Chapter 1: Linear Inequalities/Equations

Section 1-1: Linear equations & Inequalities

1) Linear Equations

**Ex 1: Solve and check**

a) \[3x - 2(2x - 5) = 2(x + 3) - 8\]

b) \[x + 2 - \frac{x}{2} = 5\]

c) \[\frac{x + 1}{3} - \frac{x}{4} = 2\]

d) \[\frac{x}{3} - 5 = \frac{2}{5}\]
**Linear Inequality**
- When multiplying/dividing both sides by a *negative* number, the inequality **reverses**.

**Interval notation**
- Interval notation | Inequality notation | Line graph

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Ex. Solve and graph
a) \[
\frac{-4}{5} < \frac{3}{2}
\]

b) \[
\frac{x}{2} - \frac{2}{3} < \frac{x}{3} + 2
\]

c) \[
3(x-1) \leq 5(x-2) - 2x - 5
\]

2) Compound Inequalities

Ex 3: Solve and graph

\( a) -4 \leq 2y - 3 < 9 \)
\( b) -1 \leq \frac{2}{3}t + 5 \leq 11 \)
Ex 4: Solve for the indicated variable.
   a) \( y = \frac{2}{3} x + c \), for \( x \)   
   b) \( C = \frac{5}{9}(F - 32) \), for \( F \)

Ex 5: An all-day parking meter takes only dimes and quarters. If it contains 100 coins with a total value of $14.50, how many of each type of coin are in the meter?
Ex6: IRA. You have $500,000 in an IRA at the time you retire. You have the option of investing this money into 2 funds: Fund A pays 5.2% annually and Fund B pays 7.7% annually. How should you divide your money between Fund A and Fund B to produce an annual interest income of $30,000?

Ex7: Retail & sale prices: Sale prices in a department store are obtained by marking down the retail price by 15%. That is, sale price is obtained by subtracting 15% of the retail price from the retail price.

a) What is the sale price of a hat that has a retail price of $60?
b) what is the retail price of a dress that has a sale price of $136?

Ex8: Sale commission: A 2nd employee of the computer store is paid a base salary of $3,000 a month plus a 5% commission on all sales during the month. How much must this employee sell in one month to earn a total of $4,000 for the month?

Ex9: Break-even analysis: The publisher of a new book figured fixed costs at $92,000 and variable costs of $3.10 for each book produced. If the book is sold to distributors for $11 each, how many must be produced and sold for the
Section 1.2: Graphs & Lines

1) Cartesian coordinate system

Ex: Sketch a graph using intercepts

(a) \( y = \frac{x}{2} + 1 \)

Ex: Write the equation of the line through:

\[ y = -x + 1 \]  
\[ 2x - 3y = 24 \]
b) Slope-intercept form

Ex 2: Find the slope and y-intercept of the graph

a) \( y = 3x + 2 \)

b) \( y = -\frac{10}{3}x + 4 \)

c) \( y = \frac{x}{5} - \frac{1}{2} \)

d) \( 5x - y = -2 \)

e) \( 2x - 3y = 18 \)

f) \( -x + 8y = 4 \)
10. Equations of a line

- Standard form
- Slope-intercept form
- Point-slope form
- Horizontal line
- Vertical line

\[ \text{Slope} = m = \]

**Ex 3:** Write the equations of the vertical and horizontal lines through each point.

a) \((-5, 0)\)  

b) \((2.6, 3.8)\)

**Ex 4:** Write the equation of the line through each indicated point with the indicated slope.

Write the final answer in the form \( y = mx + b \).

a) \( m = -0 \); \((-4, 1)\)
8.5: (A) Find the slope of the line that passes through the given points.

(B) Find the standard form of the equation of the line.

(C) Find the slope-intercept form of the equation of the line.

a) \((1,2) \& (3,5)\)  

b) \((1,4) \& (0,4)\)  

c) \((2,0) \& (2,-3)\)
iv) Applications

Example: Cost Analysis: A small company manufactures picnic tables. The weekly fixed cost is $1200 and the variable cost is $45 per table. Find the total weekly cost of producing \( x \) picnic tables. How many picnic tables can be produced for a total weekly cost of $4800?

Example: Business - Make up Policy: A clothing store sells a shirt costing $20 for $33 and a jacket costing $60 for $95.

(A) If the mark up policy of the store is assumed to be linear, write an equation that expresses retail price \( R \) in terms of cost \( C \) (wholesale price).

...
(b) What does a store pay for a suit that retails for $240?

Ex: Boiling point: the temperature at which water starts to boil is also linearly related to barometric pressure. Water boils at 212°F at a pressure of 29.9 inches of mercury, and a 191°F at a pressure of 28.9 inches of mercury.

(A) Find a relationship of the form \( T = mx + b \), where \( T \) is degrees Fahrenheit and \( x \) is pressure in inches of mercury.
(B) Find the boiling point at a pressure of 31 inHg.

(C) Find the pressure if the boiling point is 199°F.

Ex9. Demographics: The median household income divides the households into two groups: the half whose income is less than or equal to the median, and the half whose income is greater than the median. The median household income in the U.S. grew from about
$30,000 in 1990 and is about $48,000 in 2006.

(A) If represents the median household income and t represents the # of years since 1990, write a linear eq that expresses I in terms of t.

(B) Use this eq to estimate median household income in the year 2030.
Ex 10: Physics. The distance d, let, a fixed spring and the floor is a linear set of the weight w attached to the bottom of the spring. The bottom of the spring is 18 in from the floor when the weight is 3 lbs, and 10 in from the floor when the weight is 5 lbs.

(A) Find a linear eq" that expresses d in terms of w.

(B) Find the distance from bottom of the spring to the floor if no weight is attached.

(C) Find the smallest weight that will make the bottom of the spring touch the floor.