Davison Community Schools
ADVISORY CURRICULUM COUNCIL
Alt Ed. Math Strategies
Phase II, April 1, 2012

Alt. Ed Math Strategies

Course Essential Questions (from Phase I report):

1. What mathematical strategies are useful when taking the ACT?

Unit 1: Pre-Algebra

Essential Questions:

1. What Pre-Algebra skills are useful when taking the ACT?

Essential Understanding:

- Conversion of decimals, fractions and percents can be done on the calculator.
- Order of Operations is the following: Parenthesis, exponents, multiply or divide left to right, and add or subtract left to right.
- Proportions can be solved by cross multiplying.
- Data can be presented in several forms. eg: Bar graph, line graph, pie chart, box and whisker, and stem and leaf plot
- Mean, Median, and Mode are the Measures of Central Tendency used to analyze data.
- Data can be analyzed using samples from a population.
- The probability is how likely an event will occur.

Curriculum Standards

Algebra – (Reasoning with Equations and Inequalities) Solve equations and inequalities in one variable

3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Statistics and Probability – (Interpreting Categorical and Quantitative Data) Summarize, represent, and interpret data on a single count or measurement variable

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).

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(Conditional Probability) Use the rules of probability to compute probabilities of compound events in a uniform probability model

6. Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model.
7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.
8. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.

Knowledge/Content Students will know about....	Skills/Processes Students will be able to.....
• The difference between decimals, fractions, and percents. • The purpose of the order of operations • The steps for solving proportions. • The concept of measures of central tendency. • The steps for data collection. • The steps for analyzing data. • The purpose for organizing data in different ways. • The purpose of different ways of sampling a population. • The difference between theoretical and experimental probability. • The difference between permutation and combination. • The steps for solving linear equations.	• Convert Decimals to fractions and percents. • Convert Fractions to decimals and percents • Convert Percents to decimals and fractions • How to use the order of operations. • Solve proportions in contextual ways • Find probability of events. • Collect and Interpret Data • Solve Linear Equations and understand relationship between tables, graphs, and linear expressions. • Use Measure of Central Tendency to interpret and analyze data.

Phase III Textbook/Materials

Phase IV Summative Assessment Evidence

Common Summative Unit Assessments: (50%)	Agreed Upon Interim Summative Assessments: (40%) (*identifies Performance Task)

Phase V Learning Plan

Unit 2: Algebra	
Essential Questions: 1. What Algebra skills are useful when taking the ACT?	**Essential Understanding:** • The value of "a" represents the initial value at x = 0, and the value "b" represents the growth or decay rate. An exponential increases when b >1 and decreases when 0< b < 1. • The key characteristics of the graph of an exponential $y = a \cdot b^x$ are that it has a y-intercept at (0, a), it doesn't have an x-intercept, it increases or decreases, and the graph has an asymptote at the x-axis. • Compound Inequalities can be used to solve and write absolute value equations and inequalities • The Absolute Value Function is a V shaped function that translates on the coordinate plane. • Students will be able to read a word problem and translate it into algebraic symbols by using key words and check solutions for reasonableness. • Students will solve equations, including equations with variables on both sides, using properties of equality. • Develop the ability to solve problems by defining variables, relating them to one another, and writing an equation. • Use proportions to measure objects indirectly. • Students represent quantitative relationships using mathematical symbols, and interpret relationships from those representations. • The same properties for solving equations hold for inequalities with the addition of reversing the inequalities symbol when multiplying or dividing by a negative. • A polynomial function is the sum of power function whose exponents are whole numbers. • The name of the polynomial is determined by the degree and the number of terms of the polynomial. • Using the grouping method, ax^2+bx+c, can be factored • Using prior knowledge of exponent properties, combining like terms, and GCF, we can apply processes from previous topics to polynomials. • Using Area and Volume formulas to solve problems. • The leading term (highest exponent) determines what the graph looks like. • The maximum number of real zeros is determined by the degree of the polynomial. • By using the Zero-Product Property when a polynomial is in factored form, the x-intercepts can

	be found. • Students can recognize a quadratic Function by its shape. • Solutions can be found graphically and algebraically • Some solutions to equations have no real solutions. This introduces the concept of imaginary numbers.

Curriculum Standards

Number and Quantity – (Real Numbers) Extend the properties of exponents to rational exponents.

1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)^3}$ to hold, so $(5^{1/3})^3$ must equal 5.*
2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Algebra – (Seeing Structure in Expressions) Interpret the structure of expressions

1. Interpret expressions that represent a quantity in terms of its context.★
   a. Interpret parts of an expression, such as terms, factors, and coefficients.
   b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*
2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*

Write expressions in equivalent forms to solve problems

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★
   a. Factor a quadratic expression to reveal the zeros of the function it defines.

(Arithmetic with Polynomials and Rational Expressions) Perform arithmetic operations on polynomials

1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

Understand the relationship between zeros and factors of polynomials

3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

(Reasoning with Equations and Inequalities) Solve equations and inequalities in one variable

4. Solve quadratic equations in one variable
   b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

Knowledge/Content Students will know about....	Skills/Processes Students will be able to.....
• What an absolute values measures • The differences on the graphs and notation of absolute inequalities **using and/or** Absolute Value graphs • The shape of the graph of an exponential function and the key characteristics of the graph: x- and y-intercepts, asymptote, increasing or decreasing • How to relate the exponential relationship to real world applications such as: investments (compounded interest or depreciation), population growth or decay, half-life • Properties of exponents: ○ Product of Powers: $a^m \times a^n = a^{m+n}$ ○ Power of a Power: $(a^m)^n = a^{mn}$ ○ Power of a Product: $(ab)^m = a^m b^m$	• Organize and summarize data sets including error tolerance • Graph Absolute Value Function • Solve Absolute Value equations and inequalities • Simplify expressions with zero and negative exponents • Evaluate exponential expressions. • Write numbers in scientific and standard notation. • Multiply power with the same base. • Raise a power to a power • Divide powers with the same base • Describe a polynomial • Add, subtract, multiply polynomials • Factor a monomial from a polynomial • Factor a polynomial using the grouping

○ Negative Exponent: $a^{-m} = 1 / (a^{m}); a <> 0$ ○ Zero Exponent: $a^{0} = 1; a <> 0$ ○ Quotient of Powers: $a^{m} / a^{n} = a^{m-n}; a <> 0$ ○ Powers of a Quotient: $(a / b)^{m} = a^{m} / b^{m}; b <> 0$ ○ The nth root of a to the m power equals $a^{m/n}$ • What the factored form of a polynomial expression looks like • The features of a polynomial function in symbolic form that determine the name and the maximum number of zeros • What the graphs of polynomial functions look like • What the zeros of a polynomial function represent • Key Words: Vertex of a Parabola Solutions, intercepts, zeros, roots, solutions to a quadratic Maximum/Minimum points Axis of Symmetry Translation (h,k) notation Completing the square Quadratic Formula	method • Classify and name polynomials • The definition of a polynomial function • What the factored form of a polynomial expression looks like from vertex form. • Identify axis of symmetry and the vertex. • Determine if vertex is maximum or minimum. • Use Quadratic Formula/discriminant to determine the number and nature of the roots. • Identify and describe the effects of varying a, h, k, or a, b, c. • Recognize which equations have no real roots.

Phase III Textbook/Materials

Phase IV Summative Assessment Evidence	
Common Summative Unit Assessments:	**Agreed Upon Interim Summative Assessments:** (*identifies Performance Task)

Phase V Learning Plan

Unit 3: Geometry	
Essential Questions: 1. What Geometry skills are useful when taking the ACT?	**Essential Understanding:** • Calculate distance and midpoint of a line segment given its endpoints using the distance/midpoint formula. • Axioms, definitions, theorems, and counterexamples are used deductively to draw conclusions about vertical angles, parallel lines, and divided line segments. • We can use the properties of vertical angles, alternate interior angles, alternate exterior angles, corresponding angles, linear pairs, complementary angles, and supplementary angles to solve for unknown angles. • Point, line, and plane are the three undefined terms in Euclidean Geometry. • A transversal intersects two coplanar lines at different points. • The Triangle Angle Sum Theorem shows there are 180 degrees in all triangles. Exterior angles form linear pairs. Exterior angle measures are equal to the sum of the two remote interior angles. • A regular polygon has congruent sides and equal interior angle measures. • Regular polygons have specific names based on number of sides. We can use the ((n-2) * 180)/ n formula for interior angle measures. • Using the interior angle sum formula we can solve for missing angles in regular polygons. • Triangles can be classified based on their side lengths as scalene, isosceles, or equilateral. Triangles can be classified based on their angle measures as acute, obtuse, or right. • There are five sufficient conditions for triangle congruence. • If a figure A is congruent to figure B, and figure B is congruent to figure C, then figure A is congruent to figure C. • The five theorems that ensure triangle congruence are SSS, SAS, ASA, AAS, and HL. • Applying the Pythagorean Theorem to the square and equilateral triangle situations (above) can determine side lengths of the special right triangles. • The Pythagorean Theorem uses two given side lengths of a right triangle to find the third. Its converse can prove three given side lengths form a right triangle.

Curriculum Standards
G-CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G-CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. G-MG.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).★ G-GPE.4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).* G-GPE.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. G-GPE.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.★ G.CO.8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. G.CO10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*

Knowledge/Content Students will know about....	Skills/Processes Students will be able to.....
• The formulas for Distance and Midpoint. • The definition of vertical angles. • The definition of linear pairs • The definition of supplementary angles. • The definition of complementary angles • The definition of right angles. • The definition of a point, line, and plane. • The difference between parallel and perpendicular lines. • The definition of a bisector. • The definition of congruent. • The definition of collinear. • The definition of corresponding angles. • The definition of alternate interior/exterior angles. • The definition of same side interior angles. • The purpose of the triangle angle sum theorem. • The definition of a regular polygon. • The definition of a N-gon. • The definition of obtuse, acute and right triangles. • The definition of a scalene, isosceles, and equilateral triangle. • The purpose of SSS, SAS, ASA, AAS, and HL.	• Find the distance/midpoint of a given line segment • Distinguish appropriate units for linear, area, and volume solutions. • Apply axioms, definitions, theorems, and counter examples to solve basic geometry problems. • Use the properties of Euclidean geometry to find unknown angles. • Know the three undefined terms of geometry. • Identify a transversal. • Use the Triangle Angle Sum Theorem to solve for missing angles in a triangle. • Know why a polygon is considered regular. • Know the properties of the regular polygons (up to 12 sided.) • Prove two triangles are congruent. • Use transitivity to prove figures are congruent. • Use the SSS, SAS, ASA, AAS and HL congruence theorems to prove triangles are congruent. • Show how a 45-45-90 right triangle is derived from a square. • Show how a 30-60-90 right triangle is

• The definition of transitivity. • The formulas for special right triangles. • The definition of ratio. • The purpose of the Pythagorean Theorem.	derived from an equilateral triangle.
Phase III Textbook/Materials	
Phase IV Summative Assessment Evidence	
Common Summative Unit Assessments:	**Agreed Upon Interim Summative Assessments:** (*identifies Performance Task)
Phase V Learning Plan	

Unit 4: Trigonometry

Essential Questions:	**Essential Understanding:**
1. What Geometry skills are useful when taking the ACT?	• $\sin\theta=\text{opp/hyp}$ • $\cos\theta=\text{adj/hyp}$ • $\tan\theta=\text{opp/adj}$ • $\sec\theta=1/\text{Cos}$ • $\csc\theta=1/\text{Sin}$ • $\cot\theta=1/\text{Tan}$

Curriculum Standards

Geometry – (Similarity, Right Triangles and Trigonometry) Define trigonometric ratios and solve problems involving right triangles

6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
7. Explain and use the relationship between the sine and cosine of complementary angles.
8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.*

Knowledge/Content Students will know about....	**Skills/Processes** Students will be able to.....
• The purpose of Sin, Cos, and Tan • The definition of Sec, Csc, and Cotan.	• Graph trig functions on the graphing calculator. • Find Sin, Cos, and Tan • Find Sec, Csc, and Cotan

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