Addis Ababa City Government

Education Bureau

Grade 12 Mathematics for (social science) Model Examination

Table of Specification

Introduction

Table of specification is also called test blueprint which is a useful plan to list the number of items that must be included in each content considering the number of periods allotted. Teachers should have to use test blue print to construct test items proportional to the number of periods allotted for each topic and must consider the competencies.

This document contains table of specification for grade 12 mathematics model examination for social science stream. The model examination should contain questions from grade 9 to grade 12; hence the table of specification is prepared based on the percentage of questions from each grade level given (i.e. from grade 9-20%, from grade 10-20%, from grade 11-20% and from grade 12-40%).

a. Test blueprint or table of specifications

The test blueprint, sometimes also called the table of specifications, **provides a listing of the major content areas and cognitive levels intended to be included on each test form**. It also includes the number of items each test form should include within each of these content and cognitive areas.
Creating a test blueprint will **help us to plan which questions are needed to include in our exam and ensure that it adequately assesses the learning objectives of the course**. A test blueprint defines the knowledge and skills we want to assess and will enable us to build purpose-driven, successful assessments, Tests, Exams etc..

b. Steps in preparing table of specification

In preparing table of specification follow the following steps:

1. List down the topics covered for ***inclusion*** in the test
2. Determine the ***objectives*** to be assessed by the test.

3. Specify the number of ***periods spent*** for teaching a particular topic.
4. Determine ***percentage*** allocation of the test items for each of the ***topics covered % for a topic***

$$\%\ \boldsymbol{of\ no.questions\ for\ a\ topic} = \frac{\boldsymbol{total\ number\ of\ periods\ alloted\ for\ a\ topic}}{\boldsymbol{total\ number\ of\ periods\ spent\ \ to\ cover\ the\ portion}}$$

5. Determine the ***number of the items*** for each topic
   - This can be done by multiplying the percentage allocation for each topic by the total number of items to be constructed.
6. Weight Lower Order Thinking Skills(LoTs) and Higher Order Thinking Skills(HoTs) to apply:
   a. ***30 →Easy,***
   b. ***50→ Moderate***
   c. ***20→ Difficult***

   Test blueprint (Table of Specification) =
   Balance the objectives with bloom's taxonomy

c. The distribution of 65 items for Grade 9^{th},10^{th} ,11^{th} and 12^{th}.

Grade	*Percentage*	*Number of items*
9	20%	$20\% * 65 = 13$
10	20%	$20\% * 65 = 13$
11	20%	$20\% * 65 = 13$
12	40%	$40\% x 65 = 26$

d. The Number of Periods and Items Allotment for Grade 12th

Unit	Period allotment	Number of items	Number of items in terms of behavioral dimensions
1	26 (3,3,6,6,8)	(26x26)/106=7	2-know., 5- app.
2	30 (10,10,10)	(30x26)/106=8	2-know., 5- app., 1-anal.
3	33(18,5,3,7)	(33x26)/106=8	1-know., 2- Comp., 5- app. 1- anal
4	17(1,5,11)	(17x26)/106=4	2-know., 2- app.

e. The Number of Periods and Items Allotment for Grade 11th

Unit	Period allotment	Number of items	Number of items in terms of behavioral dimensions
1	15 (2, 4, 2, 3, 4)	(15x13)/163=1	1- kow.
2	12 (4,3,5)	(12x13)/163=1	1-anal
3	21 (3,18)	(21x13)/163=2	2- app.
4	16(13,3)	(16x13)/163=1	1- App
5	31 (14,17)	(31x13)/163=3	1- Comp., 1- app., 1-anal.

6	22(4,6,4,5,3)	(22x13)/163=2	1-app.,1- anal.
7	13 (2,3,2,3,3)	(13x13)/163=1	1-know.
10	15 (2,2,5,6)	(15x13)/163=1	1- Eva
11	18 (3,4,7,4)	(18x13)/163=1	1- Eva

f. The Number of Periods and Items Allotment for Grade 10th

Unit	Period allotment	Number of items	Number of items in terms of behavioral dimensions
1	20 (5,6,4,5)	(20x13)/162=2	1app.1 anal
2	30 (6,5,6,7,6)	(30x13)/162=2	1-know., 1-anal.
3	20 (4,5,11)	(20x13)/162=2	2- app.
4	15 (2,2,8,3)	(15x13)/162=1	1- know
5	30 (15,7,3,5)	(30x13)/162=2	1-comp 1-app
6	22(5,6,6,5)	(22x13)/162=2	1- app. 1 Eva
7	25 (3,8,7,7)	(25x13)/162=2	2- comp

g. The Number of Periods and Items Allotment for Grade 9th

Unit	Period allotment	Number of items	Number of items in terms of behavioral dimensions
1	33 (3,30)	(33x13)/162=3	1-kown, 1-comp, 1-app
2	22 (3,8,3,8)	(22x13)/162=2	1-kown, 1-app
3	15 (2,4,9)	(15x13)/162=1	1- comp
4	22 (7,6,9)	(22x13)/162=2	2-Eva
5	36 (5,13,7,5,6)	(36x13)/162=3	2-app, 1-Eva
6	22(14,8)	(22x13)/162=1	1- app.
7	12 (2,2,6,2)	(12x13)/162=1	1-comp

h. Table of Specification for Grade 12th

Total number of questions expected from grade 12 is 40% of the total questions (65)
40% of 65 is 26, hence the number of questions expected from grade 12 is 26.

unit	content	Sub topic	Selected competencies	Period allotted		Behavioral dimension				Content dimension		
				Each sub	Each	know	Comp.	App.	An. Syn	for each sub	Total items	remark
1	Sequence and series	1.1.sequence	• Find the nth term of the sequence	3	26	1				1	6	
		1.2 arithmetic and geometric sequences	• Express the common difference when n arithmetic means (geometric means) are inserted b/n two terms a and	3				1		1		
		1.3 the sigma notation and partial sums	• Classify the geometric sequence is divergent or converge	6				1		1		
		1.4 infinite series	• Find the sum of infinite series	6		1				1		
		1.5 application of sequences	• Use partial sum to solve real life problems • Discuss the applications of arithmetic and geometric progressions	8				2		2		

2	Introduction to differential calculus	2.1 introduction to derivatives	• Find absolute minimum and maximum of the function a given interval • Use derivatives to find the interval on which the function is increasing and decreasing	10	30			2		2	8	
		2.2 applications of derivatives	• Apply derivative to find the rate of change of area • Use derivatives to find the dimension of the rectangle of least cost • Apply derivatives in maximization of profit	10		1		2		3		
		2.3 introduction to integration	• Find the integral of indefinite integrals of power functions • Use integration to find the area b/n the function and the x-axis • Evaluate definite integral of a power function	10		1		1	1	3		
3	statistics	3.1 measure of absolute dispersion	• Calculate the mean deviation about the mean, about the median or about the mode • Determine the corrected mean and corrected standard deviation when there is data error in a data set x • Use mean deviation to solve related problems • Calculate quartile deviation of ungrouped data	18			1	2	1	4	8	
		3.2 relative dispersions and their	• Use coefficient of mean deviation to identify the consistent data	5				1		1		

		interpretation										
		3.3 use of frequency curves	• Calculate persons coefficient or Bowely coefficient to determine skewness of the distribution	3		1				1		
		3.4 sampling techniques	• Identify advantage and limitations of sampling techniques • Apply systematic sampling technique	7	1				1	2		
4	Introduction to linear programing	4.1Graphical solutions of system of linear inequalities	• Determine graphical solutions of system of inequality	1		1				1	4	
		4.2 maximum and minimum values	• Calculate maximum or minimum value of objective function in a linear programing model	5		1				1		
		4.3 Applications	• Apply linear programing to solve manufacturing problems • Apply linear programing to solve diet problems	11				2		2		
	Total number of questions					7	2	14	3	26	26	

i. Table of Specification for Grade 11th

Total number of questions expected from grade 11 is 20% of the total questions (65)
20% of 65 is 13, hence the number of questions expected from grade 11 is 13.

Unit	Content	Sub topic	Selected competencies	Period allotted		Behavioral dimension				Content dimension		
				Each sub topic	Each unit	know	Comp.	App.	An. Syn.	Item for each sub topic	total items	remark
1	Further on Relations and Functions	1.1 revision on relations		2	15						1	
		1.2 some additional types of functions		4								
		1.3 classification of functions	• Identify functions which are one-to-one.	2		**1**				1		
		1.4 composition of functions		3								
		1.5 inverse functions and their graphs		4								
2	Rational Expressions and	2.1 simplification of rational expressions	• decompose rational expressions into sums of partial fractions	4	12				**1**	1	1	
		2.2 rational equations		3								

	Rational Functions	2.3 rational functions and their graphs		5								
3	Coordinate Geometry	3.1 straight lines		3	21						2	
		3.2 conic sections	• write equation of a circle • write the standard form of equation of a parabola	18				2		2		
4	Mathematical reasoning	4.1 logic	• Determine truth values of two or three statements connected by two or three connectives.	13	16			1		1	1	
		4.2 arguments and validity		3								
5	Statistics and probability	5.1 statistics	• Determine the mode of a given grouped data.	14	31		1			1	3	
		5.2 probability	• Find the possible ways of arranging objects by using the principles of permutation. • Determine the probability of the joint occurrence of dependent events (using multiplication rule).	17				1	1	2		
6	Matrices and determinants	6.1 matrices		4	22						2	
		6.2 determinants and their property	• Describe the properties of determinants.	6				1		1		
		6.3 inverse od square matrix		4								
		6.4 system of equations with two or three variables		5								
		6.5 cramer's rule	• Apply Cramer's rule to solve systems of linear equations.	3					1	1		

7	The set of complex numbers	7.1 the concept of complex numbers		2	13						1	
		7.2 operations on complex numbers		3								
		7.4 simplification of complex numbers	• write the simplified form of expressions involving complex number	3			**1**			1		
		7.3 complex conjugate		2								
		7.5 Argand diagram and polar representation of complex number		3								
10	Introduction to linear programming	10.1 revision on linear graphs		2	15						1	
		10.2 graphical solutions of system of linear inequalities	• Draw graphs of linear inequalities.	2					**1**	1		
		10.3 maximum and minimum values		5								
		10.4 real life linear programing problems		6								
11	Mathematical application in business	11.1 basic mathematical concepts in business		3	18						1	
		11.2 compound interest and depreciation	• compute annuity for a given arrangement in compound interest	4					**1**	1		
		11.3 saving, investing and borrowing money		7								
		11.4Taxation		4								
Total number of questions						**1**	**2**	**5**	**5**	13	13	

j. Table of Specification for Grade 10

Total number of questions expected from grade 10 is 20% of the total questions (65)
20% of 65 is 13, hence the number of questions expected from grade 10 is 13.

unit	content	Sub topic	Selected competencies	Period allotted		Behavioral dimension				Content dimension		
				Each sub	Each unit	know	Comp.	App.	An. Syn. Ev.	Item for each sub	Total items	remark
1	POLYNOMIAL FUNCTIONS	1.1 introduction to polynomial functions		5	20						2	
		1.2 theorems on polynomials	• Apply the Remainder Theorem.	6					1	1		
		1.3 zeros of polynomial functions		4								
		1.4 graphs of polynomial functions	• Describe the properties of the graph of a given polynomial function.	5		1				1		
2	EXPONENTIAL AND LOGARITHMIC FUNCTIONS	2.1 exponents and logarithms		6	30						2	
		2.2 the exponential functions and their graphs	• Describe the properties of an exponential function by using its graph.	5		1				1		
		2.3 the logarithmic functions and their graphs		6								
		2.4 equations involving exponents	• Solve equations involving logarithms.	7				1		1		

		and logarithms										
		2.5 applications of exponential and logarithmic functions		6								
3	SOLVING INEQUALITIES	3.1Inequalities involving absolute value	• Solve inequalities involving absolute value of linear expression.	4	20			1		1	2	
		3.2 systems of linear inequalities in two variables		5								
		3.3 quadratic inequalities	• Solve quadratic inequalities using the sign chart method.	11				1		1		
4	COORDINATE GEOMETRY	4.1 distance between two points		2	15						1	
		4.2 division of a line segment	• Determine the coordinates of points that divide a given line segment in a given ratio.	2		1				1		
		4.3 equation of a line		8								
		4.4 parallel and perpendicular lines		3								
5	TRIGONOMETRIC FUNCTIONS	5.1 basic trigonometric functions	• describe the relationship between trigonometric values of complementary angels	15	30		1			1	2	
		5.2 the reciprocal functions of the basic trigonometric functions		7								
		5.3 simple trigonometric identities		3								
		5.4 real life application problems	• Solve real life problems using trigonometric ratios.	5				1		1		

6	PLANE GEOMETRY	6.1 theorems on triangles		5	22						2	
		6.2 special quadrilaterals	• Apply theorems on special quadrilateral in solving related problems.	6					1	1		
		6.3more on circles		6								
		6.4 regular polygons	• Calculate the areas of regular polygons.	5				1		1		
7	MEASUREMENT	7.1 revision on surface areas and volumes of prisms and cylinders		3	25						2	
		7.2 pyramids, cones and spheres	• Calculate the volume of a given pyramid or a cone.	8			1			1		
		7.3 frustums of pyramids and cones	• Calculate the surface areas of frustums of pyramids or of cones.	7			1			1		
		7.4 surface areas and volumes of composed solids		7								
	Total number of questions					3	3	5	2	13	13	

k. Table of Specification for Grade 9

Total number of questions expected from grade 9 is 20% of the total questions (65)
20% of 65 is 13, hence the number of questions expected from grade 9 is 13.

unit	content	Sub topic	Selected competencies	Period allotted		Behavioral dimension				Content dimension		
				Each sub topic	Each unit	know	Comp.	App.	An. Syn.	Item for each sub	Total	remark
1	THE NUMBER SYSTEM	1.1 revision on the set of rational numbers	• Define prime numbers and composite numbers.	3	33	1				1	3	
		1.2 the real number system	• Use the laws of exponents to simplify expression. • Identify a rationalizing factor for a given expression.	30			1	1		2		
2	SOLUTION OF EQUATION	2.1 equations involving exponents and radicals	• Solve equations that involve exponents and radicals by applying law of exponents.	3	22			1		1	2	
		2.2 systems of linear equations in two variables	• Identify the three cases of solutions of simultaneous equations (a unique solution, no solution, infinitely many solutions).	8		1				1		
		2.3 equations involving absolute value		3								
		2.4 quadratic		8								

		equations										
3	FURTHER ON SETS	3.1 ways to describe sets		2	15						1	
		3.2 the notation of sets		4								
		3.3 operations on sets	• Describe the properties of "union" and "intersection" of sets.	9			1			1		
4	RELATIONS AND FUNCTIONS	4.1 relations	• Use graphs of relation to determine domain and range.	7	22				1	1	2	
		4.2 functions		6								
		4.3 graphs of functions	• Describe the properties of the graphs of given quadratic functions	9					1	1		
5	GEOMETRY AND MEASUREMENT	5.1 regular polygons		5	36						3	
		5.2 further on congruency and similarity	• Discover the relationship between the areas of similar plane figures and use this relationship to solve related problems.	13					1	1		
		5.3 further on trigonometry	• Use the trigonometric ratios to solve right angled triangles.	7				1		1		
		5.4 circles	• Find arc length, perimeters and areas of segments and sectors.	5				1		1		
		5.5 measurement		6								
6	STATISTICS AND PROBABILITY	6.1 statistical data	• Compute the measures of dispersion for ungrouped data.	14	22			1		1	1	
		6.2 probability		8								
7	VECTORS IN TWO DIMENSIONS	7.1 introduction to vectors and scalars		2	12						1	
		7.2 representation of vector		2								

		7.3Addition and subtraction of vectors and multiplication of vectors by a scalar	• Determine the sum of given vectors.	6			1			1		
		7.4 position vector of a point		2								
Total number of questions						2	3	5	3	13	13	

Proportionality

Behavioral dimensions	**Knowledge and compression (Easy)**	**Application and Analysis (Moderate)**	**Synthesis and Evaluation (Difficult)**	**Total**
Number of questions	**23**	**29**	**13**	**65**
Percentage weight	$\frac{23}{65} * 100\% = 35\%$	$\frac{29}{65} * 100\% = 45\%$	$\frac{13}{65} * 100\% = 20\%$	**100%**