



North Central State College

MASTER SYLLABUS

2026-2027

- A. Academic Division: Liberal Arts
- B. Discipline: Statistics
- C. Course Number and Title: STAT 0086 Algebra for Probability and Statistics
- D. Assistant Dean: Laura Irmer, MFA, MA
- E. Credit Hours: 2
- F. Prerequisites: MATH 0072 or MATH 0073 with a minimum of C- grade
-OR-
COMPASS Algebra score of 1-30
-OR-
ACT Math score of 19 or higher
-OR- ACCUPLACER Elementary Algebra score of 45 or higher
- Co-requisite: STAT 1010
- G. Syllabus Effective Date: Fall 2023
- H. Textbook(s) Title: No Textbook Required; Instructor handouts will be provided.
- I. Workbook(s) and/or Lab Manual:
TI-84 Calculator recommended ISBN #8780000100116 *Check with instructor on calculator options
- J. Course Description: This course is designed to teach students the algebraic methods and procedures that will be needed in a probability and statistics course. The topics will include demonstrations in using the calculator, scientific notation, order of operations, converting decimals to percents, inequalities, and exponents, radicals, solving equations, graphing lines using slope and y-intercept, solving equations using the quadratic formula, sequences and variation.
- K. College-Wide Learning Outcomes:

College-Wide Learning Outcome	Assessments - - How it is met & When it is met
Communication – Written	
Communication – Speech	
Intercultural Knowledge and Competence	
Critical Thinking	
Information Literacy	
Quantitative Literacy	

L. Course Outcomes and Assessment Methods:

Upon successful completion of this course, the student shall:

Outcomes	Assessments – How it is met & When it is met
1. Convert decimal numbers to scientific notation and vice versa.	In-class assignments and/or homework throughout the semester.
2. Apply the knowledge of order of operations when simplifying algebraic expressions and solving equations.	In-class assignments and/or homework throughout the semester.
3. Change algebraic expressions using properties of exponents.	In-class assignments and/or homework throughout the semester.
4. Demonstrate the knowledge of inequality symbols while solving inequalities.	In-class assignments and/or homework throughout the semester.
5. Convert decimal numbers to a percent and vice versa.	In-class assignments and/or homework mid to end of the semester.
6. Label the slope and y-intercept on a graph and draw the line.	In-class assignments and/or homework mid to end of the semester.
7. Compute the solutions of a quadratic equation using both the quadratic formula and factoring.	In-class assignments and/or homework end of the semester.
8. Determine the general term of both arithmetic and geometric sequences.	In-class assignments and/or homework end of the semester.
9. Generate an equation or formula using both direct and inverse variation when given specific pieces of data.	In-class assignments and/or homework end of the semester.

M. Recommended Grading Scale:

Course will be evaluated as Pass/Fail based on attendance and participation. Participation includes, but is not limited to, completing in-class work and outside homework assignments.

N. College Procedures/Policies:

North Central State College believes that every student is a valued and equal member of the community.* Every student brings different experiences to the College, and all are important in enriching academic life and developing greater understanding and appreciation of one another. Therefore, NC State College creates an inclusive culture in which students feel comfortable sharing their experiences. Discrimination and prejudice have no place on the campus, and the College takes any complaint in this regard seriously. Students encountering aspects of the instruction that result in barriers to their sense of being included and respected should contact the instructor, assistant dean, or dean without fear of reprisal.

* *Inclusive of race, color, religion, gender, gender identity or expression, national origin (ancestry), military status (past, present or future), disability, age (40 years or older), status as a parent during pregnancy and immediately after the birth of a child, status as a parent of a young child, status as a foster parent, genetic information, or sexual orientation*

Important information regarding College Procedures and Policies can be found on the syllabus supplement located at

<https://ncstatecollege.edu/documents/President/PoliciesProcedures/PolicyManual/Final%20PDFs/14-081b.pdf>



North Central State College
SYLLABUS ADDENDUM

Academic Division:	<u>Liberal Arts</u>	Discipline:	<u>Mathematics</u>
Course Coordinator:	<u>Sara K. Rollo</u>		
Course Number:	<u>STAT 0086 – 905B</u>	Course Title:	<u>Algebra for Probability and Statistics</u>
Semester / Session:	<u>Fall 2026 Session B</u>	Start / End Date:	<u>10/19/2026 – 12/11/2026</u>

Instructor Information

Name:	<u>Michael Enders</u>	Email:	<u>menders@ncstatecollege.edu</u>
Credentials:	<u>MA Teaching and Learning</u>		
Office Location:	<u>None</u>	Office Hours:	<u>Immediately after class</u>

I. Topical Timeline (Subject to Change): STAT0086

Week # and Dates		Day 1 – Tuesday	Day 2 – Thursday
1	10/20 & 10/22	Outcomes/objectives: Lesson 1 Learn how to use the graphing calculator No homework as we will do all of lesson 1 together in class.	Outcomes/objectives: Lesson 2 Convert decimal numbers to scientific notation and vice versa and perform unit conversion Homework Lesson 2 due next class
2	10/27 & 10/29	No in-person class on 10/27	Outcomes/objectives: Lesson 3 Apply the knowledge of order of operations when simplifying algebraic expressions Homework: Lesson 3 due next class
3	11/03 & 11/05	Outcomes/objectives: Lessons 4 & start 5 Demonstrate the knowledge of inequality symbols Homework 4 due next class	No in-person class on 11/05
4	11/10 & 11/12	Outcomes/objectives: Lesson 5 Solve equations, inequalities, and rational expressions Homework 5 due next class	Outcomes/objectives: Lesson 6 Label the slope and y-intercept on a graph and draw the line. Determine the slope given two points and from application Homework: Lesson 6
5	11/17 & 11/19	Outcomes/objectives: Lesson 7 Convert decimal numbers to a percent and vice versa Homework: Lesson 7	Outcomes/objectives: Lesson 8 Change algebraic expressions using properties of exponents Homework: Lesson 8
6	11/24 & 11/26	Outcomes/objectives: Lesson 9 Compute the solutions of a quadratic equation using both the quadratic formula and factoring Homework: Lesson 9	College Closed – Thanksgiving Break
7	12/01 & 12/03	Outcomes/objectives: Lesson 10 Determine the general term of both arithmetic and geometric sequences Homework: Lesson 10	Outcomes/objectives: Lesson 11 Generate an equation or formula using both direct and inverse variation when given specific pieces of data Homework: none
8	12/08 & 12/10	Finals week – no class	Finals week – no class

Course Number: STAT0086
Semester / Session: Fall 2026 Session B

Course Title: Algebra for Prob and Stats
Start / End Date: 10/19/2026 – 12/11/2026

II. Course Assignments:

1. Attending class
2. Lesson Homework

III. Grading and Testing Guidelines:

Homework: 50%
Attendance: 50%

IV. Examination Policy:

There are no examinations for STAT00886. (There are exams in STAT1010.)

V. Class Attendance and Homework Make-Up Policy:

Students will be allowed to turn in one homework assignment one class past due without penalty. Attendance will be taken each class and accounts for 50% of the overall grade.

VI. Classroom Expectations:

Attend class every scheduled session ready to actively participate respectfully.

STAT 0086 Co-Requisite Course STAT 1010

The lessons contained in this class are designed to help with, including but not limited to, the following:

- Probability and Statistics
- Biology
- Chemistry
- Entrance Exams for various Health Division Programs

Lesson 1: Calculator Usage

Each example or sample problem is to be done using the calculator:

1. Examples using the power (exponent) key on the calculator such as 3^4
2. Show difference between -3^4 and $(-3)^4$ on the calculator
3. How to divide a number such as $\frac{3}{5}$
4. Types of fractions: Mixed Number $3\frac{4}{5}$, Improper Fraction ($\frac{25}{12}$) and Proper Fraction ($\frac{7}{12}$)
5. Convert from decimal to a fraction, via the MATH key
6. Show how to take a square root and cubed root such as $\sqrt{144}$ and $\sqrt[3]{125}$
7. Finding the nth root of a number such as $\sqrt[4]{256}$
8. Difference between negative button and subtraction button
9. How to get back to the main screen using 2nd Quit
10. What scientific notation looks like on the calculator screen and that EE is used for the "x 10" portion of the number (more will be discussed with scientific notation in lesson 2)
11. Graph some functions and look at the table command options in the calculator.
 - a. e^x
 - b. $\ln(x)$
 - c. $y = x$
 - d. $y = 3x - 4$
 - e. $y = -\frac{1}{2}x^2$

Lesson 2 – Scientific Notation and Unit Conversions (continued next page)

Scientific notation is used in scientific disciplines to express very large or very small numbers without having to write all the zeros.

The purpose of scientific notation conversion is not to come up with a brand-new number; it is used to write decimal numbers in a different format. A format that is easier to read for large or small numbers and a format that is used by most scientists.

If N is a decimal number, then the scientific notation is:

$$N = a \times 10^n, \text{ where } 1 \leq a < 10, \text{ and } n \text{ is an integer}$$

In scientific notation, there is just one digit to the left of the decimal. The exponent tells how many places the decimal point is to be moved and in what direction.

Positive exponent $\rightarrow$ Move to the right for example, 5×10^2

Negative exponent $\leftarrow$ Move to the left for example, 5×10^{-2}

Examples:

1. Write in scientific notation:

- a. 86,000
- b. 376,000,000
- c. 0.036 2
- d. 0.000 058 9
- e. 0.006 1

2. Write in decimal form:

- a. 4.2×10^{-2}
- b. 8.35×10^{-5}
- c. 7.5692×10^8
- d. 6.132×10^{-5}

3. Perform the indicated operations by first writing the number in scientific notation. Then perform the indicated operation. Write your answer in scientific notation. Follow-up: do entirely in calculator (EE button).

a. $0.000\,002\,4 \cdot 40,000$

b. $300 \cdot 0.000\,015$

c.
$$\begin{array}{r} 125 \\ \hline 50,000 \end{array}$$

a.
$$\begin{array}{r} 0.046 \\ \hline 230 \end{array}$$

b.
$$\begin{array}{r} 0.02 \cdot 3,900 \\ \hline 0.013 \end{array}$$

Homework : Convert to scientific or regular notation

1. 725,000,000,000

2. 0.000 000 685

3. 9.325×10^{-7}

4. $1.987\,6 \times 10^{12}$

5. 75,000

6. 7.25×10^{-6}

7. 0.000 576

8. 0.000 026 7

9. 2.59×10^9

10. 1.3×10^{-3}

Scientific notation is just one example of conversion. **Dimensional analysis** is an example of unit conversion used for engineering and science disciplines. Dimensional analysis is the analysis of the relationships between different physical quantities.

The process is:

- identify the base (or starting) units,
- determine the desired units,
- identify the proper conversion factor(s) - or ratios -
- then cancel units when we can by performing the proper mathematical operations.

Examples of Conversion Factors:

1 mile = 5280 feet
1 meter = 3.281 feet
1 kilometer = 0.621 miles
1 ft = 12 in
1 in = 2.54 cm
60 minutes = 1 hour
60 seconds = 1 minute

Metrics:

King Henry Drinks Delicious Chocolate Milk

Examples:

1. Convert 52.1 cm to its equivalent measurement in mm.
2. Change a speed of 62.5 miles per hour to its equivalent in meters per second.
3. Convert a speed of 88 m/s to its equivalent in cm/s.
4. Convert a density of 9.45 g/L to its equivalent in g/mL.
5. The density of mercury is 13.6 g/mL. What is the mass in kilograms of a 2 L commercial flask of mercury?
6. Convert 57 mL to its equivalent in L.

Lesson 3: Order of Operations

Calculate: $10 \div 2 + 8$

Order of Operations - The purpose is to provide the exact order that should be followed when simplifying algebraic expressions. This can also be used when solving equations.

Parentheses –any grouped items, including the numerator and denominator of a fraction

Exponents

Multiplication/Division – in order from left to right

Addition/Subtraction- in order from left to right

The acronym to help remember this order is **Please Excuse My Dear Aunt Sally (PEMDAS)**

Like Terms- Any term having the same variable(s) and those variable(s) having the same exponent.

Combine Like Terms (simplify) - Add or subtract the coefficients of the terms and leave the variable(s) and exponent the same.

Use the order of operations to combine like terms

1. $(x^3 + 2x - 9) + (x^2 - 5x + 2) + (x^3 - 4x^2 + 1)$
2. $20 - 16 \div 4$
3. $60 - 30 \div 3 * 5 + 7$
4. $900 \div (6 + 3 * 8) - 10$
5. $(-3x^4 + 2x^3 - 7x^2 + 6x + 12) - (x^4 + 9x^3 + 4x^2 + x - 1)$
6. $-4(x - 6) - (8x + 2)$
7. $2x + [9x - 4(3x + 2) - 7]$
8. $-[6x^2 - 3(4 + 2x) + 9] - (x^2 + 5)$
9. $-3[-x + (10 - 3x) - (8 - 3x)] + (2x - 1)$
10. $x(x - 5) + [6x - x(4 - x)]$

Homework :

- | | |
|---|---|
| 1. $3x + [8x - 4(3x + 1)] - 9$ | 6. $4x + x(13 - 7)$ |
| 2. $(x^2 + 4) - [-6 + 2(3 - 2x^2) + x]$ | 7. $18y - 2(1 + 7y)$ |
| 3. $2[4x + 5(x - 8) - (2x + 3)] + (3x - 5)$ | 8. $9x + 4x(2 + 3) - 4(2x + 3x)$ |
| 4. $4p(q - 1) + q(1 - p)$ | 9. $23y - 2(43y + z)$ |
| 5. $9r - (s + 2r) + (6 - s)$ | 10. $3\{[6(x - 4) + 5] - 2[5(x + 8) - 3]\}$ |

Lesson 4: Inequalities

Not everything in mathematics is exactly equal; oftentimes we have a range of possible answers/solutions. Sometimes, we need to show the relationship between two values with something other than an equal sign since we don't always have exact equality.

Inequality symbols are used to show if one value is bigger or smaller than another value and reference where the numbers are on the number line. Smaller numbers are to the left. Larger numbers are to the right.

$<$ *less than*

$\geq$ *greater than or equal to*

$\leq$ *less than or equal to*

$>$ *greater than*

Something to remember is that the opening (or the "mouth") is always facing (or "eating") the bigger value.

Examples:

Place the proper inequality symbol in the examples below. Also draw a rough sketch of the number line.

1. $0.5 \underline{\hspace{1cm}} 0.06$

2. $-1 \underline{\hspace{1cm}} -25$

3. $15 \underline{\hspace{1cm}} 13$

4. $15 \underline{\hspace{1cm}} -36$

5. $2532 \underline{\hspace{1cm}} 5257$

6. $1,000 \underline{\hspace{1cm}} 2,537$

7. $0.0005 \underline{\hspace{1cm}} 0.005$

Homework : Come up with 10 of your own inequality expressions. Use whole numbers, negative numbers, decimals and fractions in your examples. Show the "answer" to your own expressions also.

Lesson 5: Solving Equations and Inequalities

Any expression with an “=” sign is called an equation. With equations, we can find a solution. The solution is the number value that if we plug into the variable, we will get a true statement. The true statement occurs when the left side of the equal sign matches the right side of the equal sign.

Steps to solve an equation:

1. Combine like terms on each side of the equal sign (use PEMDAS)
2. Start performing opposite operations in order to get all the variable terms on ONE side of the equal sign and the non-variable terms on the OTHER side
3. After the variable term is by itself on one side of the equation, isolate the variable by performing the opposite operation.

Examples. Solve the following:

1. $x - 6 = 1$
2. Set-up the mathematical expression from the following statement: Twice a number
3. Set-up the mathematical expression from the following statement: Five times the difference of six and four times some number
4. $7n = 42$
5. $56y = -25$
6. $2x + 3 = -7$
7. $20 = 5x - 3x - 4$
8. $6y - 4.5 = y + 4.5$
9. $4(x - 2) = 3(x + 6)$
10. $-2(y + 2) - 4 = 6 - (y + 12)$
11. The sum of four times some number and forty-three is the same as three times the difference of the number and seventy-eight. Find the number.
12. A minor league ballpark attracts 88 fans and draws in \$553 in revenue from ticket sales. A child's ticket costs \$4 and an adult's ticket is \$7. How many of each type of tickets were sold?

There are other types of equations such as those involving rational expressions. With solving such type equations, we would first want to **multiply each term by the least common multiple of each denominator in order to “clear” the fraction** component of the problem. You will see then that the equation becomes just like those previously solved. Just be sure to double check for extraneous solutions – those that cause the fraction to be undefined. Recall that undefined is when the denominator is equal to 0.

Compare the “cross products” of each: $\frac{1}{2} = \frac{3}{6}$ $\frac{1}{4} = \frac{25}{100}$

Examples:

1.
$$\frac{2}{15} = \frac{8}{3x}$$

2.
$$\frac{21}{x+4} = \frac{7}{8}$$

3. Jared ran 10 miles in 80 minutes. At that rate how far would he run in 2.5 hours?

4. Mel fills his gas tank with 6 gallons of premium unleaded gas for a cost of \$26.58. How much would it cost to fill an 18 gallon tank?

5.
$$\frac{6}{x-4} = \frac{5}{x+7}$$

6.
$$\frac{x-2}{3} - \frac{x-3}{5} = \frac{13}{15}$$

7.
$$\frac{2+x}{4} - \frac{5x-2}{12} = \frac{8-2x}{5}$$

8.
$$\frac{2x}{x-2} + 3 = \frac{9}{x-2}$$

9.
$$3 + \frac{2x}{x-3} = \frac{4}{x-3}$$

10.
$$\frac{6}{x-3} + 1 = \frac{2x}{x-3}$$

We don't always have an equal sign; sometimes we have inequalities, as discussed in a previous lesson. We can also solve inequalities, but we will not have just ONE answer, we will have all numbers that are greater than (or equal to) and less than (or equal to) a certain value or we will have all numbers that are between two values. Follow the same steps as above. **However, if we divide by a negative, we have to flip the inequality symbol.**

Examples:

1. $4x + 6 \geq 10$
2. $y - 6 > 3y + 4$
3. $5y + 8 < 2y + 5$
4. $-4 < 5x + 1 < 16$
5. $1 \leq 3x - 5 \leq 10$

Homework :

1. $25n + 7 = 15n + 4$
2. $2(y + 8.3) + 1.2 = y - 16.6 - 1.2$
3. $2x + 5 - 3 \leq 6$
4. $-3(7 - 2x) \geq 2 + 3x - 10$
5. $4(x - 3) + 12 = 15 - 5(x + 6)$
6. $3(2x - 1) + x = 5x + 3$

7.
$$\frac{x}{3} - \frac{3}{4} = \frac{2x + 3}{12}$$

8. $13 - 7x \geq 10x - 4$
9. $-3(2x + 1) > -2(x + 4)$
10. $-4 < 3x + 2 \leq 18$

11.
$$\frac{10}{x} = \frac{5}{x - 2}$$

12.
$$\frac{5}{x - 6} - 5 = \frac{2x}{x - 6}$$

13.
$$\frac{12}{x - 4} = 6 + \frac{3x}{x - 4}$$

14. If 4 U.S. dollars can be exchanged for 1.75 Euros, how many Euros can be obtained for 144 U.S. dollars?
15. Crayola can make 2400 crayons in 4 minutes. How many can be made in 15 minutes?
16. Set-up the mathematical expression from the following statement: The difference of a number and eight.
17. Set-up the mathematical expression from the following statement: Twice the sum of a number and three.
18. Five times a number plus nineteen is eighty-four. What is the number?

19. Enrique weighs 5 pounds more than twice Braden's weight. Together, Enrique and Braden weigh 225. How much do Enrique and Braden weigh?

Lesson 6: Lines and Slope

In your previous math course, you discussed graphing equations using ordered pairs. An ordered pair being (x, y) where both x and y are numbers that you can plot on the Cartesian coordinate system. The x -value is called the independent variable because we can choose x to be any value we want it to be (as long as it doesn't make the equation undefined) and the y -value is called the dependent variable because this value depends on what we plug in for x .

The reason for graphing an equation is because the line can tell us about the relationship between the independent and the dependent variables. This relationship is called the slope (or average rate of change). The steeper the slope (or the graph of the line) the faster the dependent variable changes given a certain change in the independent variable. For example, a steep slope could be a mountain. The height of the mountain changes much more quickly than the length of the mountain.

Slope can be defined in several ways such as $\frac{\text{rise}}{\text{run}} = \frac{\Delta x}{\Delta y}$. But most commonly it is $m = \frac{y_2 - y_1}{x_2 - x_1}$. We will be

finding slope using the slope-intercept form of a line. We will also find slope when two ordered pairs are given.

The **slope-intercept form** of a line is $y = mx + b$; where m is the slope and $(0, b)$ is the y -intercept. The y -intercept is the place the graph crosses the y -axis and is also when the x -value is equal to zero.

We can tell we have a steep slope of a line when the numerator is bigger than the denominator and we have a gentle slope of a line when the numerator is smaller than the denominator.

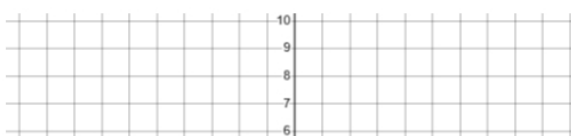
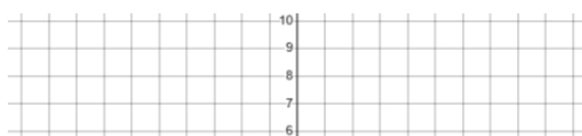
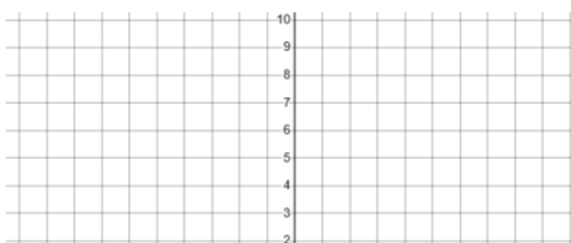
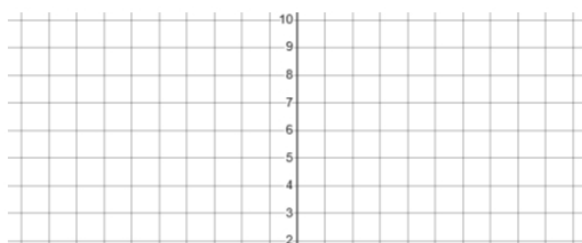
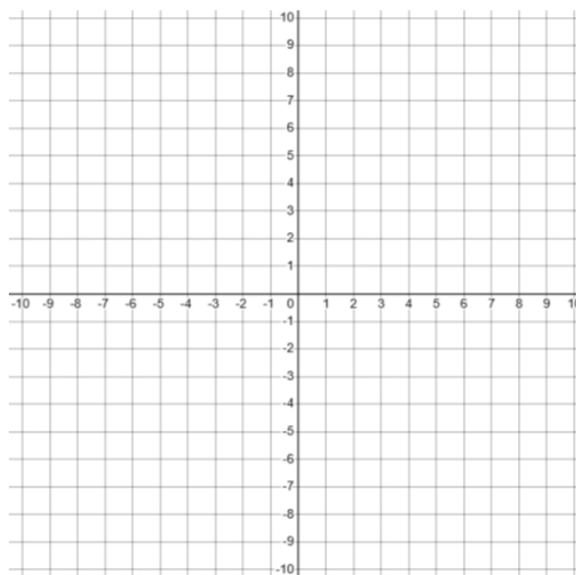
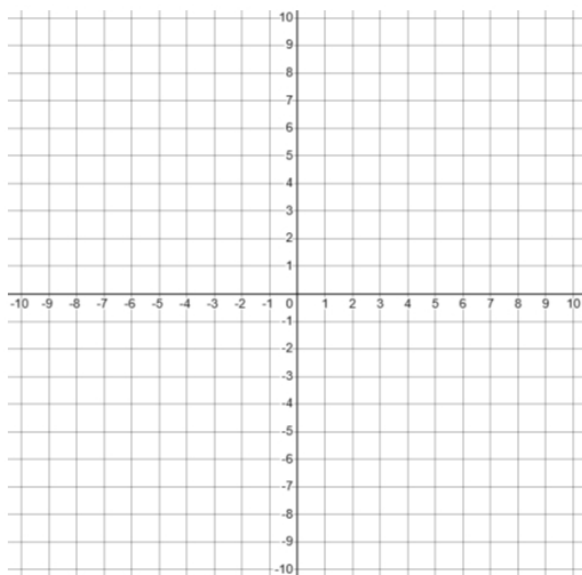
If the equation of the line is not given, we can still find the equation by using two points that the line passes through and by using the **point-slope form** of a line $y - y_1 = m(x - x_1)$.

Examples: In the following examples, state the slope and the y -intercept and then graph the line.

1. $y = 2x - 6$ also find the y -value when $x = 12$
2. $y = -3x + 4$
3. $x + y = 1.5$
4. $x - 2y = 10$ also find the y -value when $x = -5$
5. $2x - y = 12$
6. $x + 4y = 2$ also find the y -value when $x = 3.4$
7. $y = 2 - 3x$
8. A climber is on a hike. After 2 hours he is at an altitude of 400 feet. After 6 hours, he is at an altitude of 700 feet. What is the average rate of change?
9. A scuba diver is 30 feet below the surface of the water 10 seconds after he entered the water and 100 feet below the surface after 40 seconds. What is the scuba divers rate of change?
10. The graph of a line passes through the points $(2, 3)$, $(3, 6)$. Find the equation of the line
11. The graph of a line passes through the points $(3, 7)$, $(5, 16)$. Find the equation of the line

Homework : #1-5, 8-10: State the slope and the y-intercept. Also graph.

1. $y - 2x = 3$
2. $2x + 5y = 10$
3. $2x + 3y = 16$
4. $y = 2x + 7$
5. $3x - 2y = 5$
6. The graph of a line passes through the points (5,4) and (7,9). Find the equation of the line.
7. The graph of a line passes through the points (-3,2) and (4,-7). Find the equation of the line.
8. $6y - 9x = 6$
9. $y = -12x - 4$
10. $y = 3x + 2$
11. A teacher weighed 145 pounds in 1986 and weighs 190 pounds in 2007. What is the rate of change in weight?
12. A rocket is 1 mile above the earth in 30 seconds and 5 miles above the earth in 2.5 minutes. What is the rockets rate of change in miles per second?



Lesson 7: Percents

The word **percent** comes from the Latin per centum, meaning **per hundred** . It is the ratio of the number to 100. The symbol % is called the percent sign.

$$\frac{\text{amount}}{100} = \%$$

To change a Decimal to a Percent:

1. Locate the position of the decimal point. Move it 2 places to the right.
2. Write the % sign.

Why are we moving 2 places? (As opposed to only one place or 3 places?)

When moving the decimal point to the right, what mathematical operation is this using?

To change a Percent to a Decimal:

1. Locate the position of the decimal point. Move it 2 places to the left.
2. Delete the % sign.

When moving the decimal point to the left, what mathematical operation is this using?

Examples:

1. Change each decimal to a percent.

- | | |
|-----------|-----------|
| a. 0.34 | g. 0.025 |
| b. 0.0082 | h. 0.0004 |
| c. 1 | i. 2.3 |
| d. 5.799 | j. 2 |
| e. 0.02 | |
| f. 0.7 | |

2. Change each percent to a decimal.

- | | |
|-----------|----------|
| a. 40% | g. 232% |
| b. 211% | h. 10.1% |
| c. 0.6% | i. 13.2% |
| d. 29.37% | j. 6.5% |
| e. 2% | |
| f. 0.52% | |

Homework : Change each percent to a number and each number to a percent.

- | | |
|-----------|------------|
| 1. 3.89 | 7. 7% |
| 2. 0.0004 | 8. 0.04% |
| 3. 0.0023 | 9. 24.3% |
| 4. 0.45 | 10. 0.009% |
| 5. 0.067 | |
| 6. 35% | |

Lesson 8: Properties of Exponents

Properties of exponents:

1. The exponent 1: $a^1 = a$
2. The exponent 0: $a^0 = 1$
3. The product rule: $a^m \cdot a^n = a^{m+n}$
4. The quotient rule: $\frac{a^m}{a^n} = a^{m-n}$
5. Negative exponents: $a^{-1} = \frac{1}{a}$
6. Power rule: $(a^m)^n = a^{mn}$
7. Power of a product: $(ab)^n = a^n b^n$
8. Power of a quotient: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

Simplify the following examples:

1. -3^4

2. $(-3)^4$

3. $4(-3x)^3$

4. $\left(\frac{3x}{y}\right)^3$

5. $\left(\frac{2x}{y}\right)^{-2}$

6. $x(3x^2y^3)^4 + x^7(3x^2y^3)^4$

Roots and Radicals :

The symbol $\sqrt{\quad}$ is called a radical sign. The number under the radical sign is called the radicand. The complete expression $\sqrt{49}$ is called a radical or radical expression.

If $a^2 = b$ then $a = \sqrt{b}$.

Similarly, if $a^3 = b$, then $a = \sqrt[3]{b}$. We can do this for any exponent and its partner radical.

Simplify the following examples. Also give a decimal approximation from the calculator.

1. $\sqrt{9}$

2. $\sqrt{289}$

3. $\sqrt{48}$

Homework. Simplify the following and give a decimal approximation in the calculator.

4. $\sqrt[3]{\frac{1}{8}}$

1. $(3x^{-2}y^3z^{-5})^{-4}$
2. $(-7)^{-3}$
3. $(-10)^5$
4. $\sqrt{18}$
5. $\frac{-2 - \sqrt{12}}{3}$
6. $\sqrt{1300}$
7. $(16y^0)2y^{-2}$
8. $16\sqrt{24} + 7\sqrt{54} - 12\sqrt{6}$
9. $\frac{4^{-2}x^3y^{-3}}{2x^0}$
10. $\sqrt[5]{-243}$

Lesson 9: Quadratic Equations

In lesson 5, we learned how to solve linear equations. Linear equations have a variable whose exponent is not bigger than one. Not all graphs are linear; however, and we will learn a little bit about quadratic equations today. **A quadratic equation is one whose variable has an exponent of 2**.

Quadratic equations can still be solved for the variable but require slightly different methods than do linear equations. We will be looking at a couple of those methods for this lesson.

Standard form of a quadratic equation: $ax^2 + bx + c = 0$, where $a \neq 0$.

Since the exponent is two, generally there will be two solutions, but not always. As a reminder, the solution is called the x-intercept and is where the graph crosses the x-axis. In the case of having two solutions, the graph crosses the x-axis in two different places.

Solving Techniques:

1. quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

2. Factoring (reverse FOIL) is often the faster of the two methods but does not always work.

Examples. Solve by either using factoring or by using the quadratic formula:

1. $x^2 + 4x - 4 = 0$

2. $2x^2 + 5x - 3 = 0$

3. $3x^2 - 7x + 4 = 0$

4. $4x^2 + 6x + 1 = 0$

5. $2x^2 - 3x - 1 = 0$

6. $x^2 + 4x + 3 = 0$

7. $6x^2 = 5x + 1$

8. $3x^2 + 10x - 8 = 0$

9. $5x^2 + 10x - 8 = 0$

10. $6x^2 + 13x - 28 = 0$

11. $\frac{12}{x+1} + 1 = \frac{5}{x-1}$

12. $\frac{8}{x-4} - 3 = \frac{1}{x-10}$

Homework :

1. $x^2 - 6x - 1 = 0$
2. $9x^2 + 12x + 4 = 0$
3. $x^2 - 5x + 2 = 0$
4. $4x^2 + 15x + 9 = 0$
5. $3x^2 + 5x + 2 = 0$
6. $x^2 + 4x = -1$
7. $x^2 + 5x + 1 = 0$
8. $3x^2 - 5x - 2 = 0$
9. $8x^2 + 14x + 3 = 0$
10. $10x^2 - 3x - 5 = 0$

Lesson 10: Sums

In mathematics, we often have a long series of numbers in which to find the sum. We do not want to physically write out each number that we want to add so a notation was discovered that helps us to illustrate the sum we want to find without having to write the series of numbers. This notation is called **sigma notation**. There are times when we want to just find a partial sum. We know that we can add infinitely many numbers, but that is impossible to actually do, so we can find the partial sum.

The **nth partial sum**, S_n , of the first n terms of a sequence $\{a_n\}$ is $\sum_{k=1}^n a_k = a_1 + a_2 + \dots + a_n$. k is called the **index of summation**, and k takes the integer values $1, 2, 3, \dots, n$. n is the upper **limit of summation**, and 1 is the **lower limit of summation**.

Examples:

1. Find the indicated sum: $\sum_{k=1}^5 2k$

2. Find the indicated sum: $\sum_{k=3}^6 (9 - 2k)$

There are two specific types of sequences that we will discuss in this lesson. The first is the arithmetic sequence, which has the characteristic of each term in the sequence having the same difference and the second is the geometric sequence, which has the characteristic of each term in the sequence having the same ratio.

A sequence $\{a_n\}$ is called an **arithmetic sequence** if for any natural number k , $a_{k+1} - a_k = d$ where d is a constant and is called the common difference. The arithmetic sequence has the form $a_n = a_1 + (n-1)d$ where d is the common difference between two consecutive terms.

Examples:

1. Find the general term, a_n . $a_1 = 1, d = 2/3$

2. Find the general term, a_n . $a_1 = 7, d = -2$

3. Find the general term, a_n . $a_1 = -3, d = 4/5$

Homework :

1. $a_1 = 9, d = -\frac{1}{3}$

2. $a_1 = 10, d = \frac{1}{4}$

3. $a_1 = 3, d = -2$

4. $a_1 = -5, d = 7$

5. $a_1 = 1, d = \frac{1}{3}$

A sequence $\{a_n\}$ is called **a geometric sequence** if for any positive integer k , $\frac{a_{k+1}}{a_k} = r$, where r is constant and $r \neq 0$ and r is called the common ratio. The geometric sequence has the form $a_n = a_1 r^{n-1}$

Examples:

1. Find the general term, a_n . $a_1 = 3, r = 2$
2. Find the general term, a_n . $a_1 = -2, r = 1/5$
3. Find the general term, a_n . $a_1 = 5, r = \sqrt{2}$

Homework :

1. $a_1 = 12, r = -12$
2. $a_1 = 7, r = \frac{1}{2}$
3. $a_1 = 4, r = -3$
4. $a_1 = \frac{7}{8}, r = 4$
5. $a_1 = -5, r = 5$

Lesson 11: Variation

In many sciences, there are major relationships that have a variation relationship. There are several types of variation. One type is **direct variation** which occurs when increasing the value of one variable indicates an increase in the other variable and the ratio of the two variables is a constant. Another type is **inverse variation** which occurs when an increase in the value of one variable indicates a decrease in the other variable. Also, the product of the two variables that vary inversely is a constant.

A variable quantity y **varies directly as** (or is **directly proportional to**) a variable x if there is a constant k such that $\frac{y}{x} = k$ or $y = kx$ where k is the constant of variation.

A variable quantity y **varies inversely as** (or is **inversely proportional to**) a variable x if there is a constant k such that $x \cdot y = k$ or $y = \frac{k}{x}$ where k is the constant of variation.

Examples:

For the following, write an equation or formula that represents the general relationship indicated. Then use the given information to find the unknown value.

1. If y varies directly as x , and $y=3$ when $x=9$, find y if $x=7$.
2. If y is directly proportional to x^2 , and $y=3$ when $x=2$, what is y when $x=8$?
3. If y varies inversely as x , and $y=5$ when $x=8$, find y if $x=20$.
4. If y varies inversely as x^2 , and $y=-8$ when $x=2$, find y if $x=3$.
5. If y is inversely proportional to x^3 , and $y=40$ when $x=1/2$, what is y when $x=1/3$?
6. If y is proportional to the square root of x , and $y = 6$ when $x=1/4$, what is y when $x=9$?

Homework:

1. If y is directly proportional to x , and $y = 10$ when x is 3, what is y when x is 7?
2. If y is inversely proportional to x^4 , and $y = 50$ when $x = \frac{1}{2}$, what is y when $x = \frac{1}{10}$?
3. Suppose that y is inversely proportional to x and that $y = 0.4$ when $x = 2.25$. Find y when $x = 4$.
4. If y varies directly as x , and $x = 9$ when $y = 15$, find y when $x = 33.5$.
5. If c varies directly as the square root of d , and $c = 14$ when $d = 64$, find c when $d = 324$.
6. If p varies directly as the cube of q , and $p = 26$ when $q = 2$, find p when $q = 5.7$.
7. The distance required to stop a car varies directly as the square of its speed. If 250 feet are required to stop a car traveling at 60 miles per hour, how many feet are required to stop a car traveling at 45 miles per hour?
8. If y varies inversely as x , and $y = 32$ when $x = 3$, find x when $y = 15$.

9. If r varies inversely as the cube of s , and $r = 17$ when $s = 3$, find r when $s = 2$.
10. The current in a simple electrical circuit is inversely proportional to the resistance. If the current is 80 amps when the resistance is 50 ohms, find the current when the resistance is 22 ohms.

This lesson is designed to give additional practice for the concepts that you will learn in Probability and Statistics. Your statistics instructor will go into more detail with the definitions and the application of these concepts. In this class, you will simply be introduced to the topic or concept and gain some practice in using those topics or concepts in their respective formulas.

1. The following data entries are from a sample: 12, 14, 25, 27, 28, 32, 35, 47. Find the average, or the mean, $\bar{x}$, of the sample.
2. If you know that the mean of a population is $\mu=13$ and the standard deviation of the same population is $\sigma=2.3$, then use that information to find the z -score of a random sample whose value is 17. The z -score is used to standardize data and is found with the formula $z = \frac{x-\mu}{\sigma}$ [Note: Standard Deviation describes how far, on average, each observation is from the mean. It is the deviation about the mean.]

3. For the following data and using the formula
$$\mu = \frac{\sum (x_i f_i)}{\sum f_i}$$
, approximate the mean number of emails

received per day. Where Σ indicates finding the sum, x_i is the midpoint of each class, f_i is the frequency of each class and Σf_i is the sum of all the frequencies. The subscript i is used to differentiate the first class, second class, third class, etc. To find the midpoint of each class use $\frac{\text{upper limit} + \text{lower limit}}{2}$ where the upper limit and lower limit are the beginning number and ending number of each class. For example, the lower limit of the first class is 8 and the upper limit of the same class is 11.

Emails (per day)	Frequency
8-11	3
12-15	34
16-19	31
20-23	8
24-27	27

4. Calculate the population standard deviation for the following data using the formula
$$\sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{N}}$$
 where μ is the mean of the data, σ is the population standard deviation, and N is the total number of data entries. The data entries are: 10, 13, 15, 17, 18, 22

NOTE: You have been introduced to two symbols representing the mean or average of data. The distinction is that $\bar{x}$ is the mean of a sample and μ is the mean of a population. You will get into more detail with this distinction during your Probability and Statistics class.