Today's Plan:

Learning Target (standard): I will graph polynomial functions using transformations.

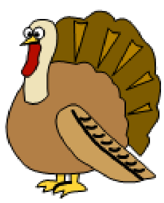
Students will: Complete practice problems over previous concepts at the boards, put up homework problems on the board and make necessary corrections to their own work, take notes over new material and complete practice problems over new concepts.

Teacher will: Provide practice problems over previous concepts, check homework problems for accuracy and provide students feedback, describe and provide examples of new concepts and assign students assessment problems over new concepts.

Assessment: Board work, homework check and homework assignment

Differentiation: Students will work at the board, go over and correct homework at their seats, actively engage in lecture over new concepts, practice new concepts with the aid of other students and the teacher and complete homework assignment.

Go over your homework with someone around you!



Graph using transformations:

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

parent: $f(x) = x^2$

x	y
-2	4
-1	1
0	0
1	1
2	4

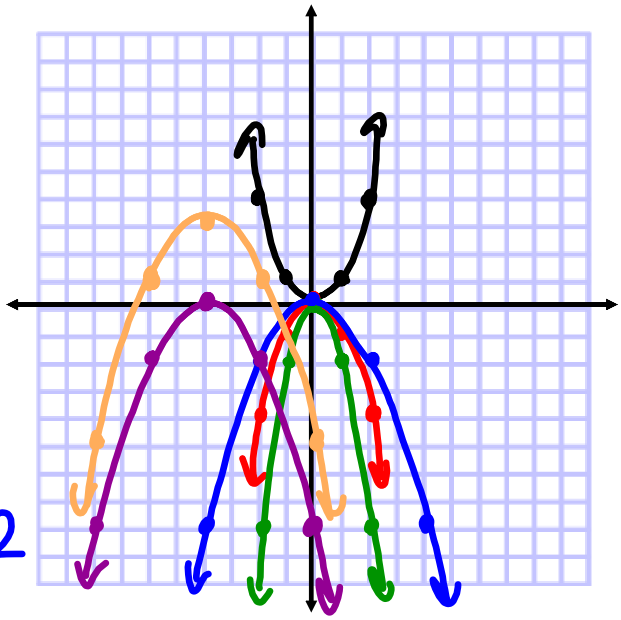
1) $f(x) = -x^2$ r_x

2) $f(x) = -2x^2$ v.s. by 2

3) $f(x) = -2\left(\frac{1}{2}x\right)^2$ h.s. by 2

4) $f(x) = -2\left(\frac{1}{2}(x+4)\right)^2$ shift left 4

5) $f(x) = -2\left(\frac{1}{2}x+2\right)^2 + 3$ shift up 3



Graph using transformations:

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

parent: $f(x) = x^4$

x	y
-2	16
-1	1
0	0
1	1
2	16

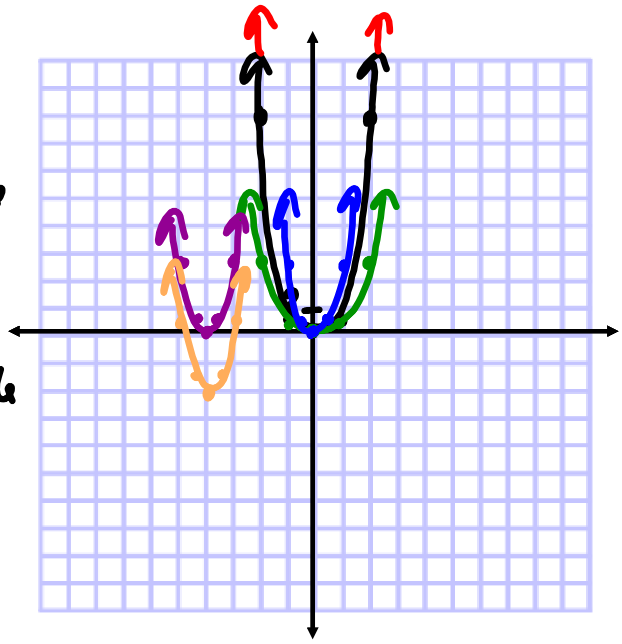
1) $f(x) = (-x)^4$ r_y

2) $f(x) = \frac{1}{3}(-x)^4$ v.c. by $\frac{1}{3}$

3) $f(x) = \frac{1}{3}(-2x)^4$ h.c. by $\frac{1}{2}$

4) $f(x) = \frac{1}{3}(-2(x+4))^4$ shift left 4

5) $f(x) = \frac{1}{3}(-2x-8)^4 - 4$ shift down 4



Important Terminology about Polynomials:

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

n (whole #)

- The degree of the polynomial is *n*
- The degree of the polynomial tells the number of zeros the polynomial will have (both real and complex)

$f(x) = 4x^{27} - x^3 - 3x^2 + 2x - 1$ polynomial? yes degree: 27

$f(x) = \frac{1}{3}x^7 + 2x - 3$ polynomial? yes degree: 7

not whole #

$f(x) = x^{\frac{1}{2}} - 4$ polynomial? no degree: —

$f(x) = 2x - 1$ polynomial? yes degree: 1

$f(x) = 3x^0$ polynomial? yes degree: 0

$f(x) = 0$ polynomial? yes degree: —

Important Terminology about Polynomials:

- The multiplicity of each zero is the number of times the zero appears in the function
  - even - touches x-axis
  - odd - crosses x-axis

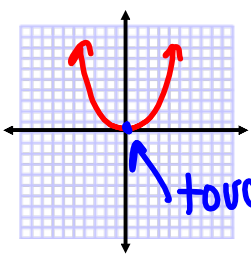
$f(x) = x^2$

$x^2 = 0$

$x \cdot x = 0$

$zero: x = 0$

multiplicity of 2



touches x-axis

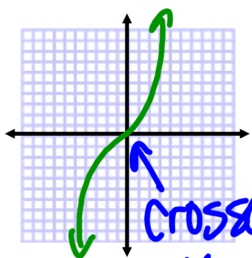
$f(x) = x^3$

$x^3 = 0$

$x \cdot x \cdot x = 0$

$zero: x = 0$

multiplicity of 3

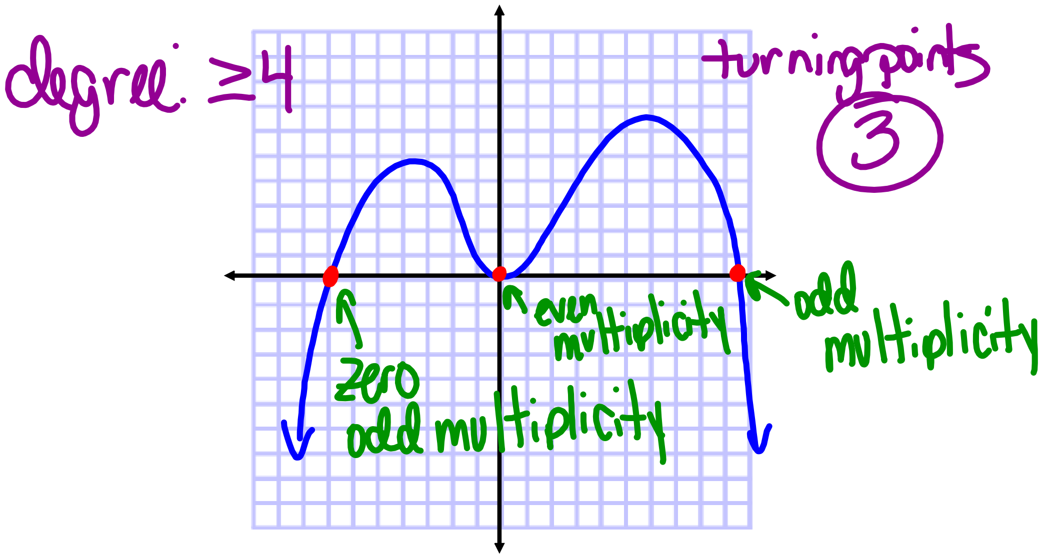


crosses x-axis

Important Terminology about Polynomials:

- The maximum number of turning points is the degree minus one $(n - 1)$

- points where the function changes direction from increasing to decreasing or decreasing to increasing



Important Terminology about Polynomials:

- The end behavior is the power function that the graph of the function resembles for large values of x

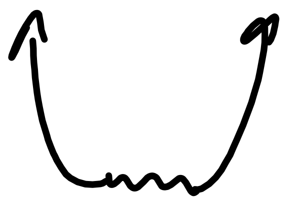
$$f(x) = a_n x^n$$

- The end behavior is the leading term of the polynomial when it is in standard form and it describes what the two arrows are doing

End Behavior:

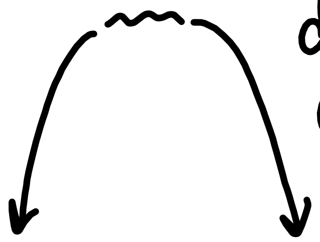
If $f(x) = ax^n$ and n is even:

1) $a(+)$



up on left
up on right

2) $a(-)$



down on left
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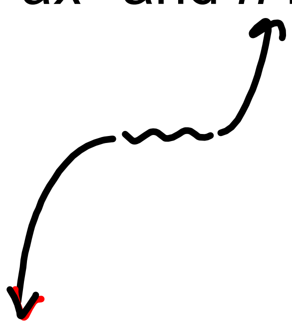
End Behavior:

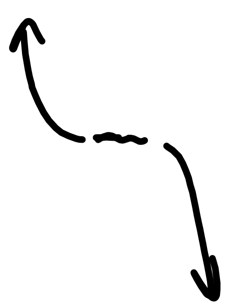
If $f(x) = ax^n$ and n is odd:

1) $a(+)$



down on left
up on right

2) $a(-)$



up on left
down on right

$f(x)=(x-2)^{1}(x+1)^{2}(x-3)^{5}$

degree: $1+2+5=8$

MTP: degree $-1=7$

Zeros: $x=2$ mult. 1 → crosses x-axis

$x=-1$ mult. 2 → touches x-axis

$x=3$ mult. 5 → crosses x-axis

EB:

$x\cdot x^2\cdot x^5$

$f(x)=x^8$ up on left

U

For each polynomial, tell the degree, the MTP, the zeros and their multiplicity and whether the graph will cross or touch the x-axis at the zero, and the EB function with the behavior.

$f(x)=-3(x-4)(2x-3)^4$ $\quad -3\cdot x\cdot 16x^4=-48x^5$

degree: 5

MTP: 4

Zeros: $x=4$ mult. 1 → crosses x-axis

$x=\frac{3}{2}$ mult. 4 → touches x-axis

EB: $f(x)=-48x^5$

up on left

down on right

For each polynomial, tell the degree, the MTP, the zeros and their multiplicity and whether the graph will cross or touch the x-axis at the zero, and the EB function with the behavior.

$$f(x) = 2(3x+5)^2(x-3)^2 \quad 2 \cdot 9x^2 \cdot x^2 = 18x^4$$

degree: 4

MTP: 3

Zeros: $x = -\frac{5}{3}$ mult. 2 → touches x-axis

$x = 3$ mult. 2 → touches x-axis

EB: $f(x) = 18x^4$ up on left
up on right

For each polynomial, tell the degree, the MTP, the zeros and their multiplicity and whether the graph will cross or touch the x-axis at the zero, and the EB function with the behavior.

$$f(x) = 5(2x-1)^3(2-x)^4 \quad 5 \cdot 8x^3 \cdot x^4 = 40x^7$$

degree: 7

MTP: 6

Zeros: $x = \frac{1}{2}$ mult. 3 → crosses x-axis

$x = 2$ mult. 4 → touches x-axis

EB: $f(x) = 40x^7$
down on left
up on right

Assignment:

p.213 #20-30 even

* Follow the examples for the set-up of these *