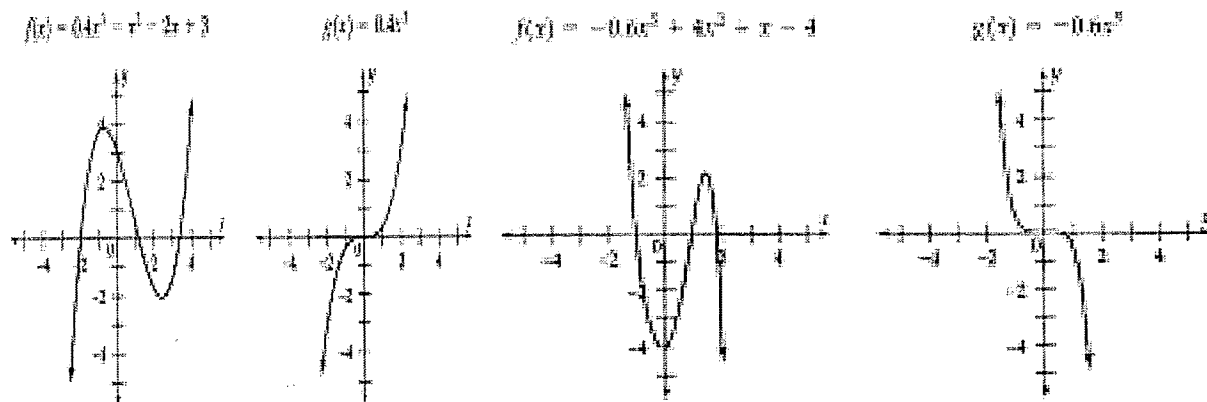


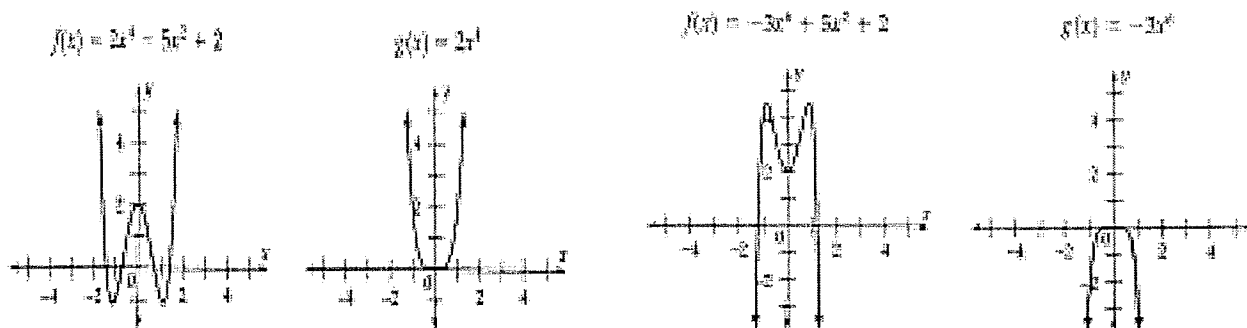
4.4 Graphing polynomial functions

In 4.3 we learned about 2 basic shapes of polynomial functions depending on the degree of the polynomial function: ODD vs EVEN.

A. ODD: The left and right ends are going in opposite direction. If the leading coefficient is positive, the right side goes up and the left side goes down. If the leading coefficient is negative, the right side goes down and the left side goes up.



EVEN: The left and the right ends go in the same direction. If the leading coefficient is positive, the left and right side both go up. If the leading coefficient is negative, the left and right side both go down.



B. We also discussed the multiplicity of each zero. That is, when the function is factored completely, you can if the graph will **touch (multiplicity is even)** or if it will **cross (multiplicity is odd)** at each zero.

C. How do you find the zeros? You must factor the polynomial completely.

D. How do you find the y intercept? Set $x=0$ and solve for y .

E. How many local extrema are there? There are at most $(n-1)$, where n is the degree of the polynomial, maximum and minimums.

EXAMPLE 1: Sketch the graph $f(x) = x^2(x-1)(x-4)$

Degree of Poly 4 Leading coefficient: +

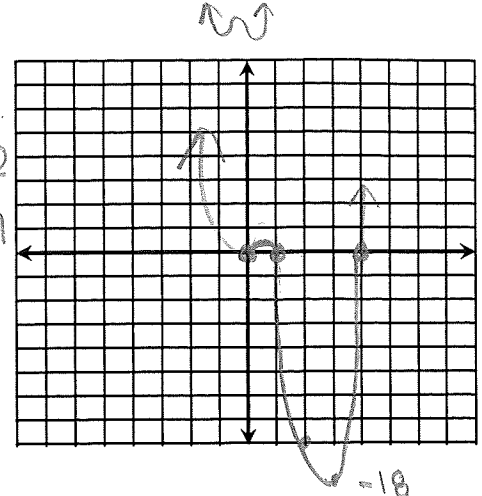


Zeros: 0 / 1 / 4
 even / odd / odd

Multiplicity of each zero: 2 / 1 / 1

Y intercept: (0,0)

x	y
2	4 · 1 · 2
3	9 · 2 · 1
5	4



EXAMPLE 2: Sketch the graph $f(x) = -2(x+1)^2(x-3)^2$

Degree of polynomial: 4 Leading coefficient: -

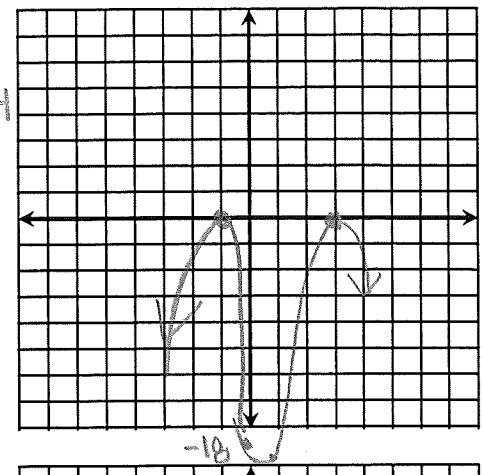


Zeros: -1 / 3
 even / even
 Touch / Touch

Multiplicity of each zero: 2 / 2

Y intercept: -2(1)(9)
-18

x	y
1	-2 · 4 · 4
2	-18



EXAMPLE 3: Sketch the graph $f(x) = -\frac{1}{2}(x-1)(x-3)(x+2)$

Degree of polynomial: 3 Leading coefficient: -

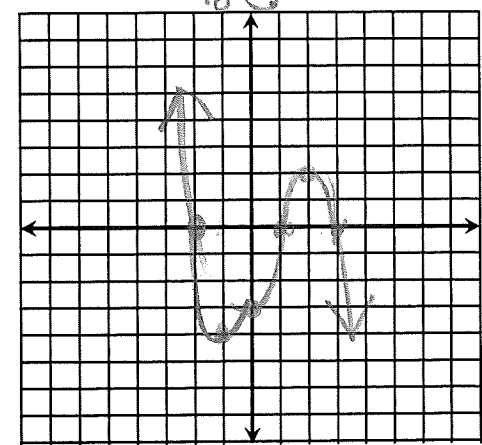


Zeros: 1 / 3 / -2

Multiplicity of each zero: Cross thru all

Y intercept: (0, -3)
 $-\frac{1}{2} \cdot (-1) \cdot (-3) \cdot (2)$

x	y
-1	-4
2	2



EXAMPLE 4: Sketch the graph $f(x) = x^3 - 5x^2 + 7x - 3$

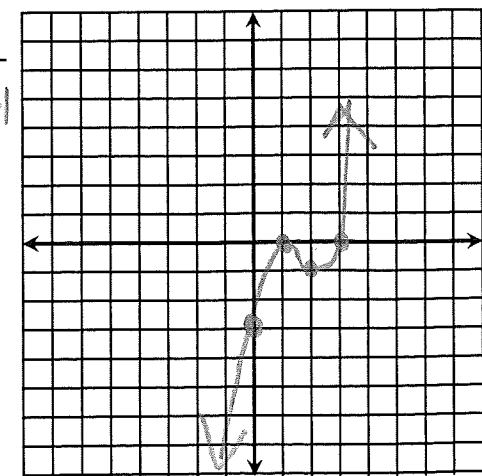
Degree of polynomial: 3 Leading coefficient: +



Zeros: 1, 3
 even, odd

Multiplicity of each zero: 2 / 1 y intercept 0, -3

X	Y
2	1 · -1



$$\begin{array}{r}
 1 \mid 1 \quad -5 \quad 7 \quad -3 \\
 \underline{1 \quad -4 \quad 3} \\
 1 \quad -4 \quad 3 \quad 0 \\
 (x-1)(x^2-4x+3) \\
 (x-1)(x-3)(x-1) \\
 (x-1)^2(x-3)
 \end{array}$$

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

2. $f(x) = -(x-2)(x+1)^2(x+3)$

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

Zeros: _____

Mult of each zero: _____

Degree of polynomial: _____

Leading coefficient: _____

Y intercept: _____

Zeros: _____

Mult of each zero: _____

Degree of polynomial: _____

Leading coefficient: _____

Y intercept: _____

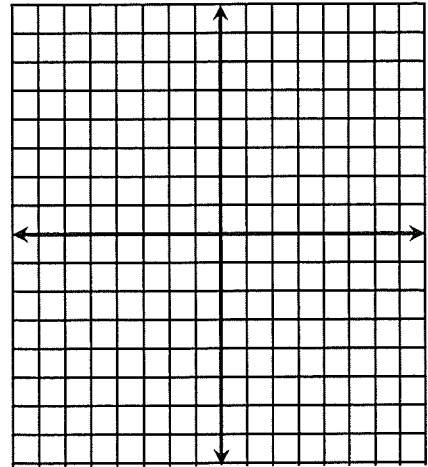
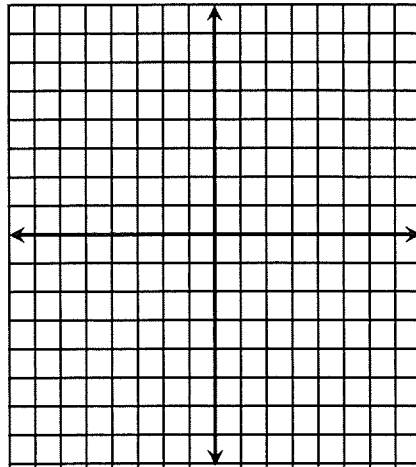
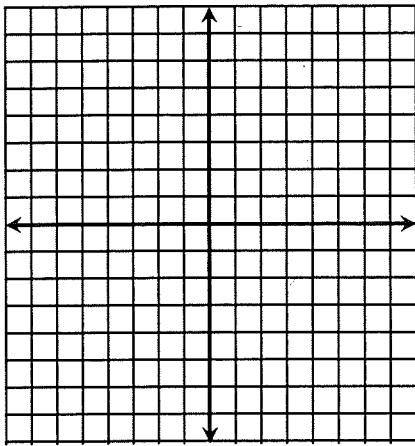
Zeros: _____

Mult of each zero: _____

Degree of polynomial: _____

Leading coefficient: _____

Y intercept: _____



Graph each polynomial completely.

4. $f(x) = \frac{1}{4}(x^2 - 2x - 15)$

5. $f(x) = -x^2 + 10x - 16$

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

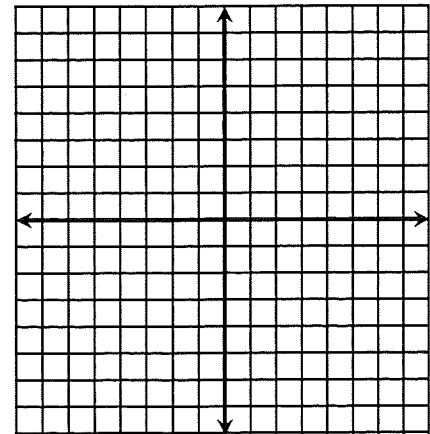
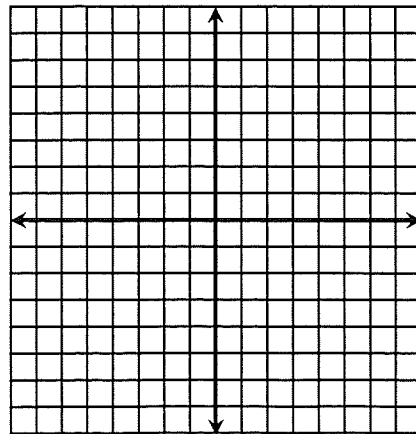
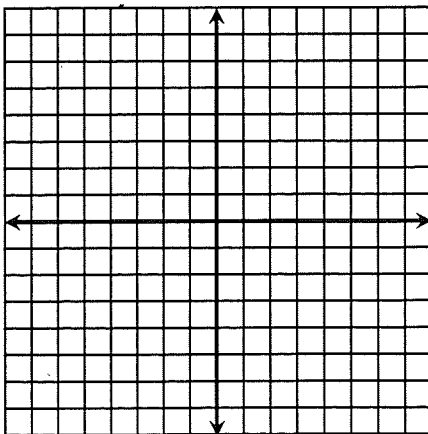
Zeros: _____

Mult of each zero: _____

Degree of polynomial: _____

Leading coefficient: _____

Y intercept: _____



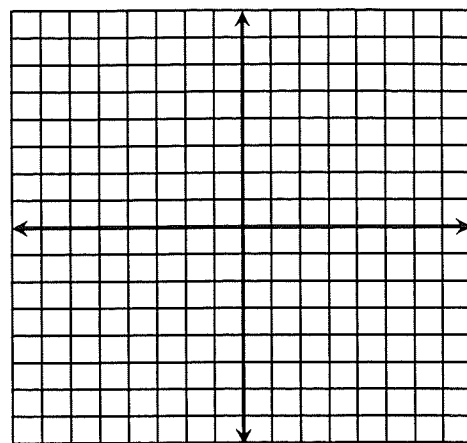
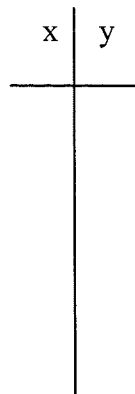
7. Sketch the graph $f(x) = x^4 - 4x^3 + 3x^2 + 4x - 4$

Degree of polynomial: _____ Leading coefficient: _____

Zeros: _____

Multiplicity of each zero: _____

Y intercept: _____



8. Sketch the graph $f(x) = x^3 + 3x^2 - 13x - 15$

Degree of polynomial: _____ Leading coefficient: _____

Zeros: _____

Multiplicity of each zero: _____ y intercept _____

