Learner Name	
ID Number	
Organisation	

FORMATIVE ASSESSMENT: LEARNER WORK FILE VERSION 1

Unit Standard Title: **Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems**

Unit Standard No: **9015**
Unit Standard Credits: **6**
NQF Level: **4**

Mark information:

Specific Outcome/Section	1	2	3	4	5	Total	%	C / NYC
Maximum marks	21	97	60			178	100	

This outcomes-based learning material was developed by Masifunde Training Centre with funding from INSETA in July 2014. The material is generic in nature and is intended to serve as a minimum standard for the industry.

Section 1: 21 marks

Activity 1 (6 marks)

Think of three issues relating to society that you believe could be investigated through statistical methods. For each of them, pose a question that would lead to an investigation.

Activity 2 (5 marks)

Select one of the problems that you identified in Activity 1. Now identify the variables which you believe contribute to or affect this problem.

Activity 3 (10 marks)

Case Study: from page 6 Learner Guide

The Medical Research Council (MRC) wished to document and monitor the prevalence of tobacco use of adolescents aged 13-15. They also wanted to assess pupil's knowledge, beliefs and attitudes relating to tobacco-using behaviour. In 2014 they conducted a survey using a sample of 207 schools nationally. They had an 80% participation rate.

3.1 Do you think it is possible to question every adolescent aged 13-15 years in South Africa? (1)

3.2 Do you think that a sample of 207 schools in South Africa would be enough to represent all schools in South Africa? (1)

3.3 What factors do you think the MRC would have taken into account when selecting a sample of schools from the population of all schools in South Africa? (Any 4) (4)

3.4 What technique (method) do you think the MRC used to gather the information from school children? (1)

3.5 What other methods of data collection could they have used? (1)

3.6 Can you think of any problems in the methods of collection described in (4) or (5)? (2)

Section 2: 97 marks

Activity 4 **(9 marks)**

Consider the following table from Stats SA and answer the questions that follow:

Population 16 years and above, in urban and non-urban areas, by province and gender (Stats SA)

Column 10	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
	Urban				Non-urban				Grand
Province	Female	Male	Unstated	Total	Female	Male	Unstated	Total	Total
Eastern Cape	879 370	769 579		1 648 950	1 264 007	856 390		2 120 397	3 769 347
Free State	718 041	555 993		1 274 035	203 533	330 422		533 955	1 807 989
Gauteng	2 615 535	2 621 644	11 028	5 248 206	74 220	237 852		312 072	5 560 278
KwaZulu-Natal	1 555 122	1 599 675	17 000	3 171 798	1 404 272	830 317		2 234 588	5 406 386
Mpumalanga	366 049	388 025		754 074	563 378	470 510		1 033 888	1 787 963
North West	549 956	518 999		1 068 955	579 434	559 309		1 138 743	2 207 698
Northern Cape	250 891	200 926		451 817	38 031	70 791		108 823	560 639
Northern Province	174 450	148 101		322 551	1 438 552	1 039 747	9 710	2 488 009	2 810 560
Western Cape	1 349 576	1 230 514		2 580 090	99 427	118 540		217 967	2 798 058
Total	8 458 992	8 033 456	28 028	16 520 476	5 664 854	4 513 878	9 710	10 188 442	26 708 918

4.1 What does column 2 represent? (1)

4.2 What does column 5 represent? (1)

4.3 Which column represents the number of males living in non-urban areas? (1)

4.4 If you wanted to find the total number of people, 16 years and older, living in a certain province, which column would you look in? (1)

4.5 How many males, 16 years and older, live in urban areas in KwaZulu-Natal? (1)

4.6 What proportion is that of all the people, 16 years and older, living in KZN? (1)

4.7 How many females, 16 years and older, live in rural areas in South Africa? (1)

4.8 What proportion is that of all the people, 16 years and older, living in South Africa? (1)

4.9 Which province has the smallest non-urban adult male population? (1)

Activity 5 **(8 marks)**

Every year millions of man days are lost because of people striking. A man day is one work day for one person. In other words, if 20 people strike for one day, 20 man days are lost. If 20 people strike for 2 days, 40 man days are lost. Look at this table of man days lost because of strikes.

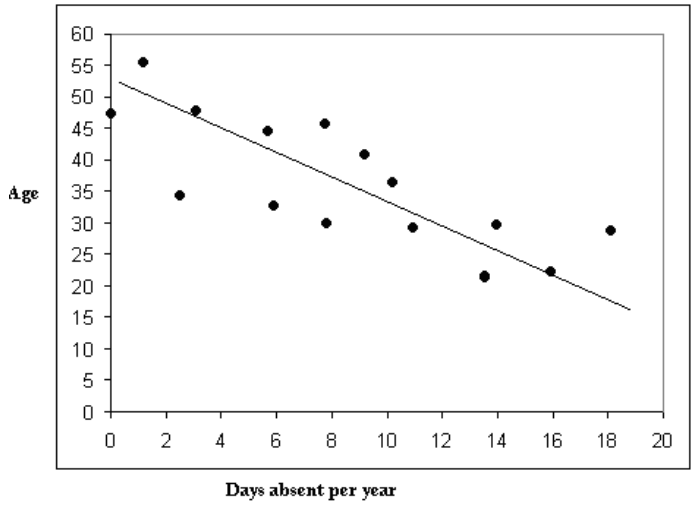
Year	Man days lost
1988	9.0 million
1989	1,5 million
1990	3 million
1991	4,0 million
1992	3,5 million
1993	4 million
1994	3,5 million
1995	1,5 million
1996	1,5 million
1997	0,5 million

5.1 Draw a bar graph to represent the data in the table. Label the axes of your graph. (4)

5.2 Draw a line graph to represent the data in the table. Label the axes of your graph. (4)

Activity 6 **(6 marks)**

The Human Resources Manager of a company employing 200 workers conducts a survey to investigate whether there is a relationship between the age of workers and the number of days they are absent per year. He takes a sample of 15 files and records the age and number of days absent of the workers in the sample. He then plots the results of the survey on the following scatter graph.



6.1 Do you think the department would decide that there **is** a correlation between number of days absent and the age of workers? If yes, describe the correlation. (1)

6.2 A ruler has been used to draw a line through the scatter plot in the place that best fits the plotted points. This line is called **the line of best fit.** What is the purpose of this line? (1)

6.3 Using your line of best fit, estimate:

6.3.1 How many days a 35 year old worker can be expected to be absent in a year? (1)

6.3.2 The age of a worker who is likely to be absent for 3 days in a year. (1)

6.4 Do you think this is an accurate indication of the relationship between age of workers and absenteeism? (1)

6.5 Do you think the sample size of the survey is large enough to form conclusions about the investigation? (1)

Activity 7 **(5 marks)**

Critically discuss the results of this survey on cell phone users found on pages 7-9 and page 11-12 in the Learner Guide. In your discussion, consider sample bias, sample size etc. Record the outcomes of your discussion.

Activity 8 **(6 marks)**

Example: A worker puts in overtime and records the following extra hours per week:
8, 3, 4, 7, 6, 8, 8, 11, 15, 12

Determine the:
(i) mean *82 ÷ 10 = 8,2 hours*
(ii) median *3, 4, 6, 7, 8, 8, 8, 11, 12, 15*
Median = 8
(iii) mode *8*
(iv) range *15 – 3 = 12*

for the hours of overtime.

Task: The manager of a company is concerned about low productivity and feels that absenteeism is a problem in his workforce. He decides to investigate and obtains the number of days each worker was absent over the last year. The results are as follows: 11, 2, 3, 0, 15, 5, 9, 0, 5, 1, 3, 1, 20, 6, 0, 1, 3, 2, 6, 10 and 1.

8.1 Sort the data into an ordered array. (1)

8.2 Calculate the mean, median, mode and range. (3)

8.3 Which of the three averages best represents the absenteeism in this company? (1)

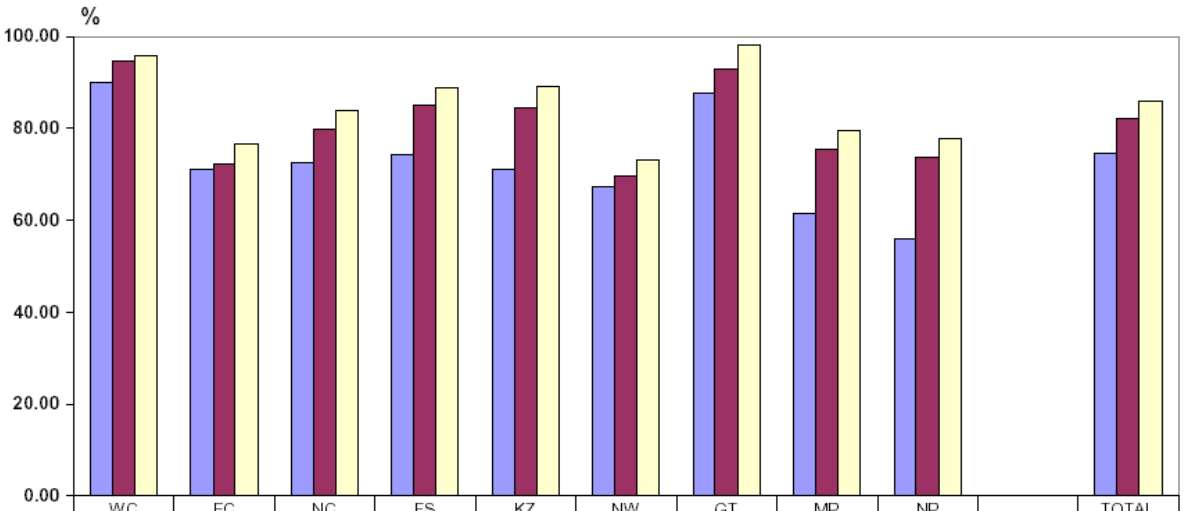
8.4 Do you think that the manager is right to be concerned about the absenteeism? (1)

Activity 9 **(5 marks)**

A survey using data from an insurance company statistics makes the inference that women are better drivers than men. The study actually shows that on average a woman in the 20 – 65 year age group will have fewer accidents than a man of the same age. Do you think the inference that women are better drivers than men is accurate from this study? Discuss.

Activity 10 **(15 marks)**

Adult literacy rate (%) by province for 1980,1991 and 1996



	WC	EC	NC	FS	KZ	NW	GT	MP	NP		TOTAL
1980	89.97	71.19	72.51	74.30	71.09	67.31	87.61	61.35	55.96		74.43
1991	94.57	72.34	79.83	84.82	84.26	69.46	92.91	75.48	73.64		82.16
1996	95.76	76.47	83.79	88.77	89.17	73.16	98.13	79.42	77.70		85.93

Source Stats SA data sets

10.1 Which province has seen the greatest improvement from 1980 to 1996? What is the percentage increase? What is the average increase per year? (3)

10.2 Which province has experienced the least improvement from 1980 to 1996? What is the percentage increase? What is the average increase per year? (3)

You will have seen that the Eastern Cape had the worst improvement in the percentage of literate adults from 1980 to 1996.

1980	71,2%
1991	72,3%
1996	76,5%

Let's help the Eastern Cape provincial government to better represent this data.

10.3 Look at the bar graph from Stats SA

10.3.1 What does the vertical axis measure? (1)

10.3.2 What scale is used and what is the range of percentages? (2)

10.4 Draw a new bar graph for E.C. but this time use a scale of 1cm = 1% and a range from 71% to 77%. (4)

10.4.1 Compare the representations in the two bar graphs. (1)

10.4.2 If the E.C. provincial government were to publish their bar graph, do you think people would be impressed with the improvement? Give a reason for your answer. (1)

Activity 11 **(8 marks)**

The following statistics are supplied by Stats SA and the World Health Organisation.

The life expectancy (in years) at birth, of a South African is recorded as follows:

1980	58,8
1991	62,8
1996	57,0
2001	49,0

11.1 Use the axes below to draw a broken line graph to represent this data. (4)

11.2 The Minister of Health has to present a report to the public on these statistics. By changing the scale on the axes, draw a new broken line graph that will make the situation less frightening. (4)

Activity 12 **(10 marks)**

A political party reports that a survey indicates that 65% of voters will vote for their politician X in the next municipal election. The result of the survey was based on data received from interviews with 100 people at a soccer stadium.
Critically evaluate the inference drawn from this study, identifying potential sources of bias and potential misuses of the data.

Statistics Project 1 (25 Marks)

You may work in a group for this project. If you do, please indicate the names of the other group members.

You are to conduct a survey on an issue that interests you and then present the results of your investigation. Remember that you must present your work in your own words.

You will be required to

1. Pose a question to be investigated
2. Select a suitable sample
3. Collect data through questionnaires or suitable experiments
4. Represent the data in the form of tables and graphs
5. Calculate statistics (measures of central spread and range) to analyse your results
6. Write a few sentences to interpret your findings
7. Critically evaluate your study

Section 3: 60 marks

Activity 13: (6 marks)

13.1 Flip a coin 20 times. Use a tally and record the **outcomes** (heads or tails) in the table below. (2)

Heads	Tails	Total no. outcomes for Heads	Total no. outcomes for Tails	Ratio for Heads	Ratio for Tails

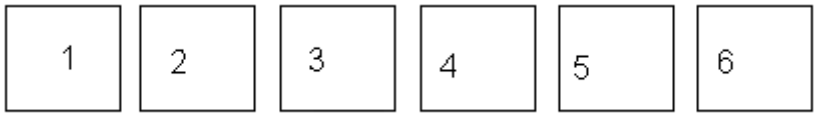
13.2 Now record the ratios in the last 2 columns of the table in decimal form. (2)

13.3 What do you observe about the ratios? (2)

Activity 14: (6 marks)

Please use a die. (Plural = dice)

The numbers on the die are listed in the blocks below:



14.1 How many **equally likely outcomes** are there for each throw of the die? (1)

14.2 If you tossed the die 30 times, predict how many times you would get a 2?

(1)

14.3 Conduct a trial: Throw the die 30 times.

How many times do you get the number 2? (1)

14.4 Calculate the **experimental probability** of getting a 2. Write it as a ratio.

(2)

14.5 Now calculate the **theoretical probability** of getting a 2 with one throw of a die.

(1)

Activity 15 **(9 marks)**

Conduct an experiment to determine the probability of throwing an even number with the throw of 1 die.

15.1 Design the experiment (decide on how many throws of the die you will make). (1)

15.2 Make a prediction based on the theoretical probability of obtaining an even number with the throw of 1 die. (1)

15.3 Conduct the experiment, recording the results in the table below. (4)

Even	odd	$\frac{\text{No. of evens}}{\text{Total no. outcomes}}$

15.4 Calculate the experimental probability of obtaining an even number with the throw of 1 die. (2)

15.5 Compare the experimental results with the prediction you made in (b) (1)

Statistics Project 2 **(20marks)**

Each of the letters of the word **ASSESSMENT** are written on separate cards and placed in a box. If you select a card from the box without looking, what is the probability of:

a) selecting a card with the letter M

b) selecting a card with the letter S

c) selecting a card with the letter E

Design and conduct an experiment to compare the experimental probability to the theoretical probability of (a) to (c) above. Does the experiment confirm the predicted probability? **Communicate your results clearly.**
If you would prefer not to use the above experiment, you may design an experiment to develop models and make predictions for any situation that you choose.

Activity 16 **(11 marks)**

You are writing a test with six True/False questions.
What is the probability of guessing the correct answer to:

16.1 the first question?

16.2 the first two questions?

16.3 the first four questions?

16.4 all six questions?

A training class consists of 5 English speaking, 3 Afrikaans speaking, 10 Zulu speaking and 2 Xhosa speaking learners. You choose a random sample of learners. What is the probability of the sample containing:

16.5 a Zulu speaking learner?

16.6 a Zulu or Xhosa speaking learner?

16.7 an English or Xhosa speaking learner?

16.8 an English, Afrikaans or Xhosa speaking learner?

Write down an event that you think will have a probability of

16.9 0

16.10 1

16.11 0,8

Activity 17 **(8 marks)**

Two fair dices are thrown together and their sum total was recorded in the table below

Dice 2

Dice 1	**1**	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	**?**	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

17.1 What value should go where there is a question mark? (2)

17.2 How many possible outcomes are there in total? (1)

17.3 How many outcomes give a score of 10? (1)

17.4 Two fair dices are thrown together. Find the probability that the sum of the resulting number is even. (2)

17.5 State two reasons which can result in bias or errors when a coin or dice is tossed. (2)

Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems

SAQA US ID	UNIT STANDARD TITLE
9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems

ORIGINATOR	ORIGINATING PROVIDER
SGB Math Literacy, Math, Math Sciences L 2 -4	

QUALITY ASSURING BODY
-

FIELD	SUBFIELD
Field 10 - Physical, Mathematical, Computer and Life Sciences	Mathematical Sciences

ABET BAND	UNIT STANDARD TYPE	OLD NQF LEVEL	NEW NQF LEVEL	CREDITS
Undefined	Regular-Fundamental	Level 4	NQF Level 04	6

REGISTRATION STATUS	REGISTRATION START DATE	REGISTRATION END DATE	SAQA DECISION NUMBER
Reregistered	2009-07-01	2012-06-30	SAQA 0480/09

LAST DATE FOR ENROLMENT	LAST DATE FOR ACHIEVEMENT
2013-06-30	2016-06-30

In all of the tables in this document, both the old and the new NQF Levels are shown. In the text (purpose statements, qualification rules, etc), any reference to NQF Levels are to the old levels unless specifically stated otherwise.

This unit standard does not replace any other unit standard and is not replaced by any other unit standard.

PURPOSE OF THE UNIT STANDARD

This Unit Standard is designed to provide credits towards the mathematical literacy requirement of the NQF at Level 4. The essential purposes of the mathematical literacy requirement are that, as the learner progresses with confidence through the levels, the learner will grow in:

A confident, insightful use of mathematics in the management of the needs of everyday living to become a self-managing person

An understanding of mathematical applications that provides insight into the learner`s present and future occupational experiences `and so develop into a contributing worker

The ability to voice a critical sensitivity to the role of mathematics in a democratic society and so become a participating citizen.

People credited with this unit standard are able to:

Critique and use techniques for collecting, organising and representing data.

Use theoretical and experimental probability to develop models, make predictions and study problems.

Critically interrogate and use probability and statistical models in problem solving and decision making in real-world situations.

LEARNING ASSUMED TO BE IN PLACE AND RECOGNITION OF PRIOR LEARNING

The credit value is based on the assumption that people starting to learn towards this unit standard al-e competent in Mathematical Literacy and Communications at NQF level 3.

UNIT STANDARD RANGE

This unit standard includes the requirement to:

Critique the selection of samples in terms of size and representativeness.

Identify features of distributions: symmetry and asymmetry, clusters and gaps, and possible outliers in data and consider their effects on the interpretation of the data.
Critique the use of data from samples to estimate population statistics.

Apply an understanding of random phenomena to critique and interpret real life and work related situations.

Critique arguments based on probability in terms of an understanding of random behaviour and the law of large numbers (e.g. lottery `hot` numbers).

Demonstrate understanding of and determine probabilities for independent, disjoint and complementary events.

Judge or critique probability values.

Further range statements are provided for specific outcomes and assessment criteria as needed.

Specific Outcomes and Assessment Criteria:

SPECIFIC OUTCOME 1

Critique and use techniques for collecting, organising and representing data.

OUTCOME NOTES

Specific purposes include:

Determining trends in societal issues such as crime and health;
Identifying relevant characteristics of target groups such as age range, gender, socio-economic group, cultural belief, and performance;
Considering the attitudes or opinions of people on issues.

OUTCOME RANGE

Techniques include:

The formulation of questions in surveys to obtain data;

The methods and devices (e.g. tables of random numbers, calculators or computers) used to select random samples;

Different instruments and scales such as yes/no (dichotomous) and 5 point (Liked scales) and discrete and continuous variables;

Evaluation of data gathering techniques and of data collected so that faults and inconsistencies are identified;
Calculating measures of center and spread such as mean, median, mode, range; and variance;
Using scatter plots and lines of best fit to represent the association between two variables;
Correlation.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

1 Situations or issues that can be dealt with through statistical methods are identified correctly.

ASSESSMENT CRITERION 2

2. Appropriate methods for collecting, recording and organising (data are used so as to maximise efficiency and ensure the resolution of a problem or issue.

ASSESSMENT CRITERION 3

3. Data sources and databases are selected in a manner that ensures the representativeness of the sample and the validity of resolutions.

ASSESSMENT CRITERION 4

4. Activities that could result in contamination of data are identified and explanations are provided of the effects of contaminated data.

ASSESSMENT CRITERION 5

5. Data is gathered using methods appropriate to the data type and purpose for gathering the data.

ASSESSMENT CRITERION 6

6. Data collection methods are used correctly.

ASSESSMENT CRITERION 7

7 Calculations and the use of statistics are correct.

ASSESSMENT CRITERION 8

8. Graphical representations and numerical summaries are consistent with the data, are clear and appropriate to the situation and target audience.

ASSESSMENT CRITERION 9

9. Resolutions for the situation or issue are supported by the data and are validated in terms of the context.

SPECIFIC OUTCOME 2

Use theoretical and experimental probability to develop models.

OUTCOME NOTES

Use theoretical and experimental probability to develop models, make predictions and study problems.

OUTCOME RANGE

Performance in this specific outcome includes the requirement to:

Use the laws governing independent, complementary and mutually exclusive events.

Determine theoretical and experimental probabilities.

Use simulations (e.g. six sided spinners, random number generators in calculators or computers) for comparing experimental results (e.g.the rolling of a die) with mathematical expectations.

Compare experimental results with mathematical expectations using probability models.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

1. Experiments and simulations are chosen and/or designed appropriately in terms of the situation to be modelled.

ASSESSMENT CRITERION 2

2. Predictions are based on validated experimental or theoretical probabilities.

ASSESSMENT CRITERION 3

3 The results of experiments and simulations are interpreted correctly in terms of the real context.

ASSESSMENT CRITERION 4

4 The outcomes of experiments and simulations are communicated clearly.

SPECIFIC OUTCOME 3

Critically interrogate and use probability and statistical models.

OUTCOME NOTES

Critically interrogate and use probability and statistical models in problem solving and decision making in real world situations.

OUTCOME RANGE

Performance in this specific outcome includes, the requirement to:

Source and interpret information from a variety of sources including databases.

Manipulate data in different ways to support opposing conclusions.

Evaluate statistically based arguments and make recommendations and describe the use and misuse of statistics in society.

Make inferences about a population on the basis of a sample selected from it.

Make comparisons between predictions and actual occurrences.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

1. Statistics generated from the data are interpreted meaningfully and interpretations are justified or critiqued.

ASSESSMENT CRITERION 2

2. Assumptions made in the collection or generation of data and statistics are defined or critiqued appropriately.

ASSESSMENT CRITERION 3

3. Tables, diagrams, charts and graphs are used or critiqued appropriately in the analysis and representation of data, statistics and probability values.

ASSESSMENT CRITERION 4

4 Predictions, conclusions and judgements are made on the basis of valid arguments and supporting data, statistics and probability models.

ASSESSMENT CRITERION 5

5. Evaluations of the statistics identify potential sources of bias, errors in measurement, potential uses and misuses and their effects.

ASSESSMENT CRITERION RANGE

Effects on arguments, judgements, conclusions and ultimately the audience.

UNIT STANDARD ACCREDITATION AND MODERATION OPTIONS

 This Unit Standard will be assessed by an assessor and moderated by a moderator, registered with the relevant accredited ETQA responsible for the quality assurance of this Unit Standard.

 Any institution offering learning that will enable achievement of this Unit Standard must be accredited as a provider through the appropriate quality assuring ETQA, or Learning Programme approval with an ETQA that has a Memorandum of Understanding with the quality assuring ETQA.

 Verification (external moderation) of assessment and moderation by the provider, will be conducted by the relevant quality assuring ETQA according to the moderation guidelines in the relevant Qualification and the agreed ETQA policy and procedures.

 An individual wishing to be assessed through RPL against this Unit Standard, may apply to an assessment agency or provider institution accredited by the relevant quality assuring ETQA, or by an ETQA that has a formal agreement/accreditation with the relevant quality assuring ETQA.

UNIT STANDARD ESSENTIAL EMBEDDED KNOWLEDGE

The following essential embedded knowledge will be assessed through assessment of the specific outcomes in terms of the stipulated assessment criteria. Candidates are unlikely to achieve all the specific outcomes, to the standards described in the assessment criteria, without knowledge of the listed embedded knowledge. This means that the possession or lack of the knowledge can be inferred directly from the quality of the candidate`s performance against the standards.

Methods for collecting, organising and analysing data

Measures of center and spread

Techniques for representing and evaluating statistics

Randomness, probability and association.

Critical Cross-field Outcomes (CCFO):

UNIT STANDARD CCFO IDENTIFYING

Identify and solve problems using critical and creative thinking:
Solve a variety of problems based on data, statistics and probability.

UNIT STANDARD CCFO COLLECTING

Collect, analyse, organise and critically evaluate information:
Gather, organise, evaluate and critically interpret data and statistics to make sense of situations.

UNIT STANDARD CCFO COMMUNICATING

Communicate effectively:
Use everyday language and mathematical language to represent data, statistics and probability and effectively communicate or critique conclusions.

UNIT STANDARD CCFO CONTRIBUTING

Use mathematics:
Use mathematics to critically analyse, describe and represent situations and to solve problems related to the life or work situations of the adult with increasing responsibilities.