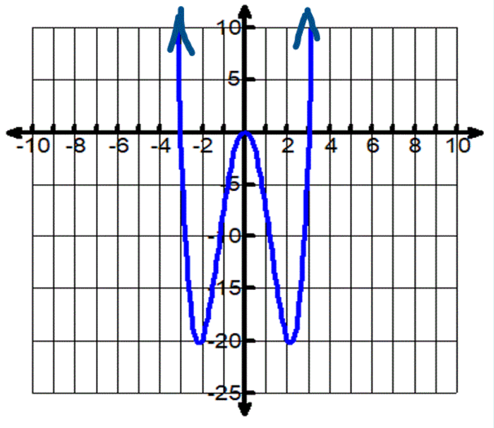
WARM-UP

Write sentences to describe the end behavior of each polynomial:

#1:



#2:

$$f(x) = 5x^5 + 2x^3 + 5x + 7$$

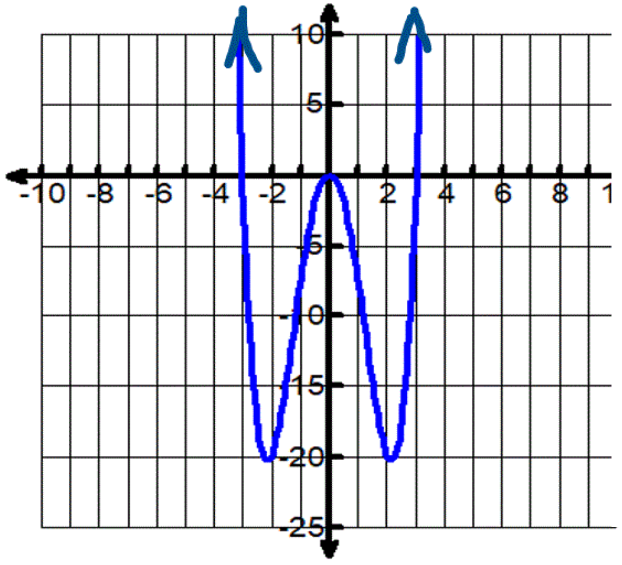
#3:

$$f(x) = -2x^4 + 4x^2 - 5$$

WARM-UP

Write sentences to describe the end behavior of the polynomial:

#1:



UP, UP

"On the left side , the arm points down."

*Translation: As x → -∞, y → +∞.

"On the right side, the arm points up."

*Translation: As x → +∞, y → +∞.

WARM-UP

Write sentences to describe the end behavior of the polynomial:

#2: $f(x) = 5x^5 + 2x^3 + 5x + 7$

ODD POSITIVE

DOWN, UP

"On the left side , the arm points down."
*Translation: As x → -∞, y → -∞.

"On the right side, the arm points up."
*Translation: As x → +∞, y → +∞.

WARM-UP

Write sentences to describe the end behavior of the polynomial:

#3: $f(x) = -2x^4 + 4x^2 - 5$

EVEN NEGATIVE

DOWN, DOWN

"On the left side , the arm points down."
*Translation: As $x \to -\infty$, $y \to -\infty$.

"On the right side, the arm points down."
*Translation: As $x \to +\infty$, $y \to -\infty$.

Use Synthetic Division to divide

$x^4 - 10x^2 - 2x + 4$ by $(x + 3)$

-3	1	0	-10	-2	4
	↓	-3	9	3	-3
	1	-3	-1	1	1 remainder

$$\left(x^3 - 3x^2 - x + 1\right) + \frac{1}{x+3}$$

Solving Polynomial Equations

Determining if a Binomial is a Factor of a Polynomial

What makes a number a factor of another number?

*****If the number can go into the other number evenly.***

*****When you divide the numbers, there is NO REMAINDER.***

This Also Applies to Polynomials …

*****Use synthetic division to divide the polynomials.***
*****If the remainder is 0, then the binomial is a factor of the polynomial.***

EX 1: Is (x + 2) a factor of $f(x) = 3x^3 - x^2 + 2x - 4$?

-2	3	-1	2	-4
	↓	-6	-14	-24
	3	7	-12	-28

$3x^2 + 7x - 12 - 28/x+2$

NO! There is a remainder.

Solving Polynomial Equations

Factoring Polynomial Functions

How to Factor Polynomials Given 1 Factor (or Zero)?

STEP 1: Use synthetic division to divide the polynomials.
STEP 2: Factor the quotient using the best method.

If (x-1) is a factor, find the other factors of $g(x) = 3x^3 + 8x^2 - 3x - 8$

$x - 1 = 0$

$x = 1$

1	3	8	-3	-8
	↓	3	11	8
	3	11	8	0

$3x^2 + 11x + 8$

$(x+1)(3x+8)$

FACTOR using Kickback!

FACTORS: $(x-1)(x+1)(3x+8)$

Factor $P(x) = x^3 - 12x^2 + 12x + 80$, given that one of the zeros of the function is $x = 10$. Then, identify the **solutions** of the function.

STEP 1: Use Synthetic Division using 10 as the zero:

10	1	-12	12	80
	↓	10	-20	-80
	1	-2	-8	0

$x^2 - 2x - 8$

STEP 2: FACTOR using X-Method!

-8

-4 -2

-2

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

STEP 3: Write the function in FACTORED FORM:

$P(x) = (x - 4)(x - 2)(x - 10)$

STEP 4: Set each factor = 0. Solve for x.

$x - 4 = 0$ $\quad$ $x - 2 = 0$ $\quad$ $x - 10 = 0$

$x = 4$ $\quad$ $x = 2$ $\quad$ $x = 10$

Solving Polynomial Equations

Solving Polynomial Equations (from SCRATCH)

How Do I Factor or Find the Solutions of a Polynomial if I am NOT Given a Factor?

First, find the POSSIBLE Roots!

To Find the Zeros (Solutions) of a Polynomial From Scratch …

- Use the **Rational Root Theorem**:

** This theorem gives the possible zeros when the factor is not given.*

$$\text{Possible Zeros} = \frac{p}{q} = \frac{\pm \text{ factors of constant term}}{\pm \text{ factors of leading coefficient}}$$

- Where p is the *constant*, and q is the *leading coefficient*.

EX 3: **Determine all possible rational roots(zeros):**

$$f(x) = 8x^3 - 6x^2 - 23x + 6$$

- **What is the constant?** **6**
- **What is the leading coefficient?** **8**
- **What are the possible rational roots?**

Possible Zeros =	$\frac{p}{q} = \frac{\pm \text{ factors of constant term}}{\pm \text{ factors of leading coefficient}}$

$$\pm \tfrac{1}{8}, \tfrac{1}{4}, \tfrac{1}{2}, \tfrac{3}{8}, \tfrac{3}{4}, 1, \tfrac{3}{2}, 2, 3, 6$$

1. Use the Rational Root Theorem to narrow down your choices for possible zeros.
2. Use Synthetic Division to test a root. Repeat until you find one that works.
3. Factor the quotient.
4. Set each factor equal to zero and solve for x.