Algebra II 6.2
Polynomials and Linear Factors

A lot of what we will be doing today is skills you already know. What will be different, is how you apply your thinking.

If you have the polynomial: (x + 1)(x + 1)(x + 2) how would you write it in standard form?

Remember, we can only multiply two things at one time, so multiply (x + 1)(x + 1) and then multiply that trinomial times (x + 2)!



Here we go.....

(x + 1)(x + 1)(x + 2)

$(x+1)^2(x+2)$

$(x^2+2x+1)(x+2)$

$x^2+2x+1$

| x | $x^3$ | $2x^2$ | $x$ |
|---|---|---|---|
| 2 | $2x^2$ | $4x$ | $2$ |

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



A little review....

How would you write $6x^3 - 15x^2 - 36x$ in factored form?

$3x(2x^2-5x-12)$

$3x(2x+3)(x-4)$

$2(-12)$

$-24 \mid -5$

$-8(3) \mid -8+3$

| 2x | $2x^2$ | $-8x$ |
|---|---|---|
| 3 | $3x$ | $-12$ |

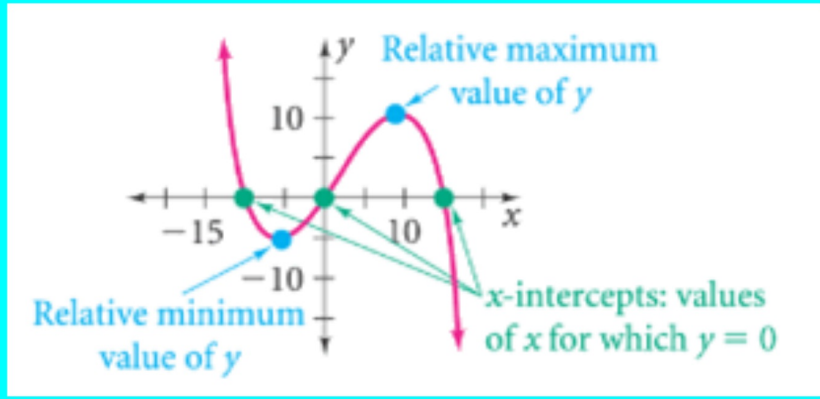
(x: −4)

How can you check this?



What is a maximum? What is a minimum?

A maximum or minimum will only exist if both the right and left side of the graph are going in the same direction.



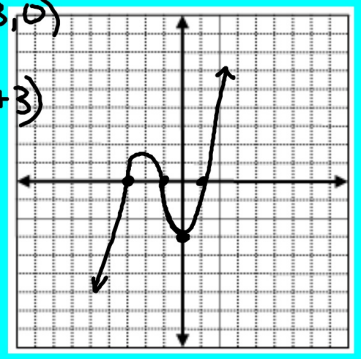

For this reason, we have *relative* maximums and minimums in polynomial functions.

Zeros are solutions, x-intercepts, and roots !!!

So, we can used factored form to easily find zeros, and we can always find our constant. If we know all these points, we can graph the polynomial function.

Find the zeros of $y = (x + 1)(x - 1)(x + 3)$. Then graph the function. (-1,0) (1,0) (-3,0)

y-int = (0+1)(0-1)(0+3)
= (1)(-1)(3)
= -3





Write a polynomial in standard form with zeros at -2, 3, and 3.

Hmmm... If I know where my zeros are, what else do I know? If I know my factors, how do I get to standard form again? Let's go.....

$(x+2)(x-3)(x-3)$

$(x^2 - x - 6)(x-3)$

$x^2 - x - 6$

| x | $x^3$ | $-x^2$ | $-6x$ |
|---|---|---|---|
| -3 | $-3x^2$ | $+3x$ | 18 |

$x^3 - 4x^2 - 3x + 18$



While the polynomial in the last example has three zeros, it only has 2 x-intercepts. But I thought zeros and x-intercepts were the same?!?!

If a factor has an exponent greater than 1, it has a <u>multiple zero</u>. If the exponent is even, the graph will turn at the x-axis at that solution. If the exponent is odd, the graph will cross the x-axis at that solution.

For each function, find the zeros and state their multiplicity.

$y = (x-2)(x+1)(x-1)^2$

(2,0)
(-1,0)
(1,0) multiplicity 2

$y = x^3 - 4x^2 + 4x$

$x(x^2 - 4x + 4)$
$x(x-2)^2$
(0,0)
(2,0) multiplicity 2