

Course Review

Chapter 2 - Functions and Graphs

2-1 Function Operations

Functions vs Relations

One-to-One Relations

Interval Notation

Domain and Range

Function Notation

Continuous vs Discontinuous

x-intercepts / y-intercepts

2-2 Linear Functions and Models

Scatterplots

Least Squares Regression Lines (LSRL): $a + bx$

Correlation (r) and Determination (r^2)

2-3 Properties of Functions

Average Rate of Change: $\frac{f(x) - f(c)}{x - c}$ where $x \neq c$ (slope of the secant line)

Increasing and Decreasing functions

Maximums and Minimums (Local and Absolute)

Even functions: $f(x) = f(-x)$; symmetry with respect to y-axis

Odd functions: $f(x) = -f(-x)$; symmetry with respect to origin

2-4 Parent Functions / Piecewise Functions

Parent function: The simplest (non-transformed) function in a family of functions

Linear function: $y = x$

Quadratic function: $y = x^2$

Cubic function: $y = x^3$

Square Root function: $y = \sqrt{x}$

Rational function: $y = \frac{1}{x}$

Absolute Value function: $y = |x|$

Greatest Integer function: $y = [x]$

Exponential function: $y = b^x$

Logarithmic function: $y = \log(x)$

Constant function: $y = c$

Piecewise functions: A function made up of multiple sub-functions, each defined for a segment of the domain.

2-5 Graphing Transformations

Reflections

Across x-axis: x-values: unchanged; y-values: change sign ($y = -f(x)$)

Across y-axis: x-values: change sign; y-values: unchanged ($y = f(-x)$)

Across $y = x$: x-values and y-values are swapped

Across origin: x-values: change sign; y-values: change sign

Transformations

Vertical shift: $f(x) + c$; function moves up ($c > 0$) or down ($c < 0$)

Horizontal shift: $f(x + c)$; function moves left ($c > 0$) or right ($c < 0$) *NOTE: Opposite of sign*

Vertical Stretch/Compression: $c \cdot f(x)$; function widens ($c < 0$) or narrows ($c > 0$) in the y-direction

Horizontal Stretch/Compression: $f(c \cdot x)$; function widens ($c > 0$) or narrows ($c < 0$) in the x-direction

2-6 Operations on Functions / Composite Functions

Sum of functions: $(f+g)(x) = f(x) + g(x)$

Difference of functions: $(f-g)(x) = f(x) - g(x)$

Product of Functions: $(f \cdot g)(x) = f(x) \cdot g(x)$

Quotient of functions: $(f/g)(x) = f(x)/g(x)$

Composite functions: $(f \circ g)(x) = f(g(x))$

2-7 Mathematical Models / Constructing Functions

Converting word problems into functions.

EX: The perimeter of a rectangle is 50ft. Express the area as a function of side with length x .

$$P = 2L + 2W; A = L \cdot W$$

$$\begin{aligned} \text{Let } x = \text{length} \rightarrow 50 &= 2x + 2W \\ 2W &= 50 - 2x \\ W &= (50 - 2x)/2 \\ W &= 25 - x \end{aligned}$$

$$A = x \cdot (25 - x) = 25x - x^2$$

$$\text{Function notation: } \mathbf{f(x) = 25x - x^2}$$