

Federal Democratic Republic of Ethiopia
Ministry of Education

Minimum Learning Competencies

Mathematics, Grades 9 to 12

2009

Statement of Minimum Learning Competencies (MLCs) in Mathematics for Grade 9 & 10

Area of Competency	Grade 9	Grade 10
<p>I. NUMBER SYSTEM</p> <p>The real number system</p>	<ul style="list-style-type: none"> • identify natural numbers and integers • define prime numbers and composite numbers • determine common factors and common multiples of pairs of numbers • show that repeating decimals are also rational numbers • identify irrational numbers • locate some irrational numbers on a number line. • define real numbers. • describe the correspondence between real numbers and points on a numbers line. • Realize the relationship between a power with fractional exponent and a radical form. • Convert powers with fractional exponent to radical form and vice-versa • perform any one of the four operation on the set of real numbers • use the laws of exponents to simplify expression. • give appropriate upper and lower bounds for a given data to a specified accuracy (e.g. rounding off) • express any positive rational number in its standard form. • explain the notion of rationalization. • identify a rationalizing factor for a given expression. • use the Euclid's division algorithm to express given quotients of the form $\frac{p}{q}$ where, $p > q$. 	
<p>II. ALGEBRA</p> <p>Solving Equations and Inequalities</p>	<ul style="list-style-type: none"> • Solve equations involving exponents and radicals • Solve simultaneous equation • identify the three cases of solutions of simultaneous equations (a unique solution, no solution, infinitely many solutions) • Solve equations involving absolute value • Solve quadratic equations by using any one of the three 	<ul style="list-style-type: none"> • describe sets using internal notation. • solve inequalities involving absolute value of linear expression • solve system of linear inequalities in two variables by using graphical method • solve quadratic inequalities by using product properties

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	<p>methods</p> <ul style="list-style-type: none"> • Apply Viète's theorem to solve related problems 	<ul style="list-style-type: none"> • solve quadratic inequalities using the sign chart method. • solve quadratic inequalities using graphs
III. SETS	<ul style="list-style-type: none"> • describe sets in different ways • identify the elements of a given set • explain the notion "empty set" and "universal set" • determine the numbers of subsets of a given finite set and list them. • give the power set of a given set • determine the number of proper subsets of a given finite set and list them. • distinguishes between equal sets and equivalent sets • find equal sets and equivalent sets to a given set • determine number of elements in the union of two finite set. • describe the properties of "union" and "intersection" of sets. • determine the absolute complement of a given set. • determine the relative complement of two sets • determine the symmetric difference of two sets. • determine the Cartesian product of two sets. 	
IV. RELATION AND FUNCTION	<ul style="list-style-type: none"> • define the notions "relation", "domain" and "range" • draw graphs of relations • use graphs of relation to determine domain and range • define function • determine the domain and range of a given function. • determine the sum difference, produced and quotient of functions. • Evaluate combination of functions for a given values from their respective domain. • sketch graphs of linear functions • describe the properties of the graphs of linear functions. • sketch the graphs of a given quadratic function. 	<ul style="list-style-type: none"> • define the polynomial function of one variable • identify the degree, leading coefficient and constant terms of a given polynomial functions. • give different forms of polynomial functions • perform the four fundamental operation on polynomials • state and apply the polynomial division theorem • state and apply the Factor Theorem • determine the zero(s) of a given polynomial function • state and apply the Location theorem to approximate the zero(s) of a given polynomial function
IV. RELATION AND	<ul style="list-style-type: none"> • describe the properties of the graphs of given quadratic 	<ul style="list-style-type: none"> • apply the rational root test to determine the zero(s)

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Area of Competency	Grade 9	Grade 10
<p>FUNCTION (cont.)</p>	<p>functions</p> <ul style="list-style-type: none"> determine the maximum and minimum values of a given quadratic function 	<p>of a given polynomial function.</p> <ul style="list-style-type: none"> sketch the graph of a given polynomial function. describe the properties of the graphs of a given polynomial function explain what is meant by exponential expression state and apply the properties of exponents (where the exponents are real numbers) express what is meant by logarithmic expression by using the concept of exponential expression solve simple logarithmic equation by using the properties of logarithm recognize the advantage of using logarithm to the base 10 in calculation identify the "characteristics" and "mantissa" of a given common logarithm use the table for finding logarithm of a given positive number and antilogarithm of a number. compute using logarithm define an exponential function. draw the graph of a given exponential function describe the graphical relationship of exponential functions having bases reciprocal to each other describe the properties of an exponential function by using its graph. define a logarithmic function draw the graph of a given logarithmic function describe the properties of a logarithmic function by using its graph describe the graphical relationship of logarithmic function having bases reciprocal to each other. describe how the domains and ranges of $y = a^x$ and $y = \log_a^x$ are related explain the relationship of the graphs of $y = a^x$ and $y = \log_a^x$

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<i>Area of Competency</i>	<i>Grade 9</i>	<i>Grade 10</i>
IV. RELATION AND FUNCTION (cont.)		<ul style="list-style-type: none"> • solve equations involving exponents and logarithms as well • solve problems, involving exponential and logarithmic functions, from real life. • define the sine, cosine and tangent functions of an angle in the standard position. • determine the values of the functions for an angle in the standard position, given the terminal side of that angle. • determine the values of the sine, cosine and tangent functions for quadrantal angles • locate negative and positive angles • determine the values of trigonometric functions for some negative angles. • determine the algebraic signs of the sine, cosine and tangent functions of angles in different quadrants. • describe the relationship between trigonometrical values of complementary angles. • describe the relationship between trigonometrical values of supplementary angles. • determine the relationship between trigonometrical values of coterminal angles. • determine the trigonometrical values of large angles • construct a table of values for $y = \sin \theta$ where $-2\pi \leq \theta \leq 2\pi$. • draw the graph of $y = \sin \theta$ • determine the domain range and period of the sine function. • construct a table of values for $y = \cos \theta$, where $-2\pi \leq \theta \leq 2\pi$. • draw the graph of $y = \cos \theta$ • determine the domain, range and period of the cosine function.

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Area of Competency	Grade 9	Grade 10
<p>IV. RELATION AND FUNCTION (cont.)</p>		<ul style="list-style-type: none"> • construct a table of values for $y = \tan \theta$ where $-2\pi \leq \theta \leq 2\pi$. • draw the graph the tangent function $y = \tan\theta$. • determine the domain, range and period of the tangent function. • discuss the behavior of the graph of tangent function • define the cosecant function • determine the values of cosecant function for some angles. • define the secant function. • determine the values of secant function for some angles. • define the cotangent function • determine the values of cotangent function for some angles. • explain the concept of co-functions. • derive some of the trigonometric identities. • identity the quotient identities. • solve problems related to trigonometrical identities. • solve real life problems using trigonometirical ratios
<p>V. STATISTICS AND PROBABILITY</p> <p>Statistical Data</p>	<ul style="list-style-type: none"> • differentiate primary and secondary data • collect data from their environment • classify and tabulate primary data according to the required criteria. • construct a frequency distribution table for ungrouped data • construct a histogram for a given data • interpret a given histogram • determine the Mean, Median and Mode of a given data • describe the purposes and uses of Mean, Median and Mode • identify the properties of the Mean of a given data (population function) • compute the measures of dispersion for ungrouped data (manually and using scientific calculator) • describe the purpose and use of measures of dispersion for 	

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	<ul style="list-style-type: none"> ungrouped data. • determine the probability of an event from a repeated experiment. • determine the probability of an event. 	
<p>VI. PLANE GEOMETRY AND MEASUREMENT</p>	<ul style="list-style-type: none"> • show that the sum of the measures of the interior angles of a triangle is 180° • find the measure of each interior angle of a regular polygon • state properties of regular polygons. • determine the lines of symmetry of regular polygons • use the postulates and theorem on congruent triangle in solving related problems. • define similar plane figures and similar solid figures. • apply the SSS, SAS and AA similarity theorems to prove similarity of triangles • discover the relationship between the perimeters of similar plane figures and use this relationship to solve related problems. • discover the relationship between the areas of similar plane figures and use this' relationship to solve related problems. • discover the relationship between the volumes of similar solid's and use this relationship to solve related problems. • enlarge and reduce plane figures by a given scale factor. • solve real life problems using the concepts of similarity and congruency. • describe radian measure of an angle. • convert radian measure to degree measure and vice versa. • use the trigonometrical ratios to solve right angled triangles. • find the angle whose trigonometrical value is given (using trigonometrical table.) • find the trigonometrical values of angles from trigonometrical table. • determine the trigonometrical values for obtuse angles using trigonometrical table. • discover the symmetrical properties of circles • use the symmetrical properties of circles to solve related problems 	<ul style="list-style-type: none"> • derive the distance formula (to find distance between two points in the coordinate plane) • apply the distance formula to solve related problems in the coordinates plane • determine the coordinates of points that divide a given line segment in a given ratio • define the gradient of a given line • determine the gradient of a given line (given two points on the line) • determine the equation of a given line • identify whether to lines are parallel or not. • identify whether two lines are perpendicular or not. • apply the properties of the slopes of parallel and perpendicular lines to solve related problems • apply the incidence theorems to solve related problems. • apply theorems on special quadrilateral in solving related problems • Apply the theorems on angles and arcs determined by lines intersecting inside, on and outside a circle to solve related problems • calculate the perimeters of regular polygons • calculate the areas of regular polygons • apply the formulae for calculating surface area and volume of prism and cylinder • calculate surface areas of a given pyramid or a cone • calculate the volumes of a given pyramid or a cone. • calculate the surface area of a given sphere
<p>VI. PLANE GEOMETRY AND MEASUREMENT</p>		

Statement of Minimum Learning Competencies (MLCs) in Mathematics for Grade 11 & 12

<i>Area of Competency</i>	<i>Grade 11</i>	<i>Grade 12</i>
<p>I. NUMBER SYSTEM</p> <p>The set of Complex Number</p>	<ul style="list-style-type: none"> • add complex numbers correctly • subtract complex numbers correctly. • describe the closure property of both addition and subtraction. • describe the commutative and associative properties of complex numbers. • identify the additive identity element in \mathbb{C}. • determine the additive inverse of a given complex number. • determine the product of two complex numbers. • describe five basic properties of multiplication of complex numbers. • divide two complex numbers • give reason for each step in the process of division of complex numbers • determine the conjugate of a given complex number. • find the Modulus of any given complex number • Write the simplified form of expressions involving complex numbers • describe how to set up the Argand Plane. • Plot the point corresponding to a given complex numbers. • identify the complex number that corresponds to a given point in the Argand Plane. • represent any complex number in the polar form • determine the modulus and argument of a given complex number. 	
<p>II. ALGEBRA</p> <p>Rational Expression</p>	<ul style="list-style-type: none"> • define rational expression • identify the universal set of a given rational expression • show the simplified form and the necessary steps in simplify a given rational expression • Perform the four fundamental operations on rational expression 	

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Area of Competency	Grade 11	Grade 12
<p>Matrices and Determinants</p>	<ul style="list-style-type: none"> • decompose rational expressions into sums of partial fractions. • solve rational equations • solve rational inequalities by using algebraic method (by considering all possible cases) • solve rational inequality by using the sign chart method • define matrix • determine the sum and difference of two given matrices of the same order. • multiply a matrix by a scalar • describe the properties of multiplication of matrices by scalars. • determine the product of two matrices. • describe the properties of the product of two matrices. • determine the transpose of a matrix • determine the determinant of a square matrix of order 2. • determine the minor and cofactor of a given element of a matrix • calculate the determinate of a square matrix of order 3. • describe the properties of determinants. 	
<p>II. ALGEBRA (cont.)</p> <p>Matrices and Determinants (cont.)</p> <p>Introduction to Linear Programming</p>	<ul style="list-style-type: none"> • determine inverse of a square matrix • find associated augmented matrix of equations • describe elementary operations on matrices • solve systems of equations in two or three variables using the elementary operations • apply Cramer's rule to solve systems of linear equations <p>⇒ <i>For social science stream only</i></p> <ul style="list-style-type: none"> • draw graphs of linear inequalities <ul style="list-style-type: none"> $y \leq mx + c$ and $y \geq mx + c$ and $ax + by \leq c$ • find maximum and minimum values of a given objective 	

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Area of Competency	Grade 11	Grade 12
	function under given constraints. • create inequalities from real life examples for linear programming and solve the problem	
II. ALGEBRA (cont.) Mathematical Applications in Business	⇒ <i>For social science stream only</i> (cont.) • compare quantities in terms of ratio. • calculate the rate of increase and the rate of decrease in price of commodities. • solve problems on proportional variation in business • solve problems on compound proportion • find a required percentage of certain given amount • compute problems on percentage increase or percentage decrease • calculate payment by installment for a given simple interest arrangement. • calculate the compound interest of a certain amount invested for a given period of time. • apply the formula for compound interest to solve practical problems • compute annuity for a give arrangement in compound interest. • describe what is depreciation mean and some its causes • compute depreciation by using either of the two methods appropriately. • list five valid reasons for savings. • explain how savings become investment. • list three saving plans. • identify four kinds of financial institutions. • describe three main factors in choosing a particular institution for saving. • identify the four factors that should guide consumers in planning an investment strategy. • explain the differences between stocks and bond. • describe ways to invest in stock and bond	⇒ <i>For social science stream only</i> • find unit cost • find the most economical purchase • find total cost • apply percent increase and percent decrease to business • apply percent increase and percent decrease to business • calculate initial expenses of buying a home • calculate ongoing expenses of owing a home • calculate commissions, total hourly wages, and salaries
	⇒ <i>For social science stream only</i> (cont.)	

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<i>Area of Competency</i>	<i>Grade 11</i>	<i>Grade 12</i>
<p>II. ALGEBRA(cont.)</p> <p>Mathematical Applications in Business</p>	<ul style="list-style-type: none"> • describe the advantages and disadvantages of borrowing money • identify the usual sources of cash loan.. • compute the amount and time on the return of loan based on the or given agreement. • name three types of activities that government performs and give examples of each • explain why government collect taxes. • describe the basic principles of taxation • describe the various kinds of taxes. • give their opinion about "income taxes" mean for them in relation to their future first job. • calculate different types of taxes based on the "rate of tax" in Ethiopia 	
<p>III. RELATION AND FUNCTION</p> <p>Further on Relation and Function</p>	<ul style="list-style-type: none"> • find out the inverse of a given relation • Sketch the graph of a relation and its inverse. • define power functions • describe the properties of powers functions in relation to their exponents • determine the domains and ranges of power functions • sketch the graphs of power functions • define Modulus Function (Absolute value Function, • determine the domain and the range of modulus function • sketch the graph of a Modulus function • define the Signum function • determine the domain and range of Signum function • sketch the graph of the Signum function • define the "Greatest Integer Function" • determine the domain and range of the Greatest Integer function • Sketch the graph of the Greatest Integer function • define "one-to-one" function • identify functions as one-to-one 	

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	<ul style="list-style-type: none"> • define 'on to' function • identify functions as on to • identify one-to-one correspondence • define the composition of function. • determine the composite function given the component functions • determine the domain and the range of a composite function of two given functions. 	
<p>III. RELATION AND FUNCTION (cont.)</p> <p>Further on Relation and Function</p>	<ul style="list-style-type: none"> • define inverse function • describe the condition for the existence of inverse function • determine inverse function for an invertible function. • determine whether two given functions are inverses of each other or not. • Sketch the graph of the inverse of a function • determine the domain and range of the inverse of a given function • define rational function. • determine the domain of a given rational function. • determine the range of a given rational function. • sketch the graph of a given rational function • determine the intercepts and symmetry of the graph of a given rational function • identify the type asymptote that the graph of a given function may have. • tell the properties of a given rational function from its graph. • use graphs of rational functions to solve rational inequalities 	
<p>III. RELATION AND FUNCTION (cont.)</p> <p>Further on trigonometric</p>	<p>⇒ For Natural Science stream only</p> <ul style="list-style-type: none"> • define and describe the functions $\sec x$, $\operatorname{cosec} x$ and $\cot x$. • Sketch graphs of $\sec x$, $\operatorname{cosec} x$ and $\cot x$ 	

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Area of Competency	Grade 11	Grade 12
<p>functions</p>	<ul style="list-style-type: none"> • define and describe the functions $\sec x$, $\operatorname{cosec} x$ and $\cot x$. • Sketch graphs of $\sec x$, $\operatorname{cosec} x$ and $\cot x$ • Sketch the graphs of <ul style="list-style-type: none"> $y = a \sin x$, $y = a \sin kx$; $y = a \sin (kx + b)$, $y = a \sin (kx + b) + c$ • List the properties of these graphs. • Sketch the graphs of <ul style="list-style-type: none"> $y = a \cos x$, $y = a \cos kx$ $y = a \cos (kx + b)$ $y = a \cos (kx + b) + c$ • List the properties of these graphs. • Apply trigonometric functions to solve problems from fields of science, navigation, engineering etc 	
<p>III. RELATION AND FUNCTION (cont.)</p> <p>Sequences and Series</p>		<ul style="list-style-type: none"> • revise the notion of sets and functions. • explain the concepts sequence, term of a sequence, rule (formula of a sequence) • compute any term of a sequence using rule(formula). • draw graphs of finite sequences. • determine the sequence, use recurrence relations such as, $u_{n+1} = 2u_n + 1$, given u_1 • generate the Fibonacci sequence and investigate its uses, appearance in real life • define arithmetic progressions and geometric progressions. • Determine the terms of arithmetic and geometric sequences • use the sigma notation for sums. • compute partial sums of arithmetic and geometric progressions • apply partial sum formula to solve problems of science and technology • define a series

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Area of Competency	Grade 11	Grade 12
		<ul style="list-style-type: none"> • decide whether a given geometric series is divergent or convergent. • show how infinite series can be divergent or convergent • show how recurring decimals converge • discuss the applications of arithmetic and geometric progressions (sequences) and series in science and technology and daily life.
<p>IV. LOGIC</p> <p>Mathematical Reasoning</p>	<ul style="list-style-type: none"> • explain the difference between "statement" and "open statement" • determine the truth value of a statement • describe the rules for each of the five logical connectives. • use the symbols \neg, \wedge, \vee, \Rightarrow and \Leftrightarrow to make compound statements • determine truth values of compound statements connected by each of the logical connectives. • determine truth values of two or three statements connected by two or three connectives • describe the properties and laws of logical connectives • determine the equivalence of two statements • define "Contradiction and "Tautology" • determine that a given compound statement is either a contradiction or tautology or neither of them • find the "converse" of a given compound statement • determine the truth value of the converse of a given compound statement • find the "contra -positive" of a given statement • determine the truth value of the contra- positive of a given statement 	<ul style="list-style-type: none"> • recall what they have studied about statements and logical connectives in the previous grade • revise open statement • understand the concept of quantifiers • determine truth values of statements with quantifiers. • define argument and validity • check the validity of a given argument • use rules of inference to demonstrate the validity of a given argument • distinguish between the nature of different types of mathematical proofs. • apply the right type of proof to solve the required problem • apply the principle of mathematical induction for proving • identify a problem and determine whether it could be proved using principle of mathematical induction or not.

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Area of Competency	Grade 11	Grade 12
	<ul style="list-style-type: none"> • describe the two types of quantifiers • determine the truth value of statements involving quantifiers • describe what is meant by "argument" • check the validity of a given argument • use rules of inference to demonstrate the validity of a given argument. 	
<p>V. STATISTICS AND PROBABILITY</p> <p>Statistics and Probability</p>	<ul style="list-style-type: none"> • identify qualitative and quantitative data • describe the difference between discrete and continuous variables (data) • identify ungrouped and grouped data • determine class interval (class size) as required to form grouped data from a given ungrouped data • make cumulative frequency table for grouped data (for both discrete and continuous) • described terms related to grouped continuous data, i.e., class limit, class boundary, class interval and class midpoint. • determine class limit, class boundary, class interval and class midpoint for grouped continuous data. • find the mean of a given grouped data. • find median grouped discrete data • find median for grouped data (continuous variable) • determine the mode of a given grouped data. • identify data that are unimodal, bimodal and multimodal. • determine the quartiles for a given grouped data • determine the required deciles of a given frequency distribution • determine the required percentile of a given frequency distribution. • describe the dispersion of data values • find the range of a given data. • Compute variance for ungrouped data 	<ul style="list-style-type: none"> • ⇒For social science stream only • describe the three methods/techniques of sampling. • explain the advantages and limitation of each techniques of sampling. • describe the different ways of representations of data. • explain the purpose of each representation of data. • Construct graphs of statistical data • identify statistical graph. • explain the significance of representing a given data in different types of graphs. • draw histogram for a given frequency distribution • Sketch frequency polygon for a given frequency distribution • sketch frequency curve for a given frequency distribution • draw bar chart • construct line graph for data related to time. • construct pie chart for a given data. • compute the three mean deviations of a given data. • describe the relative significance of Mean deviation as a measure of dispersion. • calculate the inter-quartile range for a given data. • describe inter-quartile range as a measure of variability in values of a given set of data. • describe the usefulness of standard deviation in interpreting the variability of a given data.

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Area of Competency	Grade 11	Grade 12
<p>V. STATISTICS AND PROBABILITY (cont.)</p> <p>Statistics and Probability (cont.)</p>	<ul style="list-style-type: none"> • calculate variance for grouped data. • solve problems on variance • Calculate standard deviation for grouped data. • determine the number of different ways of possible selections from a given sets of objects (by using the multiplication principle) • find the number of ways of selections of mutually exclusive operations (by using the addition principle) • determine the factorial of a given non-negative integer • find the possible ways of arranging objects by using the principle of permutation • compute the possible arrangement of objects around the circle (using the principle of circular permutation) • describe the difference between arrangement of objects and selection of objects. • describe what is meant by "combination of objects" • determine the number of different combinations of n objects, taken r at a time. • explain the computational relationship between permutation and combination of objects. • prove simple facts about combination. • solve practical problems on combination of objects • write up to the 6th power of a binomial expression $(x + y)^n$ (i.e. when $n = 0, 1, 2, 3, 4, 5$) in its expanded form by using direct multiplication • describe what they observe in the expansion of $(x + y)^n$ where $n = 0, 1, 2, 3, 4, 5$ • describe "Pascal's Triangle" and its use • apply the "Binomial Theorem" in expanding the n^{th} power of binomial terms i.e. $(x + y)^n$, where $n \in \mathbf{Z}^+$ • determine any term in the expanded form of $(x + y)^n$ where $n \in \mathbf{Z}^+$ solve problems on binomial expansion 	<p>⇒ <i>For social science stream only (cont.)</i></p> <ul style="list-style-type: none"> • compare two groups of similar data.. • determine the consistency of two similar group of data with equal mean but different standard deviations • describe the application of coefficient of variation inn comparing two groups of similar data. • describe the relationship among mean, median and mode for grouped data by using its frequency curve. • use cumulative frequency graphs to determine the dispersion of values of data (interms of its Mean, Median and Standard deviation) • determine the variability of value of data interms of quartiles by using cumulative frequency graph. • describe the relationship among mean, median and mode for grouped data by using its frequency curve.
<p>V. STATISTICS AND PROBABILITY (cont.)</p>	<ul style="list-style-type: none"> • determine any term in the expanded form of $(x + y)^n$, where $n \in \mathbf{Z}^+$ • solve problems on binomial expansion • describe what is meant by "Random Experiment" • explain what is meant by an outcome of a random 	

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<p>Statistics and Probability (cont.)</p>	<p>experienced</p> <ul style="list-style-type: none"> • describe what is meant by sample space of a given random experiment. • list some of the sample points of a sample space for a given experiment. • define "equally likely outcomes" of a given trial in his own words. • define "favorable outcomes/ cases" • determine events of a given random experiment • identify sample (elementary) events and compound events • determine the number of events of a given sample space • describe the occurrence or non occurrence of an event. • explain an event denoted by "not E" where "E" is a given event • explain events connected by "or" and "and" • describe the simplified forms of events by using the properties of operations on sets • identify exhaustive events • identify mutually exclusive events • describe events that are both exhaustive and mutually exclusive • identify independent events. • identify dependent events • describe the axiomatic approach of probability • interpret basic facts in the theory of probability. 	
<p>V. STATISTICS AND PROBABILITY (cont.)</p> <p>Statistics and Probability (cont.)</p>	<ul style="list-style-type: none"> • find probabilities of events based on • find probabilities of events based on “Axiomatic” approach. • describe the odds infamous of an event or the odds against an event • Find the probability of $E_1 \cup E_2$ where E_1 and E_2 are events in a random experiment • determine the probability of mutually exclusive events. • find probability of the joint occurrence independent event (by using rule of multiplication) • describe the out comes of events using tree diagram • determine the probability of the joint occurrence of 	

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	dependent events (using multiplication rule) <ul style="list-style-type: none"> • describe the outcomes of events using tree diagram to determine their probability • identify whether a given events are independent or dependent (by comparing the equation for probability of joint occurrence of independent events). 	
VI. CALCULUS Limits of sequence of numbers		<ul style="list-style-type: none"> • define upper and lower bound of number sequences. • find out the least upper (greatest lower) bound of sequences. • define limit of a number sequence • consolidate their knowledge on the concept of sequences stressing on the concept of null sequence. • apply theorems on the convergence of bounded sequences • prove theorem about the limit of the sum of two convergent sequences. • apply theorems on the limit of the difference, product, quotient of two convergent sequences • define limit of a function. • determine the limit of a given function at a point. • find out the limit of the sum, difference, product and quotient of two functions. • define continuity of a function in interval. • describe the properties of continuous functions. • use properties of continuous functions to determine the continuity of various functions. • consolidate what they have studied on limits. • solve problems on limit and continuity to stabilize what have learnt in the unit.
VI. CALCULUS		<ul style="list-style-type: none"> • find the rate of change of one quantity with respect to another. • sketch different straight line and curved graphs and find out slopes at different points of each graph. • define differentiability of a function at a point x_0.

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Area of Competency	Grade 11	Grade 12
<p>Introduction to Integral Calculus</p>		<ul style="list-style-type: none"> • differentiate between the concepts differentiation and integration • use the properties of indefinite integrals in solving problems of integration • integrate simple trigonometric functions • use different techniques of integration for computation of integrals • Compute area under a curve. • use the concept of definite integral to calculate the area under a curve. • state fundamental theorem of calculus • apply fundamental theorem of calculus to solve integration problems. • state the properties of definite integrals. • apply the properties of definite integrals for computations of integration • apply the knowledge on integral calculus to solve problems.
<p>VII. GEOMETRY</p> <p>Coordinate Geometry and Vectors</p>	<ul style="list-style-type: none"> • write different forms of equation of a line. • determine the slope, x-intercept and y-intercept of a line from its equation • determine the angle between two intersecting lines on the coordinate plane whose equations are given. • determine the distance between a point and a line given on the coordinates plane. • name the different types of conic sections • explain how the conic sections are generated (formed) • define circle as a locus and write equation of a circle • find the radius and center of a circle from its equation. • determine whether a given line and circle have a point of intersection . • determine the coordinates for the intersection point(s) (if the given line and the given circle intersect) • write equation of a tangent line to a given circle. (where the point of tangency is given) 	<p>⇒ For social science stream only</p> <ul style="list-style-type: none"> • construct the coordinate axes in space • identify planes determined by the axes in space. • identify the octants determined by the planes and axes. • read the coordinates of a point in space. • describe how to locate a point in space. • plot a point whose coordinates are given. • give the equations for the planes determined by the axes. • show graphically how to find the distance between two points in space. • compute distance between two given points in space. • determine coordinates of the mid-point of a segment in space. • describe the equation of a sphere • derive equation of a sphere

Minimum Learning Competencies Grades 9–12

<i>Area of Competency</i>	<i>Grade 11</i>	<i>Grade 12</i>
	<ul style="list-style-type: none"> • Write the standard form of equation of a parabola. • draw different types of a parabolas • describe some properties of a given parabola. • define "ellipse" as a locus (set of points on the plane which satisfy a certain given condition) • write the standard form of equation of an ellipse and sketch ellipse • describe some terms related to ellipses (such as latus rectum, eccentricity, major and minor axes...) • define hyperbola as a locus • write the standard form of equation of an ellipse • describe related terms to hyperbola (foci, centre, transverse axis, asymptotes, conjugate axis...) • sketch hyperbola based on its given equation • give eccentricity of a given hyperbola solve problems on hyperbola 	<ul style="list-style-type: none"> • solve problems related with sphere • add, subtract vectors and multiply by a scalar in space • use the unit vectors i, j and k while representing a vector. • describe the properties of addition to solve exercise problems.. • show the closure property on their own • find the length of a vector in space • find the scalar product of two vectors in space. • evaluate and show the angle between two vectors in space.

