Chapter One

1.1 Lines

- slope is change in y divided by change in x
  - no slope (y=b) is horizontal
  - undefined (x=a) is vertical
- point-slope form is $y-y_1 = m(x-x_1)$
- slope-intercept form is $y = mx + b$
- parallel lines have = slops
- perpendicular lines have slopes that are the opposite reciprocal (ex. 4 --> -1/4)

1.2 Functions

- a relation is a correspondance between two values
- a function is a one to one correspondance
  - domain/input/x
  - range/output/y
  - can be represented verbally, coordinate pairs, chart, graph, algebra
- domain can be explicit (given) or implicit (implied)
- notation
  - set {x | x does not equal 3}
  - interval (-infinity, 3) U (3, infinity)
    - [] includes
    - () not include
    - use () for infinity and not []
- piecewise functions are multiple functions with defined domains
- the difference quotient can be found with [f(x+h) - f(x)] / h

1.3 Graphs

- domain and range are not always endpoints
- vertical line test: draw a vertical line through a graph. if it passes through more than one point, the graph is not a function
- maximum and minimum are relative
- symmetry
  - over the y-axis: even f(-x) = f(x)
  - over the origin: odd f(-x) = -f(x)
- greatest integer function f(x) = [| x |]
  - greatest integer is less than or equal to the input
    - f(x) = [|-3.411|] = -4
  - graph it with steps! closed circle ----- open circle

1.4 Transformations of Graphs

- types of functions
  - constant f(x) = c
  - identity f(x) = x
  - absolute value f(x) = |x|
  - square root f(x) = sqrt(x)
  - quadratic f(x) = x^2
  - cubic f(x) = x^3
- types of rigid transformations
  - y = -f(x) is a reflection over the x-axis
  - y = f(-x) is a reflection over the y-axis
  - y = f(x) + c is a vertical shift
    - positive c shifts up, while negative c shifts down
  - y = f(x-c) is a horizontal shift
    - x-c shifts to the right
    - x+c (or x - -c) shifts to the left
- types of non-rigid transformations
  - y = cf(x)
    - |x| > 1 is a vertical stretch
    - 1 > |x| > 0 is a vertical compression
  - y = f(cx)
    - |x| > 1 is a horizontal compression
    - 1 > |x| > 0 is a vertical stretch
- order of transformations: reflect over x-axis, horizontal shift, reflect over y-axis, vertical shift

1.5 Combinations of Functions

- arithmetic
  - (f+g)(x) = f(x) + g(x) (or use -)
  - (fg)(x) = f(x)g(x)
  - (f/g)(x) = [f(x)]/[g(x)]
- composition
  - f(g(x)) = (f o g)(x)

1.6 Inverse Functions

- use $f^{-1}(x)$
  - domain of f(x) is the range of the inverse of f(x) (and vice versa)
- $f(f^{-1}(x)) = x$
- the graphs are reflections over y=x
- horizontal line test: does it have an inverse
- w/ algebra: switch the x and y (in the equation) & solve for y
  - so y = mx + b --> x = my + b (--> (x-b)/m = y)