Q1: leading term $= (-4x^{\boxed{3}}) \cdot (x^{\boxed{2}}) \cdot (x^{\boxed{1}})$

$= -4x^6$

Q2: Degree $= 6 \rightarrow$ Even

leading coeff. $= -4 \rightarrow a_n < 0$

End Behavior: Falls left, Falls right.

E.g. Given $f(x) = 2x^3(x-1)(x+5)$.

Q1: Find the leading term of f.

Q2: Determine the end behavior.

Answer: Q1: leading term $= (2x^3) \cdot (x) \cdot (x)$

$= \underbrace{\boxed{2}}_{>0} x^{\boxed{5}} \rightarrow$ odd

Q2: End behavior: Rises right, falls left.

Obj 2: Zeros of Polynomial Functions and Multiplicities of Zeros.

Terminology: If f is a polynomial function, then the values of x for which $f(x)$ is equal to 0 are called the zeros (or roots) of f.

(These values are also the x-coordinate of the x-intercepts of the graph of f)

To find the zeros (or roots or x-intercepts) of f, we take the equation of f, set it equal to zero and solve for x.

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

Q1: Find the zeros of f.

Q2: Find the multiplicity of each zero.

Sol:

Q1: $(x+1)\cdot(2x-3)^2 = 0$

$x + 1 = 0$

$\boxed{x = -1}$

$(2x-3)^2 = 0$

$2x - 3 = 0$

$\boxed{x = \frac{3}{2}}$

Zeros (Roots) of f are: $-1, \frac{3}{2}$.

Q2: $x = -1$ has multiplicity 1 because it comes from a factor with exponent = 1

$x = \frac{3}{2}$ has multiplicity 2 because it comes from a factor with exponent = 2.

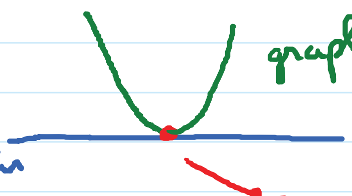
E.g. Given $f(x) = \left(x+\frac{1}{2}\right)^3 \cdot (x-5)^4$

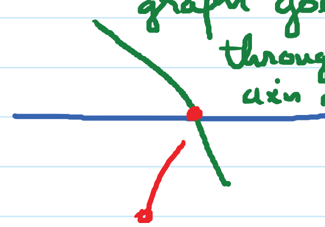
Find the zeros of f and multiplicity of each zero.

Sol: To find the zeros: $\left(x+\frac{1}{2}\right)^{\boxed{3}}(x-5)^{\boxed{4}} = 0$

$\left(x+\frac{1}{2}\right)^3 = 0$	$(x-5)^4 = 0$
$x + \frac{1}{2} = 0$	$x - 5 = 0$
$x = -\frac{1}{2}$	$x = 5$
multiplicity $= 3$	multiplicity $= 4$

Why is multiplicity important?





Obj 3: Graph polynomial functions

Process:

Step 1: Determine the end behavior by using the leading term test.

Step 2: Find the zeros and multiplicity of each zero.

Step 3: Find y-intercept and additional points if necessary.

Step 4: Graph the function.

E.g. Graph $f(x) = -2(x-1)^2(x+2)$

Step 1: End Behavior.

leading term $= -2x^3$

End behavior: Rises left, falls right.

Step 2: Zeros and their multiplicity.

Zeros: $x = 1$; $x = -2$

mult. $= 2$ → even ; mult. $= 1$ → odd

Step 3: Find y-intercept: Put $x = 0$.

$y = -2 \cdot (-1)^2 \cdot (2) = -4$

So, y-intercept: $(0, -4)$.