1. Sketch the quadratic polynomial f given by

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

$f(x) = A(x-h)^2 + K$

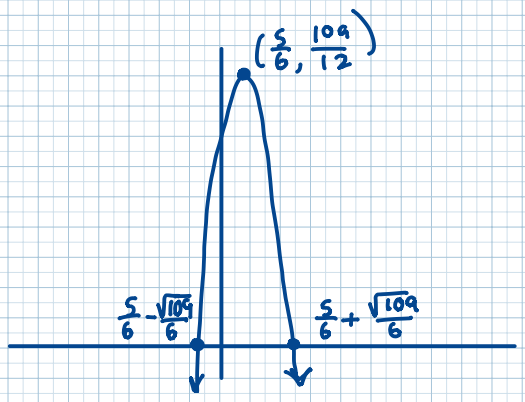
$-3x^2+5x+7 = Ax^2 - 2Ahx + Ah^2 + K$

$\Downarrow$

$\begin{cases} -3 = A \\ 5 = -2Ah \\ 7 = Ah^2 + K \end{cases}$

Solve to get

$A = -3$, $h = \frac{5}{6}$, $K = \frac{109}{12}$.



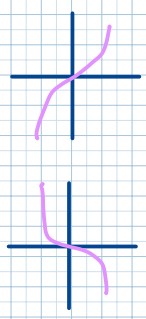
So $f(x) = -3\left(x - \frac{5}{6}\right)^2 + \frac{109}{12}$ zeros at $x = \frac{5}{6} + \frac{\sqrt{109}}{6}$ and $x = \frac{5}{6} - \frac{\sqrt{109}}{6}$

2. Identify the zeros and order of each zero of f where f is given by

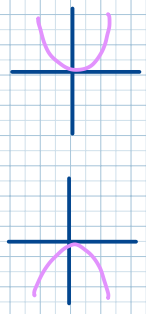
$$f(x) = -4(x+6)^3(x+2)^4(x-2)^7(x-6)^8.$$

Sketch all possible local behaviors at each zero by using only the order of each zero.

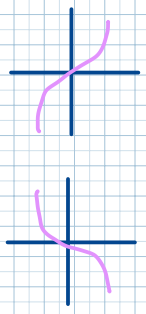
$x = -6$ order 3



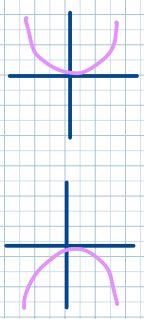
$x = -2$ order 4



$x = 2$ order 7



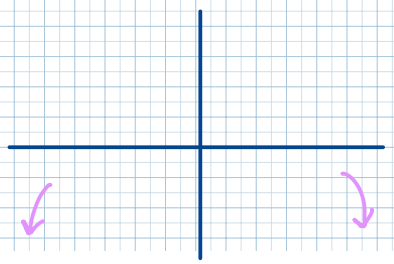
$x = 6$ order 8



3. Determine the asymptotic behavior of the polynomial f given by

$$f(x) = -4(x+6)^3(x+2)^4(x-2)^7(x-6)^8.$$

$f \sim -4 \cdot x^3 \cdot x^4 \cdot x^7 \cdot x^8 = -4x^{22}$

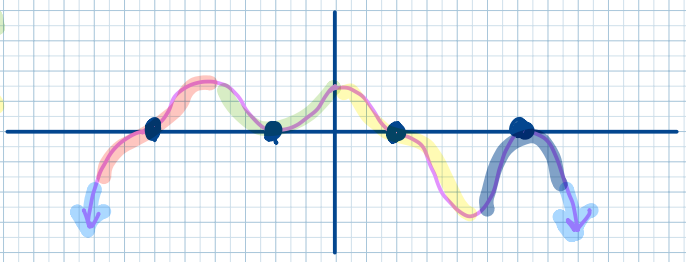


4. Use the local and global behavior of a polynomial to sketch f, where f is given by

$$f(x) = -4(x+6)^3(x+2)^4(x-2)^7(x-6)^8.$$

zero	order	
-6	3	or
-2	4	or
2	7	or
6	8	or

$f \sim -4x^{22}$

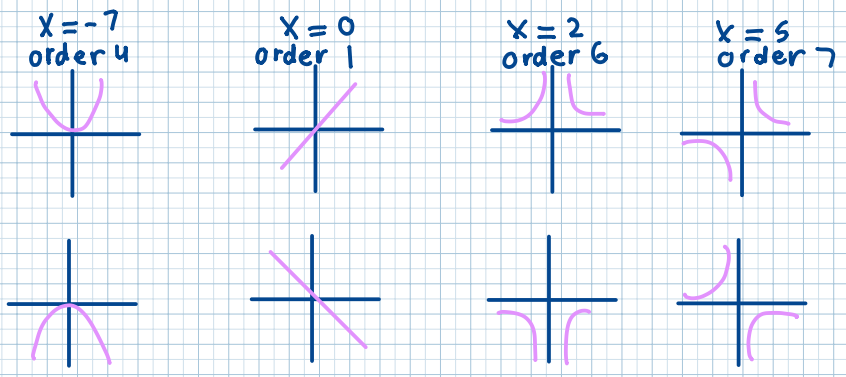


5. Identify the zeros and poles and the order of each zero and pole of f where f is given by

$$f(x) = \frac{x(x+7)^4}{(x-2)^6(x-5)^7}.$$

Sketch all possible local behaviors at each zero by using only the order of each zero.

zero	pole	order
-7		4
0		1
	2	6
	5	7

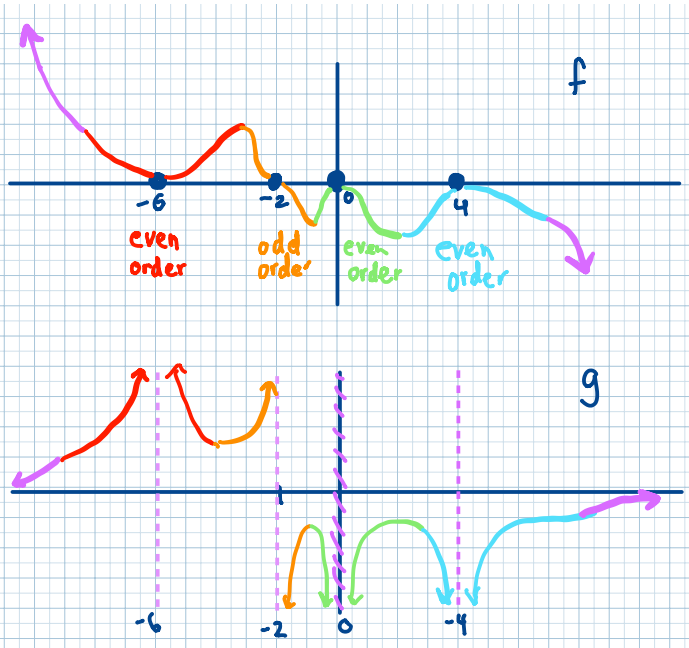


6. Take f to be the polynomial given by

$$f(x) = -9x^4(x+6)^8(x+2)^9(x-4)^2.$$

Sketch f and use y-axis inversion to sketch g, where g is given by

$$g(x) = \frac{1}{-9x^4(x+6)^8(x+2)^9(x-4)^2}.$$



$f \sim -9x^{23}$

zero	order
-6	8
-2	9
0	4
4	2

7. Use the global and local behavior of a rational function to sketch f, where f is given by

$$f(x) = \frac{x(x+7)^4}{(x-2)^6(x-5)^7}.$$

$f \sim \frac{x \cdot x^4}{x^6 \cdot x^7} = \frac{1}{x^8}$

zero	pole	order
-7		4
0		1
	2	6
	5	7

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