Def: constants - describe static situations in which change is not under consideration. (eg. 12 in a dozen, $2 + 5 = 7$)
Def: variables - changeable quantities

Ways variables are used:

- to describe generalized properties: $a + (b + c) = (a + b) + c$ for all real a, b, c.
  (Here a, b, c are generalized variables - they represent an arbitrary member of a set)
- to express relationships: Jolie was born on her 3-year old sister Kendra's birthday. How are their ages related? ($J = K - 3, K = J + 3, K - J = 3$)
- to serve as unknowns in equations: $\square + 5 = 9$, $(2x - 6)(x - 1) = 0$
- to express formulas: $d = rt, A = lw, P = 2l + 2w$

p. 496 #2: In each situation below, classify the role of the variables as one of the following types: generalized; expressing a relationship; expressing a formula; an unknown.
(a) For all real numbers x, y, z: $x(y + z) = xy + xz$ ⧫ Generalized variables
(b) Elena is 4 inches shorter than her husband, Joe, so $E = J - 4$. ⧫ Expressing a relationship
(c) To construct a circular flower bed covering 400 square feet of ground, the radius r of the bed must satisfy $\pi r^2 = 400$. ⧫ Unknown
(d) Tickets to the play are \$5 for adults and \$3 for children. If A adults and C children attend the play, the total proceeds are $5A + 3C$. ⧫ Expressing a formula

Def: numerical expression - any representation of a number that involves numbers and operation symbols. $(3 + 8)$
Def: algebraic expression - an expression involving variables, numbers and operation symbols. $(4x + 8y)$

p. 496 #4: Penny is p years old. Form algebraic expressions with the variable p that represent the ages requested.
(a) Penny's age in 5 years $(p + 5)$
(b) Penny's age 8 years ago $(p - 8)$
(c) The *current* age of Penny's little brother, who in two more years will be half of Penny's age. $(\frac{1}{2}(p+2)-2)$
(d) The *current* age of Penny's mother, who, three years ago was 4 times Penny's age. $(4(p - 3) + 3)$

Def: domain of a variable - the set of all values for which the expression is meaningful.
Def: to evaluate an expression - to replace all the variables with particular values.
Def: equation - two algebraic expressions with the same value

There are two types of equations:
Def: identity equation - an equation that is true for all evaluations of the variables. $((x + y)^2 = (x^2 + 2xy + y^2))$
Def: conditional equation - an equation that is true only for specific evaluations of the variables. $(a^2 + b^2 = c^2)$

Def: solution set - the set of all values in the domain of the variables that satisfy the given equation.
Def: equivalent equations - two equations that have the same solution set.

We use equivalent equations to simplify equations. You must be careful though, as some operations are not completely equivalent.

Def: function on a set D- a rule that associates each element $x \in D$ precisely one value y.
Def: domain of a function - the set on which the function is defined (D in the above definition).

We typically use letters or words to name the function. $f(x)$, sqrt(z), etc.
Functions can also be thought of as a set of ordered pairs $\{(x, y)|x \in Dandy = f(x)\}$. We can then use the Vertical Line Test to check if it is a function.

Def: image or value of f at x- what comes out of the function when you plug x in.
Def: range of a function - the set of all images of f on D. (range $f = \{y|y = f(x) \text{ for some } x \in D\}$)

Example 8.3: Let f be the function defined by the formula $f(x) = x(10 - x)$ on the domain $D = \{1, 3, 5, 7, 9\}$.

x	1	3	5	7	9
$f(x)$	9	21	25	21	9

The range of f is $\{9, 21, 25\}$.

Example 8.4: Guess the rule

x	2	5	6	0	1
$f(x)$	-1	8	11	-7	-4

$f(x) = 3x - 7$

x	5	2	4	0	-2	-5
$f(x)$	24	3	15	-1	3	24

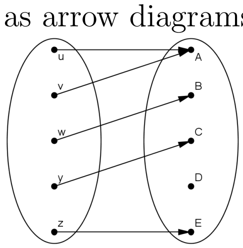
$f(x) = x^2 - 1$

Ways to describe or visualize functions:

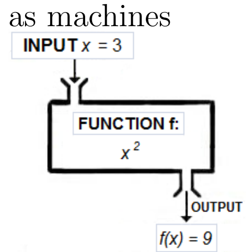
- as formulas: $A(r) = \pi r^2$, $f(n) = f_n = \frac{n(n+1)}{2}$
(Functions defined on $\mathbb{N}$ are called sequences)
- as tables:

Student	A	B	C
Grade	8	7	10

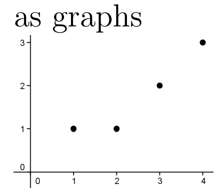
- as arrow diagrams



- as machines



- as graphs



Note: Functions of the form $f(x) = mx + b$ are called linear functions.

Section 8.1 HW: #3, 10, 13, 17, 20, 21, 24, 29, 32, 45 (part of HW1)