



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

## **MATHEMATICAL LITERACY**

### **EXAMINATION GUIDELINES**

## **GRADE 12**

## **2009**

**This guideline consists of 20 pages.**

**MATHEMATICAL LITERACY****EXAMINATION GUIDELINE**

- This guideline document must be read in conjunction with the Subject Assessment Guidelines (SAGs): Mathematical Literacy – January 2008 and the Learning Programme Guidelines (LPGs) for Mathematical Literacy – January 2008. However, some material from the Subject Assessment Guidelines has been included in this document for easy reference. These include the Core Assessment Standards (given in Appendix 1), the description of the levels in the Mathematical Literacy assessment taxonomy (given in Appendix 2) and some information regarding the allocation of marks. While this document contains some materials from the documents mentioned above, it doesn't replace them. Note that the Core Assessment Standards are the only ones that will be tested in the 2009 and 2010 final Grade 12 examination.
- A detailed analysis of the different taxonomy levels according to Learning Outcomes is included in this document in order to enable teachers and other interested stakeholders to understand the levels of complexity when teaching and assessing Mathematical Literacy. This document should be of assistance to teachers when developing examination papers and should also assist the teacher with assessing homework tasks and assignments.

**MATHEMATICAL LITERACY EXAMINATION PAPERS FOR GRADES 10 AND 11 AND 12****END-OF-YEAR EXAMINATION**

- The end of year examination papers for Grades 10 and 11 will be internally set, internally marked and internally moderated, unless otherwise instructed by provincial departments of education.
- The Grade 12 final end-of-year examination is nationally set, marked and moderated.

**Table 1: Number of examination papers (and control tests) and the duration and mark allocation of each paper for Grade 10, 11 and 12**

	<b>GRADE 10</b>	<b>GRADE 11</b>		<b>GRADE 12</b>	
<b>TERM 1</b>	Control Test	Control Test		Control Test	
<b>TERM 2</b>	One Paper: 2 hours (100 marks)	Paper 1: 1½ hours (75 marks)	Paper 2: 1½ hours (75 marks)	Paper 1: 3 hours (150 marks)	Paper 2: 2 hours (100 marks)
<b>TERM 3</b>	Control Test			Control Test Paper 1: 3 hours (150 marks)	Control Test Paper 2: 3 hours (150 marks)
<b>TERM 4</b>	One Paper: 3 hours (150 marks)	Paper 1: 2½ hours (100 marks)	Paper 2: 2½ hours (100 marks)	<i>Nationally Set</i> Paper 1: 3 hours (150 marks)      Paper 2: 3 hours (150 marks)	

**NOTE:**

In Grade 12, one of the two examinations in Term 2 and Term 3 may be a Control Test. That is, at least one of these two **MUST** be an internal examination. (See SAG Document on pages 4 and 14.)

**ADDITIONAL INFORMATION WITH REGARD TO THE QUESTION PAPERS:****EXAMINATION PAPERS FOR GRADE 10**

- The question paper should cover all four Learning Outcomes, with approximately 25% of the marks allocated to each Learning Outcome.
- Questions should be set that cover all four levels in the Mathematical Literacy taxonomy. Approximately 30% of the marks should be set at Level 1 (**Knowing**), 30% at Level 2 (**Applying routine procedures in familiar contexts**), 20% at Level 3 (**Applying multi-step procedures in a variety of contexts**) and 20% at Level 4 (**Reasoning and reflecting**). (See Appendix 2 for explanations of the Levels)
- Each question should be set on a different context.
- Each context should contain questions from at least two different Learning Outcomes.

**EXAMINATION PAPERS FOR GRADES 11 AND 12****Paper One – a basic knowing and routine applications paper that will consist of between five and eight shorter questions.**

- The question paper should cover all four Learning Outcomes, with approximately 25% of the marks allocated to each Learning Outcome.
- Only Level 1 (**Knowing**) and Level 2 (**Applying routine procedures in familiar contexts**) questions should be set. Approximately 60% of the marks should be set at Level 1 and 40% of the marks should be set at Level 2. (See Appendix 2 for explanations of the Levels)
- Question 1 could contain some basic calculations and simple short questions. Questions do not necessarily need to be integrated between Learning Outcomes.
- Question 2 could contain simple short context questions divided into sub-questions. Sub-questions may not necessarily be integrated between Learning Outcomes.
- For the rest of the paper:
  - There could be three to six further questions
  - Each question should be set on a different context.
  - Each context should contain questions from at least two different Learning Outcomes.

**Paper Two – an applications, reasoning and reflecting paper that will consist of between four and six longer questions. By contrast to Paper 1 these questions will require more interpretation and application of the information provided.**

- The question paper should cover all four Learning Outcomes, with approximately 25% of the marks allocated to each Learning Outcome.
- No Level 1 (**Knowing**) questions should be contained in Paper 2. Approximately 20% of the marks should be set at Level 2 (**Applying routine procedures in familiar contexts**), 40% of the marks should be set at Level 3 (**Applying multi-step procedures in a variety of contexts**) and 40% of the marks should be set at Level 4 (**Reasoning and reflecting**). (See Appendix 2 for explanations of the Levels)
- Each question should be set on a different context.
- Each context should contain questions from at least two different Learning Outcomes.

**CONTEXTS**

- Be careful that the context doesn't interfere with the mathematics and detract from the mathematics.
- Each context should be relevant to the learners.
- Where necessary, diagrams and explanations of terms should be provided in order to make each context clear to the learners.
- Language should be simple and sentences should be short. Where possible, the present tense should be used when describing the context.

**ALLOCATION OF MARKS ACCORDING TO LEARNING OUTCOMES (LOs)**

- Only the Assessment Standards listed in the table of Core Assessment Standards in Appendix 1 should be tested until 2010.

**Table 2: Allocation of the Learning Outcomes according to percentage**

<b>LEARNING OUTCOMES</b>				
	<b>LO1 Number and Operations in Context</b>	<b>LO2 Functional Relationships</b>	<b>LO3 Space, Shape and Measurement</b>	<b>LO4 Data Handling</b>
<b>Percentage of each paper allocated to each Learning Outcome</b>	<b>25% ± 5%</b>	<b>25% ± 5%</b>	<b>25% ± 5%</b>	<b>25% ± 5%</b>

**Table 3: Allocation of the Learning Outcomes according to marks**

	<b>LO1 Number and Operations in Context</b>	<b>LO2 Functional Relationships</b>	<b>LO3 Space, Shape and Measurement</b>	<b>LO4 Data Handling</b>
<b>75 marks</b>	15 – 23 marks	15 – 23 marks	15 – 23 marks	15 – 23 marks
<b>100 marks</b>	20 – 30 marks	20 – 30 marks	20 – 30 marks	20 – 30 marks
<b>150 marks</b>	30 – 45 marks	30 – 45 marks	30 – 45 marks	30 – 45 marks

**THE MATHEMATICAL LITERACY ASSESSMENT TAXONOMY**

- Assessment can be pitched at different levels of cognitive demand. On one end of the spectrum are tasks that require the simple reproduction of facts (Knowing) while on the other end of the spectrum are tasks that require detailed analysis and the use of varied and complex methods and approaches (Reasoning and reflection).

**Table 4: Percentage of marks to be allocated to different taxonomy levels**

THE FOUR LEVELS OF THE MATHEMATICAL LITERACY ASSESSMENT TAXONOMY	Grade 10	Grades 11 and 12		
		Paper 1	Paper 2	Overall allocation
<b>Level 1: Knowing</b>	30% $\pm$ 5%	60% $\pm$ 5%		30% $\pm$ 5%
<b>Level 2: Applying routine procedures in familiar contexts</b>	30% $\pm$ 5%	40% $\pm$ 5%	20% $\pm$ 5%	30% $\pm$ 5%
<b>Level 3: Applying multi-step procedures in a variety of contexts</b>	20% $\pm$ 5%		40% $\pm$ 5%	20% $\pm$ 5%
<b>Level 4: Reasoning and reflecting</b>	20% $\pm$ 5%		40% $\pm$ 5%	20% $\pm$ 5%

**Table 5: Allocation of marks according to different taxonomy levels**

		<b>Level 1: Knowing</b>	<b>Level 2: Applying routine procedures in familiar contexts</b>	<b>Level 3: Applying multi-step procedures in a variety of contexts</b>	<b>Level 4: Reasoning and reflecting</b>
One paper of 100 marks		25 – 35 marks	25 – 35 marks	15 – 25 marks	15 – 25 marks
One paper of 150 marks		38 – 53 marks	38 – 53 marks	23 – 38 marks	23 – 38 marks
Two papers each out of 75 marks	Paper 1	41 – 49 marks	26 – 34 marks		
	Paper 2		11 – 19 marks	26 – 34 marks	26 – 34 marks
Two papers each out of 100 marks	Paper 1	55 – 65 marks	35 – 45 marks		
	Paper 2		15 – 25 marks	35 – 45 marks	35 – 45 marks
Two papers each out of 150 marks	Paper 1	83 – 98 marks	53 – 68 marks		
	Paper 2		23 – 38 marks	53 – 68 marks	53 – 68 marks

**APPENDIX 1:**  
**CORE ASSESSMENT STANDARDS FOR THE MATHEMATICAL LITERACY EXAMINATION IN GRADE 12 IN 2008, 2009 and 2010**  
**From the Maths Literacy Subject Assessment Guidelines – January 2008.**

**Learning Outcome 1: Number and Operations in Context**

*The learner is able to use knowledge of numbers and their relationships to investigate a range of different contexts which include financial aspects of personal, business and national issues.*

<b>Grade 10</b> <b>We know this when the learner is able to:</b>	<b>Grade 11</b> <b>We know this when the learner is able to:</b>	<b>Grade 12</b> <b>We know this when the learner is able to:</b>
<p>10.1.1 Solve problems in various contexts, including financial contexts, by estimating and calculating accurately using mental, written and calculator methods where appropriate, inclusive of:</p> <ul style="list-style-type: none"> <li>• working with simple formulae e.g. <math>A = P(1+i)^n</math></li> <li>• using the relationships between arithmetical operations (including the distributive property) to simplify calculations where possible. (NOTE: students are not expected to know the distributive property by name)</li> </ul> <p>(The range of problem types includes percentage, ratio, rate and proportion).</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>explore compound growth in various situations numerically and work with the compound interest formula;</i></li> <li>* <i>find a percentage by which a quantity was increased;</i></li> <li>* <i>calculate the number of person-hours needed for a job if the number of workers is increased;</i></li> <li>* <i>calculate the amount of money allocated to education by the budget if it is 8,4% of R36,04 billion;</i></li> <li>* <i>criticise numerically based arguments.</i></li> </ul>	<p>11.1.1 In a variety of contexts, find ways to explore and analyse situations that are numerically based, by:</p> <ul style="list-style-type: none"> <li>• estimating efficiently;</li> <li>• working with formulae by hand and with a calculator, e.g. <math display="block">x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}</math></li> <li>• showing awareness of the significance of digits;</li> <li>• checking statements and results by doing relevant calculations.</li> </ul> <p>(The range of problem types includes percentage, ratio, rate and proportion).</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>estimate the length of a side if the volume of a cube is 10 cubic units;</i></li> <li>* <i>do calculations to compare different currencies;</i></li> <li>* <i>check a claim that costs of phone calls have risen by 8% by doing relevant calculations;</i></li> <li>* <i>check the effect of rounding on effective repayments on a loan or account (one of the payments will have to be adjusted to reach the total amount to be repaid).</i></li> </ul>	<p>12.1.1 Correctly apply problem-solving and calculation skills to situations and problems dealt with.</p> <p><i>For example</i></p> <ul style="list-style-type: none"> <li>* <i>work with issues involving proportional representation in voting.</i></li> </ul>

<b>Grade 10</b> <b>We know this when the learner is able to:</b>	<b>Grade 11</b> <b>We know this when the learner is able to:</b>	<b>Grade 12</b> <b>We know this when the learner is able to:</b>
<p>10.1.2 Relate calculated answers correctly and appropriately to the problem situation by:</p> <ul style="list-style-type: none"> <li>• interpreting answers in terms of the context;</li> <li>• reworking a problem if the first answer is not sensible, or if the initial conditions change;</li> <li>• interpreting calculated answers logically in relation to the problem and communicating processes and results.</li> </ul>	<p>11.1.2 Relate calculated answers correctly and appropriately to the problem situation by:</p> <ul style="list-style-type: none"> <li>• interpreting answers in terms of the context;</li> <li>• reworking a problem if the first answer is not sensible or if the initial conditions change;</li> <li>• interpreting calculated answers logically in relation to the problem, and communicating processes and results.</li> </ul>	<p>12.1.2 Relate calculated answers correctly and appropriately to the problem situation by:</p> <ul style="list-style-type: none"> <li>• interpreting answers in terms of the context;</li> <li>• reworking a problem if the first answer is not sensible or if the initial conditions change;</li> <li>• interpreting calculated answers logically in relation to the problem and communicating processes and results.</li> </ul>
<p>10.1.3 Apply mathematical knowledge and skills to plan personal finances, inclusive of:</p> <ul style="list-style-type: none"> <li>• income and expenditure;</li> <li>• the impact of interest (simple and compound) within personal finance contexts.</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* identify variable expenses and calculate new values to adapt a budget to deal with increased bond repayments due to rising interest rates;</li> <li>* adapt a budget to accommodate a change in the price of petrol;</li> <li>* calculate the value of the fraction of a bond repayment that goes towards repaying interest or capital;</li> <li>* calculate the real cost of a loan of R10 000 for 5 years at 5% capitalised monthly and half-yearly.</li> </ul>	<p>11.1.3 Apply mathematical knowledge and skills to plan personal finances and investigate opportunities for entrepreneurship inclusive of:</p> <ul style="list-style-type: none"> <li>• specifying and calculating the value of income and expenditure items;</li> <li>• estimating and checking profit.</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* calculate the effect of increased prices of imported vehicle parts on the profit margin of a motor car manufacturer or a small vehicle service workshop;</li> <li>* investigate the effect of increasing the number of employees on the profit margin of a small company;</li> <li>* investigate the effect of a sales discount on the profit margin.</li> </ul>	<p>12.1.3 Analyse and critically interpret a variety of financial situations mathematically, inclusive of:</p> <ul style="list-style-type: none"> <li>• personal and business finances;</li> <li>• the effects of taxation, inflation and changing interest rates</li> <li>• the effects of currency fluctuations;</li> <li>• critical engagement with debates about socially responsible trade.</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* calculate the effect of a fixed interest rate against probable variations in interest rates when buying a house or when choosing an investment;</li> <li>* calculate the net effect of different interest offerings and bank charges when saving schemes are considered;</li> <li>* calculate and compare the projected yields of different retirement options;</li> <li>* interpret changes in indices such as the consumer price index or the business confidence index;</li> <li>* compare different credit options;</li> <li>* calculate the effect of defaulting payments over a period of time;</li> <li>* consider different currencies for investment purposes;</li> <li>* calculate values in simplified situations in order to discuss the effect of import/export control, levies and rebates, linking the discussion to the way mathematics can be used to argue opposing points of view.</li> </ul>

**Learning Outcome 2: Functional Relationships**

*The learner is able to recognise, interpret, describe and represent various functional relationships to solve problems in real and simulated contexts.*

<b>Grade 10</b> <b>We know this when the learner is able to:</b>	<b>Grade 11</b> <b>We know this when the learner is able to:</b>	<b>Grade 12</b> <b>We know this when the learner is able to:</b>
<p>10.2.1 Work with numerical data and formulae in a variety of real-life situations in order to establish relationships between variables by:</p> <ul style="list-style-type: none"> <li>Determining output values for given input values;</li> <li>Determining input values for given output values;</li> </ul> <p>(Types of relationships to be dealt with include linear and inverse proportion relationships)</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>critique information about functional relationships in media articles such as telephone costs before and after rate changes;</li> <li>calculate relationships in speed, distance and time.</li> </ul>	<p>11.2.1 Work with numerical data and formulae in a variety of real-life situations in order to establish relationships between variables by:</p> <ul style="list-style-type: none"> <li>finding break-even points involving linear functions by solving simultaneous equations</li> </ul> <p>(Types of relationships to be dealt with include linear and inverse proportion relationships)</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>interpret and critique quotations for two similar packages given by cell phone providers or car hire companies;</li> <li>use rate of change to offset impressions created by magnification of scales on the axes of graphs.</li> </ul>	<p>12.2.1 Work with numerical data and formulae in a variety of real-life situations, in order to:</p> <ul style="list-style-type: none"> <li>solve design and planning problems;</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>find optimal values for two discrete variables, subject to two or more linear constraints.</li> <li>investigate the impact of compound change on situations.</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>investigate the rate of depletion of natural resources;</li> <li>investigate the spread of HIV/AIDS and other epidemics;</li> <li>critique articles and reports in the media that are based on graphs or tables.</li> </ul>
<p>10.2.2 Draw graphs (by hand and/or by means of technology where available) in a variety of real-life situations by:</p> <ul style="list-style-type: none"> <li>point-by-point plotting of data;</li> <li>working with formulae to establish points to plot.</li> </ul> <p><i>For example, draw graphs of:</i></p> <ul style="list-style-type: none"> <li>mass against time when on diet;</li> <li>surface area against side length of a cube;</li> <li>volume against surface area;</li> <li>lengths of a spring against mass added;</li> <li>amount of savings against the investment period.</li> </ul>	<p>11.2.2 Draw graphs (by hand and/or by means of technology where available) as required by the situations and problems being investigated.</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>compare costs of cell phone packages for different call intervals by drawing graphs of cost against time.</li> </ul>	<p>12.2.2 Draw graphs (by hand and/or by means of technology where available) as required by the situations and problems being investigated.</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>draw graphs of the number of AIDS related deaths and deaths caused by malaria over time, on the same system of axes, to describe the extent of the AIDS epidemic.</li> </ul>

<b>Grade 10</b> <b>We know this when the learner is able to:</b>	<b>Grade 11</b> <b>We know this when the learner is able to:</b>	<b>Grade 12</b> <b>We know this when the learner is able to:</b>
<p>10.2.3 Critically interpret tables and graphs that relate to a variety of real-life situations by:</p> <ul style="list-style-type: none"> <li>• finding values of variables at certain points;</li> <li>• describing overall trends;</li> <li>• identifying maximum and minimum points;</li> <li>• describing trends (including in terms of rates of change).</li> </ul> <p><i>For example, interpret graphs that:</i></p> <ul style="list-style-type: none"> <li>* compare the incidence of AIDS over time;</li> <li>* indicate trends in road fatalities;</li> <li>* show the expected changes in the mass of a baby with age.</li> </ul>	<p>11.2.3 Critically interpret tables and graphs in a variety of real-life and simulated situations by:</p> <ul style="list-style-type: none"> <li>• estimating input and output values;</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* do spot calculations of the rate of change of population growth in different countries by taking readings from supplied graphs to check figures quoted and to verify estimations of future growth.</li> </ul>	<p>12.2.3 Critically interpret tables and graphs in real life situations including in the media, inclusive of:</p> <ul style="list-style-type: none"> <li>• graphs with negative values on the axes (dependant variable in particular);</li> <li>• more than one graph on a system of axes.</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* interpret graphs of temperature against time of day during winter over a number of years to investigate claims of global warming;</li> <li>* compare graphs of indices such as the consumer price index and business confidence index to graphs of percentage change in those indices over a particular time interval.</li> </ul>

**Learning Outcome 3: Space, Shape and Measurement**

*The learner is able to measure using appropriate instruments, to estimate and calculate physical quantities, and to interpret, describe and represent properties of and relationships between 2-dimensional shapes and 3-dimensional objects in a variety of orientations and positions.*

<b>Grade 10</b> We know this when the learner is able to:	<b>Grade 11</b> We know this when the learner is able to:	<b>Grade 12</b> We know this when the learner is able to:
<p>10.3.1 Solve problems in 2-dimensional and 3-dimensional contexts by:</p> <ul style="list-style-type: none"> <li>• estimating, measuring and calculating (e.g. by the use of the Theorem of Pythagoras) values which involve:               <ul style="list-style-type: none"> <li>◦ lengths and distances,</li> <li>◦ perimeters and areas of common polygons and circles,</li> <li>◦ volumes of right prisms,</li> </ul> </li> <li>• checking values for solutions against the contexts in terms of suitability and degree of accuracy.</li> </ul> <p>(Accept the following as common polygons: Triangles, squares, rectangles, parallelograms, trapeziums, regular hexagons.)</p>	<p>11.3.1 Solve problems in 2-dimensional and 3-dimensional contexts by:</p> <ul style="list-style-type: none"> <li>• estimating, measuring and calculating values which involve:               <ul style="list-style-type: none"> <li>◦ lengths and distances,</li> <li>◦ perimeters and areas of polygons,</li> <li>◦ volumes of right prisms and right circular cylinders,</li> <li>◦ surface areas of right prisms and right circular cylinders,</li> </ul> </li> <li>• making adjustments to calculated values to accommodate measurement errors and inaccuracies due to rounding.</li> </ul>	<p>12.3.1 Solve problems in 2-dimensional and 3-dimensional contexts by:</p> <ul style="list-style-type: none"> <li>• estimating, measuring and calculating values which involve:               <ul style="list-style-type: none"> <li>◦ lengths and distances,</li> <li>◦ perimeters and areas of polygons,</li> <li>◦ volumes of right prisms and right circular cylinders,</li> <li>◦ surface areas of right prisms and right circular cylinders,</li> </ul> </li> <li>• making adjustments to calculated values to accommodate measurement errors and inaccuracies due to rounding.</li> </ul>
<p>10.3.2 Convert units of measurement within the metric system.</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* convert km to m; mm<sup>3</sup> to litres; km<sup>2</sup> to m<sup>2</sup>; cm<sup>3</sup> to m<sup>3</sup>.</li> </ul>	<p>11.3.2 Convert units of measurement between different scales and systems using conversion tables provided.</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* convert km to m; mm<sup>3</sup> to litres; miles to km; kg to lb;</li> <li>* work with international times.</li> </ul>	<p>12.3.2 Convert units of measurement between different scales and systems using conversion tables provided as required in dealing with problems.</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* the dimensions of an imported washing machine are given in inches and must be converted accurately to centimetres for installation purposes;</li> <li>* a recipe that is written with imperial measures must be rewritten with accurate metric measures;</li> <li>* measures of temperature must be converted between Fahrenheit and Celsius (conversion ratios and formulae given).</li> </ul>
<p>10.3.3 Draw and interpret scale drawings of plans to represent and describe situations.</p> <p><i>For example</i></p> <ul style="list-style-type: none"> <li>* draw and interpret top, front and side views or elevations on a plan.</li> </ul>	<p>11.3.3 Use and interpret scale drawings of plans to:</p> <ul style="list-style-type: none"> <li>• represent and identify views</li> <li>• estimate and calculate values according to scale.</li> </ul> <p><i>For example</i></p> <ul style="list-style-type: none"> <li>* study a plan of the school building and identify locations or calculate available real areas for extensions.</li> </ul>	<p>12.3.3 Use and interpret scale drawings of plans to:</p> <ul style="list-style-type: none"> <li>• estimate and calculate values according to scale</li> <li>• build models.</li> </ul> <p><i>For example</i></p> <ul style="list-style-type: none"> <li>* build a scale model of a school building, based on the plan of the building.</li> </ul>

<b>Grade 10</b> We know this when the learner is able to:	<b>Grade 11</b> We know this when the learner is able to:	<b>Grade 12</b> We know this when the learner is able to:
<p>10.3.4 Use grids and maps in order to determine locations and plan trips</p> <p><i>For example:</i></p> <p>* draw floor plans and use symbols to indicate areas and positions taken up by furniture in different arrangements.</p>	<p>11.3.4 Use grids and maps, and compass directions, in order to:</p> <ul style="list-style-type: none"> <li>• determine locations;</li> <li>• describe relative positions.</li> </ul> <p><i>For example, be able to find and understand</i></p> <p>* places using local maps;</p> <p>* seat locations in cinemas and stadiums;</p> <p>* room numbers in multi-levelled buildings.</p>	<p>12.3.4 Use grids and maps, and compass directions, in order to:</p> <ul style="list-style-type: none"> <li>• determine locations;</li> <li>• describe relative positions.</li> </ul> <p><i>For example:</i></p> <p>* understand the use of latitude and longitude in global positioning systems.</p>

**Learning Outcome 4: Data Handling**

*The learner is able to collect, summarise, display and analyse data and to apply knowledge of statistics and probability to communicate, justify, predict and critically interrogate findings and draw conclusions.*

<b>Grade 10</b> We know this when the learner is able to:	<b>Grade 11</b> We know this when the learner is able to:	<b>Grade 12</b> We know this when the learner is able to:
<p>Assessment Standard 10.4.4. is the focal Assessment Standard of LO4. The other LO4 Assessment Standards serve to develop the skills that will enable learners to achieve this one.</p> <p>10.4.4 Critically interpret a single set of data and representations thereof (with awareness of sources of error) in order to draw conclusions on questions investigated and to make predictions and to critique other interpretations.</p> <p><i>For example</i></p> <ul style="list-style-type: none"> <li>* <i>interpret data from the media on the number of stolen and recovered vehicles after a certain tracking device has been installed.</i></li> </ul>	<p>Assessment Standard 11.4.4. is the focal Assessment Standard of LO4. The other LO4 Assessment Standards serve to develop the skills that will enable learners to achieve this one.</p> <p>11.4.4 Critically interpret two sets of data and representations thereof (with awareness of sources of error and bias) in order to draw conclusions on problems investigated and make predictions and to critique other interpretations.</p> <p><i>For example</i></p> <ul style="list-style-type: none"> <li>* <i>compare data from two providers of tracking devices and draw conclusions about success rates.</i></li> </ul>	<p>Assessment Standard 12.4.4. is the focal Assessment Standard of LO4. The other LO4 Assessment Standards serve to develop the skills that will enable learners to achieve this one.</p> <p>12.4.4 Critically interpret data, in order to draw conclusions on problems investigated to predict trends and to critique other interpretations.</p> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>compare data about stolen vehicles from providers of tracking devices with data provided by official sources like SAPS, and draw conclusions about the trend in vehicle thefts (types of cars most at risk, areas most at risk).</i></li> </ul>
<p>10.4.1 Investigate situations in own life by:</p> <ul style="list-style-type: none"> <li>• formulating questions on issues such as those related to: <ul style="list-style-type: none"> <li>◦ social, environmental and political factors,</li> <li>◦ people’s opinions,</li> <li>◦ human rights and inclusivity;</li> </ul> </li> <li>• collecting or finding data by appropriate methods (e.g. interviews, questionnaires, the use of data bases) suited to the purpose of drawing conclusions to the questions.</li> </ul> <p><i>For example, investigate:</i></p> <ul style="list-style-type: none"> <li>* <i>substance abuse in the school;</i></li> <li>* <i>water conservation;</i></li> <li>* <i>prevalence of flu during winter;</i></li> <li>* <i>approaches to discipline in the school.</i></li> </ul>	<p>11.4.1 Investigate a problem on issues such as those related to:</p> <ul style="list-style-type: none"> <li>• social, environmental and political factors;</li> <li>• people’s opinions;</li> <li>• human rights and inclusivity by: <ul style="list-style-type: none"> <li>◦ collecting or finding data by appropriate methods (e.g. interviews, questionnaires, the use of data bases) suited to the purpose of drawing conclusions to the questions.</li> <li>◦ using appropriate statistical methods;</li> <li>◦ selecting a representative sample from a population with due sensitivity to issues relating to bias;</li> <li>◦ comparing data from different sources and samples.</li> </ul> </li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>conduct a survey in own school about home languages and comparing that with related data from other sources;</i></li> <li>* <i>identify possible sources of bias in gathering the data;</i></li> <li>* <i>investigate the increase in absenteeism at school (e.g. investigate the correlation between living conditions – squatter camps, houses – and absenteeism);</i></li> <li>* <i>investigate the correlation between distance from school and absenteeism.</i></li> </ul>	<p>12.4.1 Investigate a problem on issues such as those related to:</p> <ul style="list-style-type: none"> <li>• social, environmental and political factors;</li> <li>• people’s opinions;</li> <li>• human rights and inclusivity by: <ul style="list-style-type: none"> <li>◦ collecting or finding data by appropriate methods (e.g. interviews, questionnaires, the use of data bases) suited to the purpose of drawing conclusions to the questions.</li> <li>◦ using appropriate statistical methods;</li> <li>◦ selecting a representative sample from a population with due sensitivity to issues relating to bias;</li> <li>◦ comparing data from different sources and samples.</li> </ul> </li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>challenge learners to compare claims about preferred TV programmes among teenagers with data from schools in their area;</i></li> <li>* <i>compare preferences across grades and gender.</i></li> </ul>

<b>Grade 10</b> We know this when the learner is able to:	<b>Grade 11</b> We know this when the learner is able to:	<b>Grade 12</b> We know this when the learner is able to:
<p>10.4.2 Select, justify and use a variety of methods to summarise and display data in statistical charts and graphs inclusive of:</p> <ul style="list-style-type: none"> <li>• tallies;</li> <li>• tables;</li> <li>• pie charts;</li> <li>• histograms (first grouping the data);</li> <li>• single bar and compound bar graphs;</li> <li>• line and broken-line graphs.</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>pie charts to show the relative proportions of learners who have flu</i></li> <li>* <i>compound bar graphs to show the abuse of different substances in the respective Further Education and Training grades.</i></li> </ul>	<p>11.4.2 Select, justify and use a variety of methods to summarise and display data in statistical charts and graphs inclusive of:</p> <ul style="list-style-type: none"> <li>• tallies;</li> <li>• tables;</li> <li>• pie charts;</li> <li>• single and compound bar graphs;</li> <li>• line and broken-line graphs;</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>interpret the meaning of points on a broken-line graph of house prices in 2002 – does it make sense to assign a monetary value to a point halfway between January and February?</i></li> </ul>	<p>12.4.2 Select, justify and use a variety of methods to summarise and display data in statistical charts and graphs to describe trends (e.g. a positive linear association).</p> <p><i>For example</i></p> <ul style="list-style-type: none"> <li>* <i>does a positive correlation between age and height necessarily mean that height is dependent on age?</i></li> <li>* <i>does a positive correlation between mathematics marks and music marks necessarily mean that facility in mathematics is dependent on musical aptitude?</i></li> <li>* <i>does a positive correlation between pollution levels and TB infections necessarily mean that pollution causes TB?</i></li> </ul>
<p>10.4.3 Understand that data can be summarised in different ways by calculating and using appropriate measures of central tendency and spread (distribution) to make comparisons and draw conclusions, inclusive of the:</p> <ul style="list-style-type: none"> <li>• mean;</li> <li>• median;</li> <li>• mode;</li> <li>• range.</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>investigate the cost of a trolley of groceries at three different shops in the area and report the findings by means of mean, median, mode and range.</i></li> </ul>	<p>11.4.3 Understand that data can be summarised and compared in different ways by calculating, and using measures of central tendency and spread (distribution), for more than one set of data inclusive of the:</p> <ul style="list-style-type: none"> <li>• mean;</li> <li>• median;</li> <li>• mode;</li> <li>• range;</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>conduct a survey in own school about home languages and compare that with related data from other sources;</i></li> <li>* <i>identify possible sources of bias in gathering data;</i></li> <li>* <i>use concepts of average, mode or median to interpret the data.</i></li> </ul>	<p>12.4.3 Understand that data can be summarised and compared in different ways by calculating and using measures of central tendency and spread (distribution), including:</p> <ul style="list-style-type: none"> <li>• mean;</li> <li>• median;</li> <li>• mode;</li> <li>• quartiles; (INTERPRETATION ONLY)</li> <li>• percentiles.(INTERPRETATION ONLY)</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* <i>compare the increase in the cost of a trolley of groceries to the increase in the consumer price food index, and report the findings in terms of quartiles and percentiles;</i></li> <li>* <i>compare academic results in own school to those in the province in terms of quartiles and percentiles.</i></li> </ul>

<b>Grade 10</b> We know this when the learner is able to:	<b>Grade 11</b> We know this when the learner is able to:	<b>Grade 12</b> We know this when the learner is able to:
10.4.5 Work with simple notions of likelihood/probability in order to: <ul style="list-style-type: none"> <li>• express probability values in terms of fractions, ratios and percentages.</li> </ul>	11.4.5 Work with simple notions of likelihood/probability in order to: <ul style="list-style-type: none"> <li>• design simple contingency tables to estimate basic probabilities;</li> <li>• draw tree diagrams</li> </ul> <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* draw a tree diagram to investigate the probability of getting three “heads” when tossing three coins.</li> </ul>	12.4.5 Critically engage with the use of probability values in making predications of outcomes in the context of games and real-life situations. <p><i>For example:</i></p> <ul style="list-style-type: none"> <li>* investigate claims that the probability of winning a game of chance (e.g. a slot machine) improves if it has not produced a winner for some time.</li> </ul>
10.4.6 Effectively communicate conclusions and predictions (using appropriate terminology such as trend, increase, decrease, constant, impossible, likely, fifty-fifty chance), that can be made from the analysis and representation of data.	11.4.6 Demonstrate an awareness of how it is possible to use data in different ways to justify opposing conclusions.	12.4.6 Critique statistically-based arguments, describe the use and misuse of statistics in society, and make well-justified recommendations

## APPENDIX 2: TAXONOMY LEVELS

<b>DESCRIPTIONS OF THE DIFFERENT TAXONOMY LEVELS AS GIVEN IN THE SUBJECT ASSESSMENT GUIDELINES</b>			
<b>Level 1: Knowing</b>	<b>Level 2: Applying routine procedures in familiar contexts</b>	<b>Level 3: Applying multi-step procedures in a variety of contexts</b>	<b>Level 4: Reasoning and reflecting</b>
<p><b>Tasks at the <i>knowing</i> level of the Mathematical Literacy taxonomy require learners to:</b></p> <ul style="list-style-type: none"> <li>• Calculate using the basic operations including: <ul style="list-style-type: none"> <li>▫ algorithms for +, -, ×, and ÷;</li> <li>▫ appropriate rounding of numbers;</li> <li>▫ estimation;</li> <li>▫ calculating a percentage of a given amount; and</li> <li>▫ measurement.</li> </ul> </li> <li>• Know and use appropriate vocabulary such as equation, formula, bar graph, pie chart, Cartesian plane, table of values, mean, median and mode.</li> <li>• Know and use formulae such as the area of a rectangle, a triangle and a circle where each of the required dimensions is readily available.</li> <li>• Read information directly from a table (e.g. the time that bus number 1234 departs from the terminal).</li> </ul>	<p><b>Tasks at the <i>applying routine procedures in familiar contexts</i> level of the Mathematical Literacy taxonomy require learners to:</b></p> <ul style="list-style-type: none"> <li>• Perform well-known procedures in familiar contexts. Learners know what procedure is required from the way the problem is posed. All of the information required to solve the problem is immediately available to the student.</li> <li>• Solve equations by means of trial and improvement or algebraic processes.</li> <li>• Draw data graphs for provided data.</li> <li>• Draw algebraic graphs for given equations.</li> <li>• Measure dimensions such as length, weight and time using appropriate measuring instruments sensitive to levels of accuracy.</li> </ul>	<p><b>Tasks at the <i>applying multi-step procedures in a variety of contexts</i> level of the Mathematical Literacy taxonomy require learners to:</b></p> <ul style="list-style-type: none"> <li>• Solve problems using well-known procedures. The required procedure is, however, not immediately obvious from the way the problem is posed. Learners will have to decide on the most appropriate procedure to solve the solution to the question and may have to perform one or more preliminary calculations before determining a solution.</li> <li>• Select the most appropriate data from options in a table of values to solve a problem.</li> <li>• Decide on the best way to represent data to create a particular impression.</li> </ul>	<p><b>Tasks at the <i>reasoning and reflecting</i> level of the Mathematical Literacy taxonomy require learners to:</b></p> <ul style="list-style-type: none"> <li>• Pose and answer questions about what mathematics they require to solve a problem and then to select and use that mathematical content.</li> <li>• Interpret the solution they determine to a problem in the context of the problem and where necessary to adjust the mathematical solution to make sense in the context.</li> <li>• Critique solutions to problems and statements about situations made by others.</li> <li>• Generalise patterns observed in situations, make predictions based on these patterns and/or other evidence and determine conditions that will lead to desired outcomes.</li> </ul>

**FURTHER INTERPRETATION OF THE DIFFERENT TAXONOMY LEVELS ACCORDING TO LEARNING OUTCOMES**

<b>LEARNING OUTCOME 1 – Number and Operations in Context</b>			
<b>Level 1: Knowing</b>	<b>Level 2: Applying routine procedures in familiar contexts</b>	<b>Level 3: Applying multi-step procedures in a variety of contexts</b>	<b>Level 4: Reasoning and reflecting</b>
<ul style="list-style-type: none"> <li>• Add a set of numbers to calculate total income/expenses</li> <li>• Calculate profit/loss if income and expenses are both given.</li> <li>• Calculate a direct percentage of a given amount.</li> <li>• Write a ratio of two quantities which are already in the same unit</li> <li>• Substitute into a given formula.</li> <li>• Round off to a given number of decimal places.</li> <li>• Read information directly from a financial table.</li> <li>• Convert fractions to decimals.</li> <li>• Convert decimals to fractions.</li> <li>• Convert a decimal to a percentage.</li> <li>• Convert a fraction to a percentage.</li> <li>• Know and use appropriate vocabulary such as equations, formulae, Cartesian plane, table of values, ratio, rate, average, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Calculate simple interest</li> <li>• Calculate compound interest compounded annually.</li> <li>• Increase or decrease a given amount by a certain percentage.</li> <li>• Determine a ratio when the quantities are not in the same unit.</li> <li>• Calculate a one-step currency fluctuation.</li> <li>• Calculate exchange rates (e.g. exchange 20 dollars and receive R124,60. What is the exchange rate?)</li> <li>• Show the awareness of the significance of digits.</li> </ul>	<ul style="list-style-type: none"> <li>• Calculate compound interest compounded more than once in the year.</li> <li>• Calculate profit if only one of income or expenses is given and the other still needs to be calculated.</li> <li>• Calculate compound growth/decline with reference to the rates of taxation, inflation and interest rates.</li> <li>• Interpret answers in terms of the context.</li> <li>• Rework a problem if the first answer is not sensible.</li> <li>• Revise a budget if conditions change.</li> <li>• Estimate and check profit/loss.</li> </ul>	<ul style="list-style-type: none"> <li>• Interpret answers in terms of context.</li> <li>• Rework the answer if the initial conditions change</li> <li>• Analyse and interpret the effects of changing taxation, inflation and interest rates.</li> <li>• Rework a problem if the initial conditions change.</li> <li>• Choose your own method to find a solution to a problem.</li> <li>• Interpret calculated answers logically in relation to the problem and communicate processes and results.</li> </ul>

**LEARNING OUTCOME 2 – Functional Relationships**

<b>Level 1: Knowing</b>	<b>Level 2: Applying routine procedures in familiar contexts</b>	<b>Level 3: Applying multi-step procedures in a variety of contexts</b>	<b>Level 4: Reasoning and reflecting</b>
<ul style="list-style-type: none"> <li>• Substitute number(s) into a given formula when there is a functional relationship (finding output values).</li> <li>• Solve equations (finding input values for simple equations)</li> <li>• Read answers directly from a given simple graph and/or table.</li> <li>• Point-by-point plotting of data</li> </ul>	<ul style="list-style-type: none"> <li>• Solve equations (finding input values for complex equations).</li> <li>• Determine output values for given input values.</li> <li>• Work with formulae to establish points to plot.</li> <li>• Point-by-point plotting of graphs when data is given.</li> <li>• Read answers directly from a given more complex graph and tables.</li> <li>• Estimate answers to solutions to simpler equations and calculations.</li> <li>• Solve equations by trial-and-improvement method or by inspection.</li> <li>• Identify maximum/minimum/critical points from a given graph.</li> </ul>	<ul style="list-style-type: none"> <li>• Determine given input values for a given output value (changing the subject of a formula).</li> <li>• Draw graphs from a given formula.</li> <li>• Find break-even points involving linear functions by solving simultaneous equations (linear and inverse relationships).</li> <li>• Solve equations algebraically.</li> <li>• Perform one or two calculations before determining the desired solution (e.g. calculate <math>\pi R^2</math> and <math>\pi r^2</math> separately in order to calculate <math>A = \pi R^2 - \pi r^2</math>.)</li> <li>• Identify maximum/minimum/critical points from a graph which the candidate draws.</li> <li>• Draw graphs with negative values on the axes.</li> </ul>	<ul style="list-style-type: none"> <li>• Describe trends.</li> <li>• Determine how the calculated answer fits the actual situation and make adjustments (e.g. If in the calculation it is found 9 litres of paint are needed and paint is sold in 5ℓ tins, then two 5ℓ tins will be bought.)</li> <li>• Generalise patterns and make predictions.</li> <li>• Critically interpret graphs with negative values on the axes.</li> <li>• Analyse graphs with more than one graph on the same set of axes.</li> <li>• Critically interpret tables and graphs.</li> <li>• Solve planning problems by reasoning out various options.</li> <li>• Investigate the impact of compound change on situations.</li> </ul>

**LEARNING OUTCOME 3 – Space, Shape and Measurement**

<b>Level 1: Knowing</b>	<b>Level 2: Applying routine procedures in familiar contexts</b>	<b>Level 3: Applying multi step procedures in a variety of contexts</b>	<b>Level 4: Reasoning and reflecting</b>
<ul style="list-style-type: none"> <li>• Calculate and estimate values using basic operations which involve lengths and distances, where each of the required dimensions are readily available.</li> <li>• Know and use formulae such as, perimeters and areas of polygons, volumes of right prisms, right circular cylinders, and surface areas of right prisms, right circular cylinders where the dimensions and formulae are readily available.</li> <li>• Know and use appropriate vocabulary such as equation, formulae, Cartesian plane, area, surface area, perimeter, radius, diameter, length, breadth, height, base, circumference, volume, circle, cylinders, polygons, right prisms, triangular, rectangular and square.</li> <li>• Read information directly from a table and use some given information and simple operations to complete a table of values where the information is readily available.</li> </ul>	<ul style="list-style-type: none"> <li>• Measure values which involve lengths, distances, weight and time using appropriate measuring instruments sensitive to levels of accuracy in a familiar context.</li> <li>• Draw simple scale drawings where the scale is given and based on the application of simple routine procedures in a familiar context</li> <li>• Describe relationships between input and output values in a table of data concerning space, shape and measurement.</li> <li>• Use grids and maps in order to determine locations in a familiar context, applying routine procedures.</li> <li>• Convert units of measurement between different scales and systems using provided conversion tables including: <ul style="list-style-type: none"> <li>▫ Converting to a smaller unit of length, time, mass etc.</li> <li>▫ Converting to a bigger unit of length, time, mass, etc</li> <li>▫ Converting units of area</li> <li>▫ Converting units of volume</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Make adjustments to calculated values to accommodate measurement errors and inaccuracies due to rounding.</li> <li>• Use grids and maps in order to plan trips in an unfamiliar context and apply multi-step procedures where the information is readily available.</li> <li>• Use grids and maps, and compass directions (global positions), in order to: <ul style="list-style-type: none"> <li>▫ Determine locations.</li> <li>▫ Describe relative positions</li> </ul> </li> <li>• Check values (applying multi step procedures where the required procedure is not immediately obvious from the way the problem is posed) for solutions against the contexts in terms of suitability and degree of accuracy in a variety of contexts.</li> <li>• Draw scale drawings where the scale is not given and derive the scale.</li> <li>• Describe relationships between input and output values in a table of data (concerning space, shape and measurement) by means of an equation.</li> <li>• Convert units of measurement between different scales and systems applying multi step procedures, and using conversion tables provided as required in dealing with problems in a variety of contexts.</li> </ul>	<ul style="list-style-type: none"> <li>• Interpret scale drawings of plans to describe situations and answer questions about what mathematics they require to solve a problem and then to select and use that mathematical content. (The answer that the learner provides will be in a range of possible values and the quality of the answer will be based on the reasoning that is evident in determining the answer.)</li> <li>• Use and interpret scale drawings of plans to estimate and calculate values according to scale.</li> <li>• Use grids and maps, and compass directions. In order to interpret the solution they determine locations in the context of the problem and where necessary to adjust the mathematical solution to make sense of relative positions.</li> <li>• Critique solutions to problems and statements about situations made by others. (Learners are expected to evaluate the statements)</li> <li>• Generalise patterns observed in situations, make predictions based on these patterns and/or other evidence and determine conditions that will lead to desired outcomes.</li> </ul>

**LEARNING OUTCOME 4 – Data Handling**

<b>Level 1: Knowing</b>	<b>Level 2: Applying routine procedures in familiar contexts</b>	<b>Level 3: Applying multi-step procedures in a variety of contexts</b>	<b>Level 4: Reasoning and reflecting</b>
<ul style="list-style-type: none"> <li>• Understand terminologies like mode, mean, range, quartiles etc.</li> <li>• Arrange data in ascending order.</li> <li>• Identify the mode.</li> <li>• Determine the median when data is already arranged in ascending order and n is odd. (<math>n = \text{number of scores}</math>)</li> <li>• Construct frequency tables from arranged data.</li> <li>• Read information from graphs and frequency tables</li> </ul>	<ul style="list-style-type: none"> <li>• Construct tally tables</li> <li>• Determine the median when data is already arranged in ascending order, and n is even (<math>n = \text{number of scores}</math>).</li> <li>• Calculate mean and the range of given scores.</li> <li>• Draw graphs from given data. <i>These graphs include pie charts, single and compound bar graphs, line and broken line graphs and histograms.</i></li> <li>• Calculate simple probability.</li> <li>• Express the probability of choosing a score in terms of fractions, ratios and percentages.</li> </ul>	<ul style="list-style-type: none"> <li>• Determine the median, quartiles and percentiles when data is not arranged in ascending order.</li> <li>• Draw graphs if candidates still have to find appropriate data to use. <i>These graphs include pie charts, single and compound bar graphs, line and broken line graphs and histograms.</i></li> <li>• Express a probability <ul style="list-style-type: none"> <li>▫ that an event will occur</li> <li>▫ that an event will not occur</li> </ul> </li> <li>• Design simple contingency tables and use them to calculate probabilities.</li> <li>• Draw tree diagrams and use them to calculate probabilities.</li> </ul>	<ul style="list-style-type: none"> <li>• Communicate predictions such as trends, increase, decrease, constant, impossible, likely, fifty-fifty chance that can be made from an analysis of data.</li> <li>• Identify and describe the use and misuse of statistics and make justified recommendations.</li> <li>• Manipulate scale to create desired impressions.</li> <li>• Make decisions as to whether to use a pie chart, a bar graph, a line graph or a histogram should be used in order to create particular impressions and be able to explain why they chose that particular graph.</li> <li>• Select the most appropriate data from a number of options in a table of values and use them to make the problem understandable.</li> <li>• Interpret quartiles and percentiles as measures of spread.</li> <li>• Provide probable reasons why certain scores are odd or strange.</li> <li>• Critically interpret data and representations thereof.</li> </ul>