Chapter 1: Algebra Toolbox

- Regular Math

Section 1.1: Variables and Expressions

- Vocabulary…

  - Variable – a letter than represents a number

  - Coefficient – a number multiplied by a variable

  - Algebraic Expression – had one or more variables

  - Constant – a number; something that doesn't change

  - Evaluate – solve

  - Substitute – replace a variable

Example 1: Evaluating Algebraic Expressions with One Variable

- Evaluate each expression for the given value of the variable.
  - $x + 6$ for $x = 13$

  - $2a + 3$ for $a = 4$

  - $3(5 + n) - 1$ for $n = 0, 1, 2$

- Try these on your own…

  - $X - 5$ for $x = 12$
    - 7

  - $2y + 1$ for $y = 4$
    - 9

  - $6(n + 2) - 4$ for $n = 5, 6, 7$
    - 38
    - 44
    - 50

Example 2: Evaluating Algebraic Expressions with Two Variables

❖ Evaluate each expression for the given value of the variable.

  ❖ 2x + 3y for x = 15 ; y =12

  ❖ 1.5p – 2q for p = 18 ; q = 7.5

➢ Try these on your own…

  ➢ 4x + 3y for x = 2 ; y = 1
    ➢ 11

  ➢ 9r – 2p for r = 3 ; p = 5
    ➢ 17

Example 3: Physical Science Application

- If c is a temperature in degrees Celsius, then $1.8c + 32$ can be used to find the temperature in degrees Fahrenheit. Convert each temperature from degrees Celsius to degrees Fahrenheit.

  - Freezing point of water: 0 degrees Celsius

  - World's highest recorded temperature (El Azizia, Libya): 58 degrees Celsius

Try these on your own...

- Use the expression 1.8c + 32 to convert each boiling point temperature from degrees Celsius to degrees Fahrenheit.
  - Boiling point of water at sea level: 100 degrees Celsius
    - 212 degrees Fahrenheit

  - Boiling point of water at an altitude of 4400 meters: 85 degrees Celsius
    - 185 degrees Fahrenheit

Exit Questions...

1. Which of the following is a constant and which is a variable?
    a.   Your age
    b.   The year you were born

2. Does an algebraic expression contain one or more variables?

3. Should you see variables in an expression after you have solved it?

Section 1.2: Write Algebraic Expressions

	Word Phrases	Expression
+	• a number plus 5 • add 5 to a number • sum of a number and 5 • 5 more than a number • a number increased by 5	$n + 5$
−	• a number minus 11 • subtract 11 from a number • difference of a number and 11 • 11 less than a number • a number decreased by 11	$x - 11$
✖	• 3 times a number • 3 multiplied by a number • product of 3 and a number	$3m$
÷	• a number divided by 7 • 7 divided into a number • quotient of a number and 7	$\frac{a}{7}$ or $a \div 7$

Example 1: Translating Word Phrases into Math Expressions

- Write an algebraic expression for each word phrase.
  - A number n decreased by 11
  - The quotient of 3 and a number h
  - 1 more than the product of 12 and p
  - 3 times the sum of q and 1

- Try these on your own…
  - The product of 8 and a number n
    - 8n
  - 9 less than a number w
    - W – 9
  - 3 increased by the difference of p and 5
    - 3 + (p-5)
  - 24 decreased by the product of 6 and q
    - 24 – 6q

Example 2: Interpreting Which Operation to Use in Word Problems

- Monica got a 200-minute calling card and called her brother at college. After talking with him for t minutes, she had t less than 200 minutes remaining on her card. Write an expression to determine the number of minutes remaining on her calling card.

- If Monica talked with her brother for 55 minutes, how many minutes does she have left on her calling card?

Try these on your own...

- Jared worked for h hours at the pay rate of $5 each hour. Write an expression to determine how much money Jared earned.
  - 5h

- How much money will he earn if he works a total of 18 hours?
  - $90.00

Example 3: Writing and Evaluating Expressions in Word Problems

- Write an algebraic expression to evaluate each word problem.
  - Rob and his friends buy a set of baseball season tickets. The 81 ticket are to be divided equally among p people. If he divides them among 9 people, how many tickets does each person get?
  - A company airs it 30-second commercial n times during the Super Bowl at a cost of $2.2 million each time. What will the cost be if the commercial is aired 2, 3, 4, and 5 times?
  - Before Benny took his road trip, his car odometer read 14,917 miles. After the trip, his odometer read m miles more than 14,917. If he traveled 633 miles on the trip, what did the odometer read after his trip?

Try these on your own..

- Write an algebraic expression to evaluate each word problem.
  - Amed bought a new sweater for $27 plus sales tax t. If the tax was $1.76, what was the total cost of the sweater?
    - 27 + t
    - $28.76
  - The cost to rent a banquet hall is $240. If the cost will be shared equally among all of the people who attend the event, how much will it cost each person if 12, 15, 16, or 20 people attend?
    - 240 / p
    - $20, $16, $15, $12
  - An airplane was flying at an altitude of 20,000 feet when it began its descent at 9:00pm. After 10 minutes, it had descended a feet. If the plane descended 8500 feet during the ten minutes, what was its altitude at 9:10?
    - 20,000 – a
    - 11,500 feet

Flash Card Game

Section 1.3: Solving Equations by Adding or Subtracting

- Vocabulary…

  - Equation – uses an equals sign to show that two expressions are equal

  - Solve – find the value

  - Solution – answer

  - Inverse Operation – "undo" each other

  - Isolate the Variable – get the variable alone on one side

  - Addition Property of Equality – see chart

  - Subtraction Property of Equality – see chart

Example 1: Determining Whether a Number is a Solution for an Equation

- Determine which value of x is a solution for the equation.

  - x – 4 = 16;
    - x = 12
    - x = 20
    - x = 21

- Try this one on your own…

  - Determine which value of x is a solution for the equation.
    - X + 8 = 15
      - X = 5
      - X = 7
      - X = 23

    - **7 is the correct solution.**

SUBTRACTION PROPERTY OF EQUALITY		
Words	**Numbers**	**Algebra**
You can subtract the same number from both sides of an equation, and the statement will still be true.	$4 + 7 = \quad 11$ $\underline{-3} \quad \underline{-3}$ $4 + 4 = \quad 8$	$x = y$ $x - z = y - z$

ADDITION PROPERTY OF EQUALITY		
Words	**Numbers**	**Algebra**
You can add the same number to both sides of an equation, and the statement will still be true.	$2 + 3 = \quad 5$ $\underline{+4} \quad \underline{+4}$ $2 + 7 = \quad 9$	$x = y$ $x + z = y + z$

Example 2: Solving Equations Using Addition and Subtraction Properties

- $3 + t = 11$

- $M - 7 = 11$

- $15 = w + 14$

- Try these on your own…
  - $10 + n = 18$
    - $N = 8$

  - $P - 8 = 9$
    - $P = 17$

  - $22 = y - 11$
    - $Y = 33$

Example 3: Geography Applications

- The altitude of Mexico City in 2000 was about 7350 feet above sea level. What was the approximate altitude of Mexico City in 1900 if it sank 30 feet during the 100 year period?

- From 1954 to 1999, shifting plates increased the height of Mount Everest from 29,028 ft to 29,035 ft. By how many feet did Mount Everest's altitude increase during the 45-year period?

Try these on your own…

- Jan took a 34-mile trip in her car, and the odometer showed 16,550 miles at the end of the trip. What was the original odometer reading?
  - X + 34 = 16, 550
  - 16,516

- From 1980 to 2000, the population of a town increased from 895 residents to 1125 residents. What was the increase in population during that 20-year period?
  - 895 + x = 1125
  - 230

Section 1.4: Solving Equations by Multiplying or Dividing

DIVISION PROPERTY OF EQUALITY

Words	Numbers	Algebra
You can divide both sides of an equation by the same nonzero number, and the statement will still be true.	$4 \cdot 3 = 12$ $\dfrac{4 \cdot 3}{2} = \dfrac{12}{2}$ $\dfrac{12}{2} = 6$	$x = y$ $\dfrac{x}{z} = \dfrac{y}{z}$

Example 1: Solving Equations Using Division

- Solve

$7x = 35$

- Try this one on your own…
  - Solve $8x = 32$

MULTIPLICATION PROPERTY OF EQUALITY

Words	Numbers	Algebra
You can multiply both sides of an equation by the same number, and the statement will still be true.	$2 \cdot 3 = 6$ $\mathbf{4} \cdot 2 \cdot 3 = \mathbf{4} \cdot 6$ $8 \cdot 3 = 24$	$x = y$ $zx = zy$

Example 2: Solving Equations Using Multiplication

- Try this one on your own…

- Solve

  h / 3 = -6

- Solve

  n / 5 = 7

Example 3: Food Application

- A recipe calls for 1 tabasco pepper, but Jennifer wants to use jalapeno peppers. How many jalapeno peppers should she substitute in the dish to equal the Scoville units of 1 tabasco pepper?

Pepper	Scoville Units
Ancho (Poblano)	1,500
Bell	100
Cayenne	30,000
Habanero	360,000
Jalapeno	5,000
Serrano	10,000
Tabasco	30,000
Thai	90,000

Try this one on your own...

Dessert	Cups of Flour
Bread Pudding	5
Cookies (1 dozen)	2
Sheet Cake	8

- Joe has enough flour to bake one sheet cake but would rather make cookies. How many dozen cookies can he make?

  - 4 dozen

Example 4: Money Application

- Try this one on your own…

  - Meg has saved $50, which is one-fourth of the amount she needs for a school trip. What is the total amount she needs?

  - ¼ (x) = 50
  - $200

- Helene's band needs money to go to a national competition. So far, band members have raised $560, which is only one-third of what they need. What is the total amount needed?

Example 5: Solving Simple Two-Step Equations

- Solve

  $2x + 1 = 7$

- Try this one on your own…

  $3y - 7 = 20$

  $y = 9$

Section 1.5: Solving Simple Inequalities

- Vocabulary…

  - Inequality – compares two quantities

  - Algebraic Inequality – inequality that contains a variable

  - Solution of the Inequality – a number that makes the inequality true

  - Solution Set – set of all solutions

Example 1: Completing an Inequality

- Compare. Write < or >.
  - 12 − 7 ⬭
  - 3(8) ⬭ 16

- Try these one on your own…
  - 23 − 14 ⬭ 6
  - 5(12)70 ⬭

Example 2: Solving and Graphing Inequalities

- Solve and graph each inequality...

  - X + 7.5 < 10

  - 6n $\geq$ 18

  - T – 3 $\leq$ 22

  - 5 > w / 2

$\leq$ or $\geq$ -   use a closed circle

< or >   -   use an open circle

Try these on your own...

$$x + 2.5 \leq 8$$

$$5t > 15$$

$$w - 1 < 8$$

$$3 \geq \frac{p}{4}$$

Example 3: Problem Solving Application

- If all of the sheets of paper used by personal computer printers each year were laid end to end, they would circle the earth more than 800 times. The earth's circumference is about 25,120 miles (1,591,603,200 inches), and one sheet of paper is 11 inches long. How many sheets of paper are used each year?

Try this one on your own…

- An interior designer is planning to place a wallpaper border along the edges of all four walls of a room. The total distance around the room is 88 feet. The border comes in packages of 16 feet. What is the least number of packages that must be purchased to be sure that there is enough border to complete the room?

  - 6 rolls – remember you have to purchase whole rolls

Section 1.6: Combining Like Terms

- Vocabulary…

  - Term – separated by plus or minus

  - Like Terms – grouped together because they "look" the same

  - Equivalent Expressions - same value

  - Simplify – perform all possible operations

Example 1: Combining Like Terms to Simplify

- Combine like terms.

  - $5x + 3x$

  - $5m - 2m + 8 - 3m + 6$

- Try these on your own…

  - $14a - 5a$
    - $9a$

  - $7y + 8 - 3y - 1 + y$
    - $5y + 7$

Example 2: Combining Like Terms in Two-Variable Expressions

- Combine Like Terms.
  - 6a + 8a + 4b + 7

  - K + 3n − 2n + 4K

  - 4f − 12g + 16

- Try these on your own…
  - 9x + 3y − 2x + 5
    - 7x + 3y + 5

  - 5t + 7p − 3p − 2t
    - 3t + 4p

  - 4m + 9n − 2
    - 4m + 9n - 2

Example 3: Simplifying Algebraic Expressions by Combining Like Terms

- Try this one your own…
  - Simplify.
    - $6 (5 + n) - 2n$
      - $30 + 4n$

- Simplify.
  - $4 (y + 9) - 3y$

Example 4: Solving Algebraic Equations by Combining Like Terms

- Try this one on your own…
  - Solve.
    - $X + 3X = 48$
      - $X = 12$

- Solve.
  - $8X - X = 112$

Section 1.7: Ordered Pairs

- Vocabulary…

  - Ordered Pairs – (x, y) – solution to a two-variable equation

Example 1: Deciding Whether an Ordered Pair Is a Solution of an Equation

- Determine whether each ordered pair is a solution of $y = 3x + 2$.

  - $(1,4)$

  - $(2,8)$

  - $(16,50)$

- Try this one on your own…

  - Determine whether each ordered pair is a solution of $y = 4x - 1$

    - $(3,11)$

    - $(10,3)$

    - $(11,43)$

Example 2: Creating a table of Ordered Pair Solutions

- Use the given values to make a table of solutions.
  - $Y = 3x$ for $x = 1, 2, 3, 4$

X	3X	Y	(X,Y)
1	3 (1)	3	(1,3)
2	3 (2)	6	(2,6)
3	3 (3)	9	(3,9)
4	3 (4)	12	(4,12)

- $N = 4M - 3$ for $M = 1, 2, 3, 4$

M	1	2	3	4
4m − 3	4 (1) − 3	4 (2) − 3	4 (3) − 3	4 (4) - 3
N	1	5	9	13
(M,N)	(1,1)	(2,5)	(3,9)	(4,13)

Try these on your own…

- Use the given values to make a table of solutions.
  - Y = X + 3 for X = 1,2,3,4

X	X+3	Y	(X,Y)
1	(1) + 3	4	(1,4)
2	(2) + 3	5	(2,5)
3	(3) + 3	6	(3,6)
4	(4) + 3	7	(4,7)

- N = 6M − 5 for M = 1,2,3

M	1	2	3
6m − 5	6(1) − 5	6(2) − 5	6(3) − 5
N	1	7	13
(M,N)	(1,1)	(2,7)	(3,13)

Example 3: Retail Application

- In most states, the price of each item is not the total cost. Sales tax must be added. If sales tax is 8 percent, the equation for total cost is c = 1.08p, where p is the price before tax.

  - How much will Cecilia's $15 banner cost after sales tax?

  - How much will Dowen's $13 banner cost after sales tax?

Try these on your own…

- A salesman marks up the price of everything he sells by 20%. The equation for the sales price p is $p = 1.2w$, where w is the wholesale cost.

  - What will be the sales price of a sweater with a wholesale cost of $48?
    - $57.60

  - What will be the sales price of a jacket with a wholesale cost of $85?
    - $102.00

Section 1.8: Graphing on a Coordinate Plane

- Vocabulary…

  - Coordinate plane – map formed by two number lines
  - X–axis – horizontal axis
  - Y-axis – vertical axis
  - X-coordinate – listed first in an order pair (X,Y)
  - Y-coordinate – listed second in an order pair (X,Y)
  - Origin – center of coordinate plane
  - Graph of an Equation – set of all ordered pairs that are solutions of the equation

Example 1: Finding the Coordinate of Points on a Plane

- Give the coordinates of each point.

  - R
    - $(1,3)$
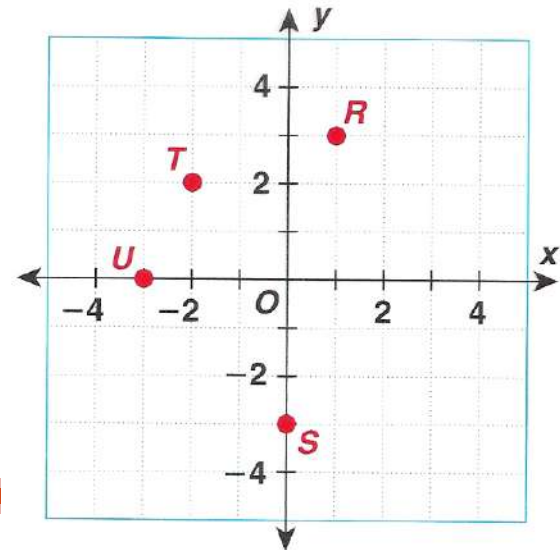 - T
    - $(-2,2)$
  - U
    - $(-3,0)$
  - S
    - $(0,-3)$

Example 2: Graphing Points on a Coordinate Plane

- Graph each point on a coordinate plane. Label the points A - D.
  - (2,5)

  - (0,4)

  - (-1,2)

  - (2, -3)

- Try these on your own…
  - Graph each point on a coordinate plane. Label the points A – D.
    - (3,4)

    - (4,0)

    - (-4,4)

    - (-1,-3)

Example 3: Graphing an Equation

- Complete each table of ordered pairs. Graph each equation on a coordinate plane.

  - Y = 2X

  - Y = 3x - 2

- Try this one your own…
  - Y = 2X – 3

X	
1	
2	
3	

Section 1.9: Interpreting Graphs and Tables

The table gives the speeds of three dogs in mi/h at given times. Tell which dog corresponds to each situation described below.

David's dog chews on a toy, then runs to the backyard, then sits and barks, and then runs back to the toy and sits.

Kareem's dog runs with him and then chases a cat until Kareem calls for him to come back. The dog returns to his side and sits.

Time	12:00	12:01	12:02	12:03	12:04
Dog 1	8	8	20	3	0
Dog 2	0	10	0	7	0
Dog 3	0	4	4	0	12

Janelle's dog sits on top of a pool slide, slides into the swimming pool, and swims to the ladder. He gets out of the pool and shakes and then runs around the pool.
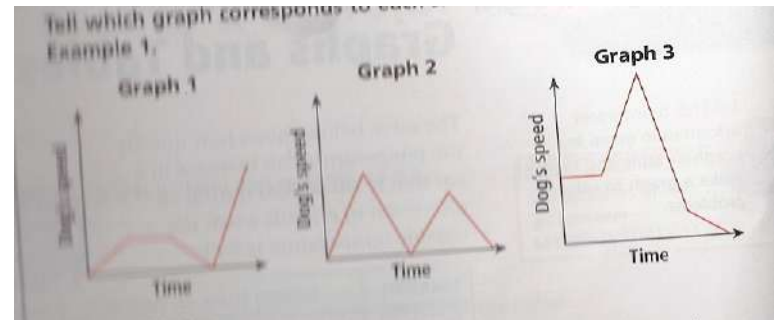
Try this one on your own…

- The table gives the speed in mi/h of two cars at given times. Tell which car corresponds to the situation described below.

- Mr. Lee is traveling on the highway. He pulls over, stops, and then gets back onto the highway.
  - Car 2

| Time	1:00	1:05	1:10	1:15	1:20
Car 1	50	50	30	25	0
Car 2	55	10	0	0	55

Example 2: Matching Situations to Graphs

- Tell which graph corresponds to each situation described in Example 1.

  - David's dog chews on a toy, then runs to the backyard, then sits and barks, and then runs back to the toy and sits.

  - Kareem's dog runs with him and then chases a cat until Kareem calls for him to come back. The dog returns to his side and sits.

  - Janelle's dog sits on top of a pool slide, slides into the swimming pool, and swims to the ladder. He gets out of the pool and shakes and then runs around the pool.

Try these on your own...

- Tell which graph corresponds to the situation described below.
  - Mr. Lee is traveling on the highway. He pulls over, stops, and then gets back onto the highway.
    - Graph 2
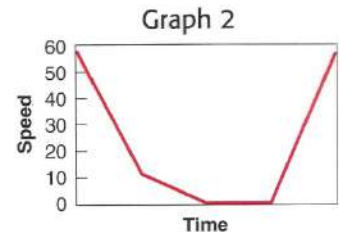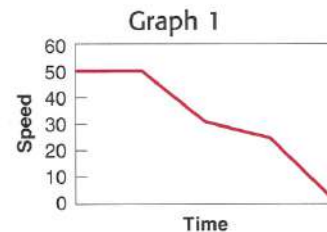
Example 3:Creating a Graph of a Situation

- The temperature (F) inside a car can get dangerously high. Create a graph that illustrates the temperature inside a car.

Location	On Arrival	On Departure
Home	-	140 at 1:00
Cleaners	75 at 1:10	95 at 1:20
Mall	72 at 1:40	165 at 3:40
Market	80 at 3:55	125 at 4:15

Try this one on your own…

- Create a graph that illustrates the temperature (F) inside the car.

Location	Arrival	Departure
Work	68 at 12:30	42 at 4:30
Cleaners	65 at 4:50	60 at 5:00
Market	65 at 5:10	49 at 5:40