Section 1.5 Notes

Linear Equations, Functions, Zeros, and Applications

1 Solving Linear Equations

Definition

- A *linear equation* is one that can be simplified to the form $mx + b = 0$.
- A *linear function* is one that can be written as $f(x) = mx + b$
- x is the variable - but other variables are fine too
- m and b are numbers

Special Cases

- Some linear equations have *infinitely many solution*:
  - This occurs when the equation simplifies to a true statement.
  - For example:

$$\begin{array}{rcl} x+3 & = & x+3 \\ -x & & -x \end{array}$$

$$3 = 3$$

  - In these cases, any real number is a solution to the equation.
- Some linear equations have *no solution*:
  - This occurs when the equation simplifies to a false statement.
  - For example:

$$\begin{array}{rcl} x+5 & = & x+3 \\ -x & & -x \end{array}$$

$$5 = 3$$

Examples

Solve the equations, if possible.

1. $3 - \frac{1}{4}x = \frac{3}{2}$

   $x = 6$

2. $\frac{2}{11} - 4t = -4t + \frac{9}{11}$

   No solution

3. $4(5y + 3) = 3(2y - 5)$

   $y = -\frac{27}{14}$

4. $2(3 - x) = -2x + 6$

   All real numbers or $(-\infty, \infty)$

2 Zeros of a Function

Definitions

- A *zero* for a function is essentially the same as the x-intercept.
- To find this, plug in zero for $y/f(x)$ and solve for x.
- The difference between zeros and x-intercepts is the form the answer is written in:
  - If the question asks for the zeros, the answer will be in the form of a number or list of numbers.
  - If the question asks for the x-intercepts, the answers will be listed as ordered pairs.

Examples

1. Find the zero and x-intercept for the function $f(x) = 3x + 1$.

$$\text{Zero: } x = -\frac{1}{3}$$
$$x\text{-intercept: } \left(-\frac{1}{3}, 0\right)$$

2. Find the zero and x-intercept for the function $g(x) = -\frac{4}{5}x + 3$.

$$\text{Zero: } x = \frac{15}{4}$$
$$x\text{-intercept: } \left(\frac{15}{4}, 0\right)$$

3 Applications

Simple Interest Formula

$$I = Prt$$

- I is interest earned
- P is the pricipal (the initial amount of money invested/borrowed)
- r is the yearly interest rate (always written in decimal form, not percent)
- t is the time in years

Key Words

Addition:

- add
- added to
- additional
- altogether
- both
- combined
- in all
- increased by
- more than
- plus
- sum
- together
- total

Subtraction:

- decreased by
- difference
- fewer
- left
- less than
- minus
- remain
- take away

Multiplication:

- product
- times
- twice
- each
- altogether
- multiply
- of
- a factor of
- scaled by

Division:

- quotient
- divide
- into
- equal parts
- split up
- out of
- per
- each has/have
- equally
- grouped

Equals:

- equals
- equivalent
- gives
- is/are/were
- the same as

Examples

1. Marissa, an audio equipment salesperson, earns a monthly salary of \$1800 per month and a commission of 8% on the amount of sales she makes. One month Marissa received a paycheck for \$2284. Find the amount of her sales for the month.

   \$6050

2. The average depth of the Pacific Ocean is 14,040 ft, and its depth is 8890 ft less than the sum of the average depths of the Atlantic and Indian Oceans. The average depth of the Indian Ocean is 272 ft less than four-fifths of the average depth of the Atlantic Ocean. Find the average depth of the Indian Ocean.

   10040 ft

3. Dimitri's two student loans total $9000. One loan is at 5% simple interest and the other is at 6% simple interest. At the end of 1 year, Dimitri owes $492 in interest. What is the amount of each loan?

   $4800 at 5%, $4200 at 6%