

Aim: How do we use zeros to help graph polynomial functions?**I. Do Now:**

1. Describe the end behavior of $f(x) = x^3 + x^2 - 6x$.

2. Factor completely:

(a) $-4x^4 + 4x^2$

(b) $4x^2 + 16$

(c) $x^4 - 5x^2 + 4$

3. A polynomial function with degree n (where n is a non-negative integer) has:

- at most _____ turning points
- at most _____ real zeros

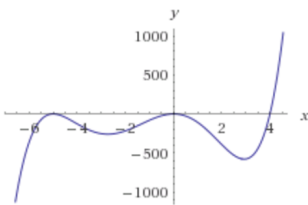
II. Development: The degree and leading coefficient of a polynomial function determine the function's end behavior. What determines the "inside" behavior? _____

The real zeros of a function $f(x)$ help us sketch the graph of the function. If $f(x)$ is a polynomial function and a is a real number, then all of the following relate to the function and are equivalent:

- $x = a$ is a zero of the function $f(x)$
- $x = a$ is a solution of the equation $f(x) = 0$
- $(a, 0)$ is an x -intercept of graph of the function $f(x)$
- $(x - a)$ is a factor of the polynomial $f(x)$

III. How Do Repeated Factors Affect Polynomial Graphs?

Consider the graph of $f(x) = x^5 + 6x^4 - 15x^3 - 100x^2$, which in factored form is $f(x) = x^2(x - 4)(x + 5)^2$.



- Real Roots : _____
- Since the factors (x) and $(x + 5)$ are each repeated twice, we say that the roots _____
- If a factor occurs an odd number of times (i.e., has an odd multiplicity), then _____
- If a factor occurs an even number of times (i.e., has an even multiplicity), then _____

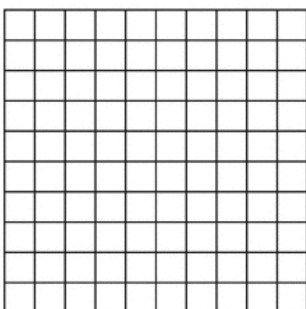
Examples: $f(x) = (x - 3)^2$, $f(x) = x(2x - 7)^3$, $f(x) = -x(x + 1)^3(x - 3)^4$, $f(x) = x^3(x + 1)^2(x - 1)^4$
(just graph on your calculator and observe whether the graph "bounces" or "crosses" at each root)

IV. Graphing Polynomial Functions Without Using A Graphing Calculator:

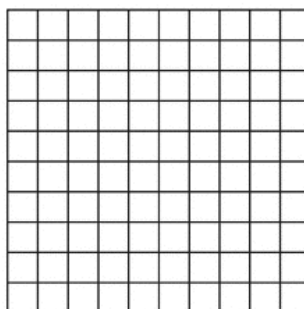
For each function:

- find all real zeros
- determine the end behavior
- sketch the graph without using a graphing calculator
- use a graphing calculator to find the coordinates of relative min/max

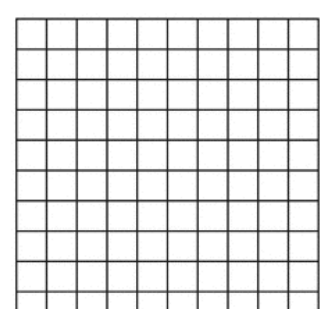
4. $f(x) = x^3 + x^2 - 6x$



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



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

**HW29**

- Read pages 104 – 107.
- p. 109: 12, 14, 19, 20, 31, 34, 49, 55, 56, 65, 67, 85