NOTES 6.1: Exploring the Graphs of Polynomial Functions

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- a ***polynomial function*** in one variable contains only the operations of multiplication and addition with real-number coefficients and whole-number exponents

  ex.

  $y = 4x^3 + 3x^2 - 2x + 5$

  can also be written as: $y = 4 \times x \cdot x + 3 \times x + (-2)x + 5$

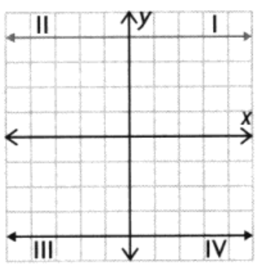
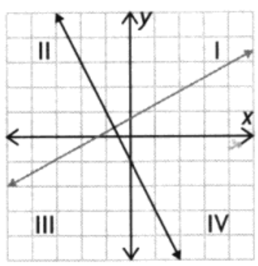
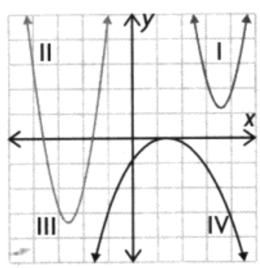
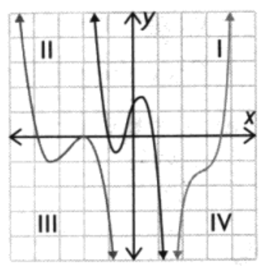
- the *degree* of a function in one variable is the greatest exponent on any of the terms

  ex.

  $y = 4x^3 + 3x^2 - 2x + 5$

  degree = 3

- the ***x-intercept*** is where a function crosses the x-axis and can be written as the ordered pair (x, 0)
- the ***y-intercept*** is where a function crosses the y-axis and can be written as the ordered pair (0, y)
- a ***turning point*** is any point where the graph of a function changes from increasing to decreasing or vice versa
  - a graph does not have a turning point if the y-values always increase or decrease
- the ***end behaviour*** is a description of the y-values of a graph as you move from left to right on the coordinate plane
  - the four possible end behaviors are (+,+), (+,-), (-,-) or (-,+)
- the ***domain*** is the set of possible x-values of a function
- the ***range*** is the set of possible y-values of a function
- the degree of a polynomial function indicates the shape of the function

Function Type	constant	linear	quadratic	cubic
Degree, *n*	0	1	2	3
Sketch				
Number of *x*-intercepts	0 (except $y = 0$)	1	0, 1, or 2	1, 2, or 3
***y*-intercepts**	1	1	1	1
Turning Points	0	0	1	0 or 2
End Behaviour	extends from Quadrant II to Quadrant I or from Quadrant III to Quadrant IV (+,+) or (-,-)	extends from Quadrant III to Quadrant I or from Quadrant II to Quadrant IV (+,-) or (-,+)	extends from Quadrant II to Quadrant I or from Quadrant III to Quadrant IV (+,+) or (-,-)	extends from Quadrant III to Quadrant I or from Quadrant II to Quadrant IV (+,-) or (-,+)
Domain	$\{x \mid x \in R\}$	$\{x \mid x \in R\}$	$\{x \mid x \in R\}$	$\{x \mid x \in R\}$
Range	$\{y \mid y = c, y \in R\}$	$\{y \mid y \in R\}$	$\{y \mid y \leq \text{maximum}, y \in R\}$ or $\{y \mid y \geq \text{minimum}, y \in R\}$	$\{y \mid y \in R\}$

- use the table to answer the following questions

1. How is the possible number of x-intercepts related to the degree of the polynomial?

- the max # of x-int is = to the degree
  ↳ even # ⇒ even # of x-int
  ↳ odd # ⇒ odd # of x-int

2. Do all polynomial functions of degree 1, 2 or 3 have only one y-intercept? Explain.

a polynomial function can only cross the y-axis @ 1 location

3. Describe how the end behaviour of a polynomial function is related to the degree of the function.

even degree = (+, +) or (−, −)
odd degree = (+, −) or (−, +)

4. Describe how the domain and range of a polynomial function are related to its degree.

domain (x-axis) = all real #

range (y-axis)
↳ odd degree = range is all real #
↳ even degree = max or min of function

5. Explain why some cubic polynomial functions have turning points but not maximum or minimum values.

cubic functions
↳ no max or min
↳ range is all real #

6. Polynomial functions of degree 0 are called constant functions. Describe characteristics of the graphs of constant functions.

horozontal line!
domain all real #
range y-int of the graph

pg 383 #1-4