3.2 - Polynomial Functions

Looks like: $f(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$

Ex: ① $f(x) = 3x^5 + 9x - 1$

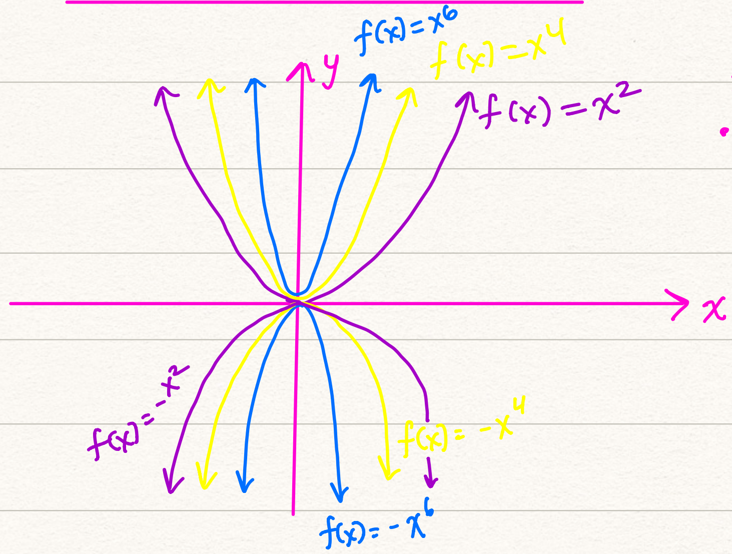
② $g(x) = 14x^2 - x$

③ $h(x) = -3x - 1 - 2x^2 - 10x^{20}$

Power Functions: Looks like: $f(x) = ax^n$

- We are interested in "End Behavior" of the graphs of power functions.

Ex: ① When n is even:



Notice:

- when $a>0$, both arrows point up.
- when $a<0$, both arrows point down.

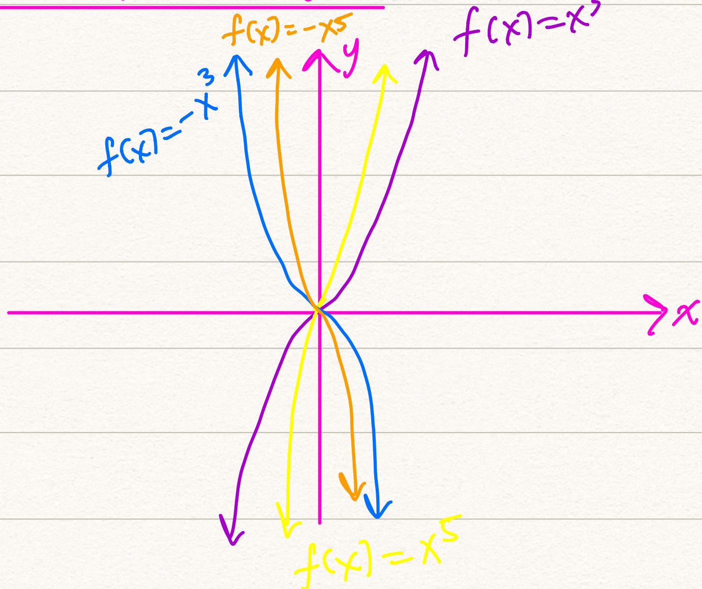
n even, $a>0$: $f(x) \to \infty$ as $x \to \infty$

$f(x) \to \infty$ as $x \to -\infty$

n even, $a<0$: $f(x) \to -\infty$ as $x \to \infty$

$f(x) \to -\infty$ as $x \to -\infty$

② When n is odd:



when n odd, $a > 0$: $f(x) \to \infty$ as $x \to \infty$

$f(x) \to -\infty$ as $x \to -\infty$

n odd, $a < 0$: $f(x) \to \infty$ as $x \to -\infty$

$f(x) \to -\infty$ as $x \to \infty$

Leading Term Test:

- $f(x)$ is a polynomial function.
- Look at highest power term: ax^n

n even		n odd	
$a > 0$	$a < 0$	$a > 0$	$a < 0$
like x^2	like $-x^2$	like x^3	like $-x^3$

- The **zeros** of a polynomial function are the x-values whose output value is zero.

Ex: $f(x) = x^2 + 7x + 10$
$= (x+5)(x+2)$

$f(x) \overset{\text{set}}{=} 0$: $(x+5)(x+2) = 0$

$x = -5$ and $x = -2$

So, $-5, -2$ are the zeroes of f.

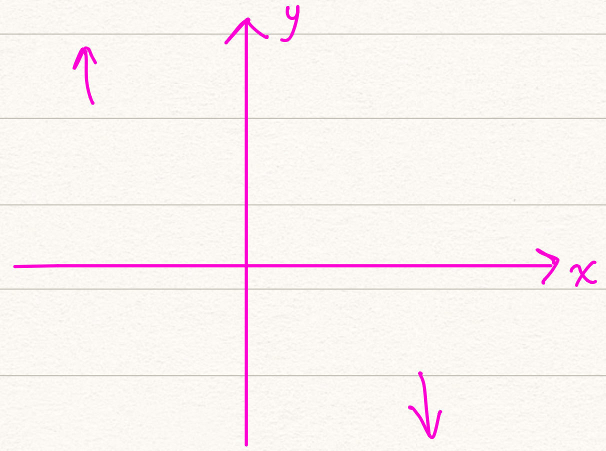
* The zeros of a polynomial function are the x-intercepts *

Graphing a Polynomial Function:

$f(x) = -x^3 - 4x^2 + 4x + 16$

① Determine End Behavior using Leading Term Test.

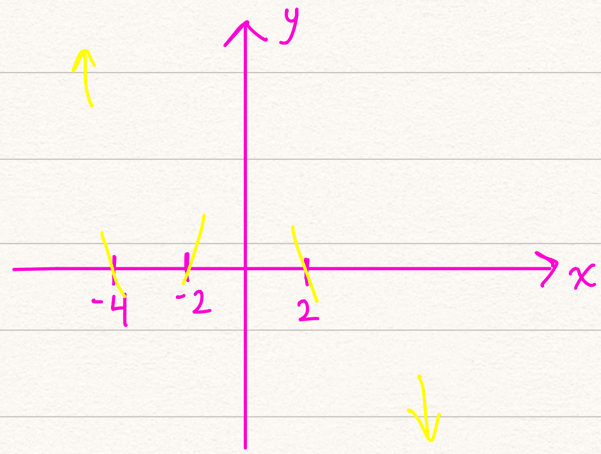
Leading Term: $-x^3$



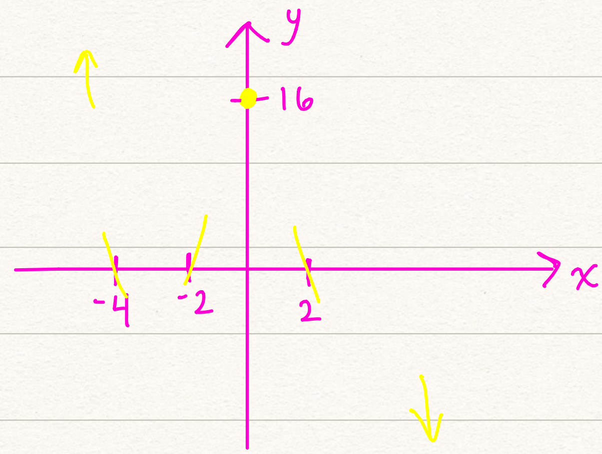
② Find zeros.

Factor by grouping: $-(x+4)(x+2)(x-2) = 0$

$x = -4$, $x = -2$, $x = 2$



3 Find y-intercept: $y = 16$



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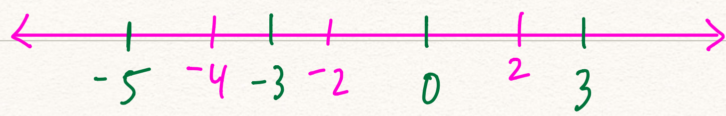

$f(-5) = 21$, $f(-3) = -5$, $f(0) = 16$, $f(3) = -35$