

# Mathematics

## National Rankings of Essential Skills (as of July 31, 2007)

National Essential Skills Study (NESS) Mathematics Topic Statements	National Rank	NESS Priority	Subgroup Rankings			
			Business/ Industry	Other Non- Educators	Math Educators	Other Educators
Perform operations fluently with positive and negative numbers, including decimals, ratios, percents, and fractions, and show reasoning to justify results	1	High	1	1	1	1
Understand and apply basic algebraic properties (commutative and associative laws of addition and multiplication, distributive law of multiplication over addition, and identities and inverses).	2	High	2	2	12	2
Use proportional reasoning to solve real-world problems.	3	High	9	9	2	3
Understand the properties of and apply parallel, perpendicular, and intersecting lines in problem-solving situations.	4	High	3	3	9	4
Examine problem-solving situations involving simple probability and use probabilistic reasoning to compare and communicate the theoretical or empirical likelihood of events.	5	High	6 *	7	8	7
Demonstrate understanding of, and accurately apply, place value to round off numbers.	6	High	11	4	16	5
Simplify and solve algebraic equations by identifying and using the correct order of operations and techniques necessary to carry out the solution.	7	High	10	5	5	8
Solve problems using units of metric measure and convert between metric and English/customary units.	8	High	8	6	19	6
Compute the perimeter and area of common two-dimensional figures.	9	High	17	16	3	11
Understand and apply a systematic methodology or procedure (e.g., direct or indirect measurement, direct or indirect proof, inductive or deductive reasoning) to model and solve problems.	10	High	6	7	13	8
Apply variables in expressions and equations to solve problems (i.e., write mathematical equations for given situation, create a mathematical model to understand the relationships between variables, or make connections between the structures of mathematically abstract concepts and the real world).	11	High	4	11	4	13
Understand accuracy and precision of measurement, round off numbers according to the correct number of significant figures, and determine percent error.	12	High	5	10	25	10
Use the technique of dimensional analysis to convert units of measure (e.g., kilometers/hour to meters/minute) and apply ratios in real-world situations (e.g., scale drawings).	13	High	12	13	11	12
Understand and apply measures of central tendency (mean, median, and mode, and representative sampling of a population).	14	High	14	16	7	15
Classify angles by measure (acute, right, obtuse, and straight) and understand angle relationships (supplementary, complementary, and vertical).	15	High	13	16	22	14
Apply pattern recognition in data sets and series to reason or solve problems involving arithmetic, geometry, exponents, etc.	16	High	21	12	10	16

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			Business/ Industry	Other Non- Educators	Math Educators	Other Educators
Understand the importance of random sampling and sample size in generating representative data.	17	Medium	19	22	29	17
Understand the properties of circles (radius, arc, diameter, chord, secant, and tangent) and apply circle quantities (lengths of line segments, angle measure within a circle, circumference, and area) in problem-solving situations.	18	Medium	23	14	26	18
Compute the distance between two points on a coordinate plane (length of a line segment) and determine the midpoint of a line segment between two points.	19	Medium	15	19	31	19
Understand and apply the basic properties and laws of exponents and scientific notation to solve problems, including those with fractional, negative, and zero exponents.	20	Medium	22	20	14	22
Evaluate and employ accurate and appropriate procedures for statistical data collection, organization, analysis, and display including making estimates and predictions, critiquing data, and drawing inferences (e.g., using the normal curve and z-scores, line of best fit).	21	Medium	18	24	26	23
Interpret data to determine correlation and distinguish between correlation and cause and effect.	22	Medium	23	30	34	21
Apply the Pythagorean Theorem to right triangles.	23	Medium	25	31	6	25
Understand the concepts of recurrence relations and apply them to solve consumer mathematics problems involving such things as percentage rates, personal loans, simple interest, compound interest, installment buying, mortgage rates, etc.	24	Medium	15	23	28	24
Perform operations and solve equations containing complex numbers.	25	Medium	30	14	53	20
Know the classification and properties of three-dimensional figures (prisms, rectangular solids, pyramids, right circular cylinders, cones, and spheres) and be able to compute the volume and surface area of common solids.	26	Medium	34	34	21	26
Find the solution of linear equations and inequalities where the variable appears on either or both sides and in which one or both sides must be simplified before solving the equation (e.g., solve $x + 2(x - 3) = -4x + 5$ for $x$ ).	27	Medium	26	26	20	29
Know and apply the six basic trigonometric functions and ratios and solve right triangles using basic trigonometric ratios (sine, cosine, tangent).	28	Medium	28	21	17	30
Factor a composite number into its prime components and use least common denominators or least common multiples to solve equations.	29	Medium	33	29	32	28
Know and apply the components and properties of the rectangular coordinate system: $x$ - $y$ axis, origin, quadrants, abscissa ( $x$ -coordinate) and ordinate ( $y$ -coordinate), and general representation of a point ( $x,y$ ).	30	Medium	27	25	15	32
Understand and apply measures of dispersion (range, mean deviation, variance, and standard deviation).	31	Medium	20	32	38	27

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Determine the probability of single and compound events and use the Counting Principle to determine the probability of independent events occurring jointly.	32	Medium	31	42	23	40
Perform operations with radicals, such as addition, subtraction, and multiplication.	33	Medium	42	27	51	31
Understand the properties and classification of polygons (triangles, the family of quadrilaterals, pentagon, hexagon, etc.) and apply knowledge of angle and side relationships of geometric shapes in problem-solving situations.	34	Medium	47	36	36	33
Use the properties of real (rational and irrational) numbers and demonstrate understanding of ordering and absolute value.	35	Medium	43	36	38	34
Simplify polynomials by performing operations (addition, subtraction, multiplication, and division) to simplify expressions (e.g., $(2a + 2) + (3a - 1) = 5a + 1$ ).	36	Medium	38	28	35	38
Define and apply the properties of relations and functions (domain, range, function composition, and inverses) and use algebraic and graphic methods to determine if a relation is a function.	37	Medium	38	35	37	37
Create or evaluate algorithms (e.g., computer program codes, flowcharts) designed to accomplish a specific task.	38	Medium	29	33	42	35
Apply techniques to obtain a rational approximation or estimate of a quantity or number (including irrational numbers such as radicals).	39	Medium	35	39	40	39
Solve systems of linear equations algebraically or graphically.	40	Medium	36	44	18	42
Understand the properties and applications of the undefined terms of geometry (point, line, and plane) and their relationship with intuitive concepts (i.e., collinear points, coplanar points, opposite rays, and parallel lines).	41	Medium	31	43	44	41
Use geometric methods, such as using an unmarked straightedge and compass, to complete basic geometric constructions.	42	Medium	36	38	57	36
Understand and apply the concepts and applications of quartiles (distributing groups into four equal sizes), percentiles (distributing individuals into 100 groups of equal size), and random distribution to understand and interpret data.	43	Low	40	48	50	43
Know the equation of a line and interpret graphically using the slope-intercept form ( $y = mx + b$ ) and the point-slope form ( $y - b = m(x - a)$ ).	44	Low	43	41	23	48
Solve linear inequalities and graph the solution set on a number line.	45	Low	40	47	42	45
Know the equation for the slope of a line and compute slope given the coordinates of two points.	46	Low	47	46	33	47
Solve quadratic equations by applying various tools or techniques.	47	Low	55	50	30	50

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Express, graph, and interpret exponential and logarithmic functions.	48	Low	46	40	52	44
Analyze the truth value of compound sentences by creating truth tables.	49	Low	50	45	64	46
Understand the concepts and apply the uses of matrices in modeling (i.e., finite graphs or structures that can be represented geometrically and interpreted algebraically in the form of a matrix).	50	Low	43	49	56	49
Determine combinations (the various groupings a set may be arranged in without regard to order) and permutations (arrangements of a set where order matters).	51	Low	49	62	46	52
Understand the characteristics and uses of vectors (representations of velocity and force) and perform basic operations on vectors (e.g., vector addition and scalar multiplication).	52	Low	51	51	58	51
Express, graph, and interpret polynomial functions (linear, quadratic, cubic, etc.).	53	Low	62	57	48	55
Apply transformations (reflection, rotation, translation, and dilation) of 2-dimensional figures graphically to interpret, analyze, and illustrate the concepts of congruency, similarity, and symmetry.	54	Low	60	65	45	56
Perform the general solution of triangles by using the Law of Sines and Law of Cosines to obtain the angle and side length measurements of any triangle.	55	Low	53	53	54	53
Express a linear function ( $f(x) = mx + b$ ) with the appropriate notation and determine the ordered pairs.	56	Low	52	53	41	58
Solve and graphically sketch problems involving two variables that exhibit direct and indirect variation.	57	Low	59	58	49	57
Use anti-derivatives and the process of integration to determine areas, volumes, and distances.	58	Low	56	52	61	54
Understand the characteristics of maxima and minima and be able to determine maximum and minimum points mathematically on a graph or curve.	59	Low	56	55	47	60
Evaluate and use finite sequence and series as systematic and useful means of quantifying things.	60	Low	53	64	65	59
Use derivatives and the process of differentiation to determine slopes of tangent lines, maxima and minima, velocity, and acceleration.	61	Low	58	56	58	61
Perform division of a polynomial by a monomial by dividing powers with like bases, using the rules for the division of powers with like bases to simplify fractions with monomial denominators and reducing fractions to lowest terms.	62	Low	62	58	62	62
Understand the concepts and apply the uses of functions and limits (i.e., conduct limiting processes using functions to investigate infinite series and sequences).	63	Low	60	61	68	63
Understand the trigonometric properties of the unit circle and sketch the graphs of basic circular functions ( $y = \sin x$ , $y = \cos x$ , and $y = \tan x$ , where the measure of the angle $x$ is expressed in radians).	64	Low	65	60	60	64

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Find the graphic solution of systems of linear inequalities (i.e., graph the solution set or region of the coordinate plane common to both inequalities).	65	Low	65	66	55	66
Know how to sketch basic conic sections (e.g., circles, parabolas) by using their equations and solve systems of non-linear equations graphically.	66	Low	65	63	66	65
Apply step and piecewise functions, including greatest integer and absolute value functions.	67	Low	65	67	66	67
Apply transformation concepts to examine two-dimensional aspects or representations of three-dimensional figures (e.g., isometries and nets).	68	Low	64	69	63	68
Apply summation notation to take the sum of an expression using limits (e.g., take the sum of $3i + 1$ from $i = 1$ to 5).	69	Low	65	68	70	69
Understand and apply the binomial theorem (e.g., explore the relationship of the binomial theorem with Pascal's triangle and the Fibonacci sequence).	70	Low	70	70	69	70

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