1.3 Properties of Graphs of Functions

- degree (the size of the largest exponent (sum) on the variables)
- symmetry
- turning pts.
- roots (intercepts)
- domain/range
- intervals of ↑ and ↓
- transformations
- end behaviours
- continuity
- concavity

Interval Notation

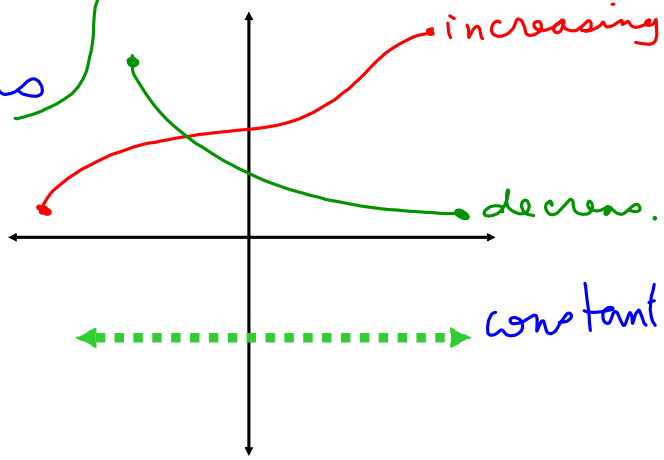
- a way to describe a range of numbers

set notation	interval notation
$\{x \in \mathbb{R} \mid -2 \leq x \leq 5\}$	$x \in [-2, 5]$
$\{y \in \mathbb{R} \mid y \geq 0\}$	$y \in [0, \infty)$
$\{x \in \mathbb{R} \mid -1 < x \leq 3\}$	$x \in (-1, 3]$

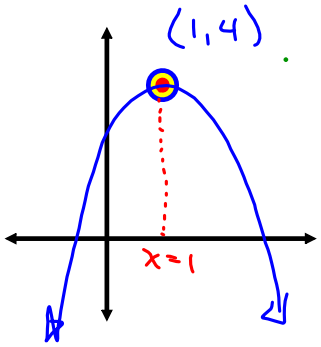
Intervals of Increase and Decrease

* increasing means rising
* decreasing means falling

read from left to right



Ex. State the intervals of increase/decrease for $f(x) = -(x-1)^2 + 4$



$f(x)$ is increasing on $x \in (-\infty, 1)$

$f(x)$ is decreasing on $x \in (1, \infty)$

Turning Points (Local Maxima and Minima)

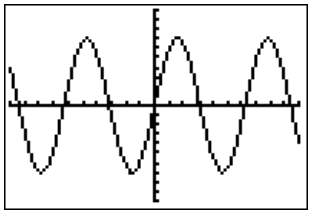
when a function changes from increasing (increas.) to decreasing (decreas.) a peak (valley) occurs. This turning point is called a local maximum (minimum)

Symmetry (Even/Odd/Neither)

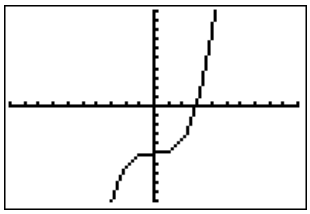
reflections in the y-axis yield identical graphs

reflections through (0,0) yield identical graphs (or x and y-axis reflections)

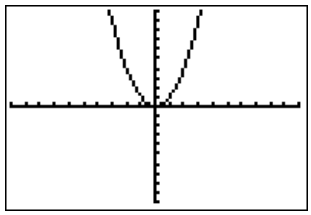
odd



neither



even



Summetry tests:

Even: $f(x) = f(-x)$

odd: $f(x) = -f(-x)$

otherwise neither

Ex. is $f(x) = x^3 - 30x$ odd, even or neither

$f(-x) = (-x)^3 - 30(-x)$

$= -x^3 + 30x$

$-f(-x) = -(-x^3 + 30x)$

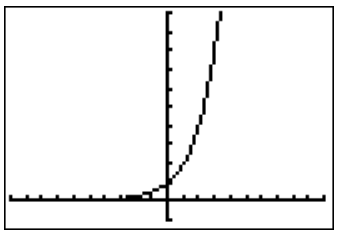
$= x^3 - 30x$

$= f(x)$ $\therefore f(x)$ is odd

End Behaviour

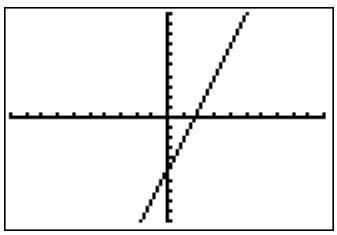
what happens for |huge| values of x

very small or very big



as $x \to \infty$, $y \to \infty$

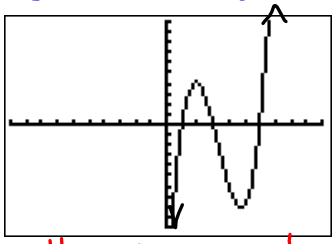
$\lim_{x \to \infty} = \infty$ $\lim_{x \to -\infty} = 0$



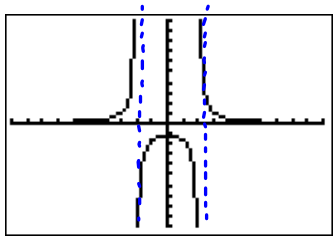
$\lim_{x \to \infty} = \infty$ $\lim_{x \to -\infty} = -\infty$

Continuity: are there any breaks in the graph? → x must be excluded from the domain in that spot.

continuous



all polynomials are!!!

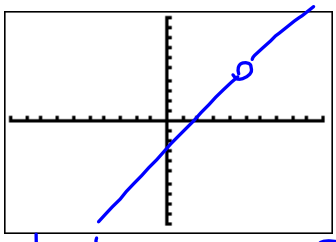


$f(x) = \frac{1}{x^2-4}$

$= \frac{1}{(x-2)(x+2)}$

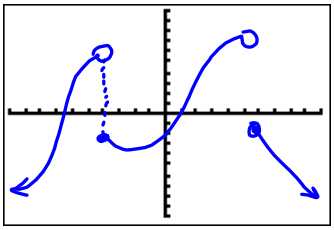
asymptotes @ $x = \pm 2$

discontinuous



hole @ x = 5

discontinuous



jumps in the graph → discontinuity

* can I draw the graph without taking my pencil off the page?

hand in #12

Homefun

page 23 #4cd, 5abc, 6, 9, 10, 11