

MIDDLE SCHOOL COURSE OUTLINE

Course Title: Algebra I (10 Credits)
Grade Level: 8
Prerequisites: Successful completion of Pre-Algebra and/or teacher recommendation.

Course Description:

Algebra is a fundamental tool for thinking and communicating symbolically across all the areas of mathematics. In the study of algebra, students develop symbol sense, acquire fluency in using symbols to describe relationships among mathematical expressions, and make generalizations. Algebraic fluency is developed in conjunction with work involving functions, geometry, statistics, and probability. Emphasis will be placed on preparing students for success in Geometry and Algebra II courses.

Student Performance Objectives for this Course:

Students will

1. identify and use the arithmetic properties of subsets of integers and rational, irrational, and real numbers, including closure properties for the four basic arithmetic operations where applicable:
 - use properties of numbers to demonstrate whether assertions are true or false.
2. understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.
3. solve equations and inequalities involving absolute values.
4. simplify expressions before solving linear equations and inequalities in one variable, such as $3(2x-5) + 4(x-2) = 12$.
5. solve multi-step problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.
6. graph a linear equation and compute the x- and y- intercepts (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by $2x + 6y < 4$).
7. verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations by using the point-slope formula.
8. understand the concepts of parallel lines and perpendicular lines and how those slopes are related. Students are able to find the equation of a line perpendicular to a given line that passes through a given point.

9. solve a system of two linear equations in two variables algebraically and are able to interpret the answer graphically and be able to solve a system of two linear inequalities in two variables and to sketch the solution sets.
10. add, subtract, multiply, and divide monomials and polynomials and solve multistep
11. problems, including word problems, by using these techniques.
12. apply basic factoring techniques to second-and simple third-degree polynomials. These
13. techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials.
14. simplify fractions with polynomials in the numerator and denominator by factoring both and reducing them to the lowest terms.
15. add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques.
16. solve a quadratic equation by factoring or completing the square.
17. apply algebraic techniques to solve rate problems, work problems, and percent mixture problems.
18. understand the concepts of a relation and a function, determine whether a given relation defines a function, and give pertinent information about given relations and functions.
19. determine the domain of independent variables and the range of dependent variables defined by a graph, a set of ordered pairs, or a symbolic expression.
20. determine whether a relation defined by a graph, a set of ordered pairs, or a symbolic expression is a function and justify the conclusion.
21. know the quadratic formula and are familiar with its proof by completing the square.
22. use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations.
23. graph quadratic functions and know that their roots are the x - intercepts.
24. use the quadratic formula or factoring techniques or both to determine whether the graph of a quadratic function will intersect the x -axis in zero, one, or two points.
25. apply quadratic equations to physical problems, such as the motion of an object under the force of gravity.

26. use and know simple aspects of a logical argument:

- be able to explain the difference between inductive and deductive reasoning and identify and provide examples of each.
- be able to identify the hypothesis and conclusion in logical deduction.
- be able to use counterexamples to show that an assertion is false and recognize that a single counterexample is sufficient to refute an assertion.

27. use properties of the number system to judge the validity of results, to justify each step of a procedure, and to prove or disprove statements:

- use properties of numbers to construct simple, valid arguments (direct and indirect) for, or formulate counterexamples to, claimed assertions.
- judge the validity of an argument according to whether the properties of the real number system and the order of operations have been applied correctly at each step.
- given a specific algebraic statement involving linear, quadratic, or absolute value expressions or equations or inequalities, students determine whether the statement is true sometimes, always, or never.

Instructional Strategies

- A. Lecture, discussion and demonstration
- B. Reading assignments
- C. Written assignments
- D. Homework and programming assignments
- E. Use of available audio-visual materials
- F. Use of available community resources

Evaluation

Student progress will be evaluated by:

- A. Completion and quality of assignments
- B. Attendance
- C. Class participation
- D. Tests/quizzes
- E. Homework
- F. Teacher observation
- G. Teacher evaluation
- H. Final exam/project