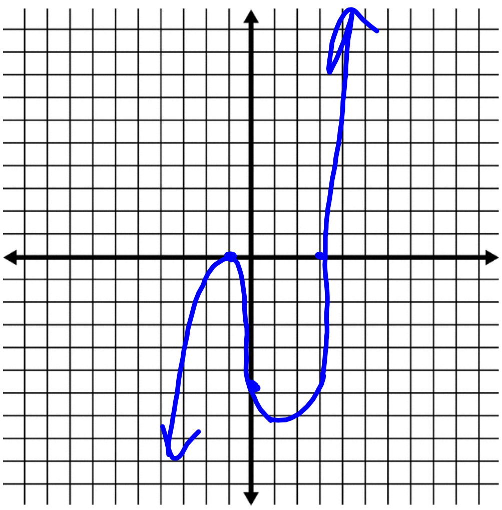
If a polynomial function y=f(x) with degree n has exactly n distinct zeros, then the factored forms are:

degree 1: Linear	f(x)=a(x-p)
degree 2: Quadratic	f(x)=a(x-p)(x-q)
degree 3: Cubic	f(x)=a(x-p)(x-q)(x-r)
degree 4: Quartic	f(x)=a(x-p)(x-q)(x-r)(x-s)
degree 5: Quintic	f(x)=a(x-p)(x-q)(x-r)(x-s)(x-t)
etc	

Example 1:

order 2

Sketch f(x)=2(x+1)²(x-3)



x-int = -1 (order 2)
x-int = +3

$f(0) = 2(1)^2(-3)$
$= -6$
$\therefore (0,-6)$

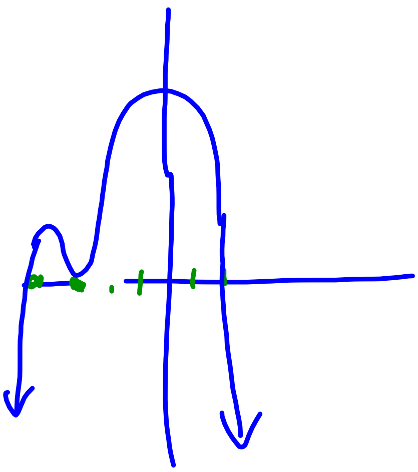
Example 2:

1. Write the equation of the function with the x-intercepts -3 (order 2), -4, and 2 that passes through the point (-2,32).
   x y
2. A family of functions are a group of functions that have the same roots. Determine at least two other functions that belong to the same family.

1.)

$f(x) = a(x+3)^2(x+4)(x-2)$
$32 = a(-2+3)^2(-2+4)(-2-2)$
$32 = a(+1)^2(2)(-4)$
$32 = a(1)(2)(-4)$
$32 = -8a$
$\frac{32}{-8} = a$
$-4 = a$

$\therefore f(x) = -4(x+3)^2(x+4)(x-2)$



2) $g(x) = 3(x+3)^2(x+4)(x-2)$
$h(x) = (x+3)^2(x+4)(x-2)$

Homework

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#1,2a,4b,6be,8ab,9ab,10d,13a, 16*

*for 16b, you will need to use Desmos