

A Guide to Discovering Statistics

Teaching Approach

This series assumes the learners have knowledge of all the Grade 9 statistics. It is important that you revise this with your class as they may have forgotten important definitions that will be needed for the Grade 10 lessons.

Statistics is a section where a lot of practical tasks can be set for learners. Create lessons where they can collect, analyse and represent data. They could then compare their conclusions in class.

For example, learners must develop a questionnaire and conduct a survey at school. In doing this, they will need to identify the population and choose a random sample that is a fair representation of the entire school. Their surveys must show that they have been unbiased and should not be influenced by their own preferences. After collecting the data, they must organise it using a frequency distribution and then represent the data and make their decision on the results they have analysed. They will need to use the measures of central tendency and distribution to help in this analysis.

Another useful activity is to look at real life situations where statistics have been misused or the collection process was biased. Discuss with your class the reasons someone would want to misuse statistics and how to identify them.

Remember to stress to learners the importance of interpreting and understanding results rather than just focus on calculations. Statistics aid in decision making every day and they need to be discussed in a manner that reflects this.

Video Summaries

Some videos have a 'PAUSE' moment, at which point the teacher or learner can choose to pause the video and try to answer the question posed or calculate the answer to the problem under discussion. Once the video starts again, the answer to the question or the right answer to the calculation is given.

Mindset suggests a number of ways to use the video lessons. These include:

- Watch or show a lesson as an introduction to a lesson
- Watch or show a lesson after a lesson, as a summary or as a way of adding in some interesting real-life applications or practical aspects
- Design a worksheet or set of questions about one video lesson. Then ask learners to watch a video related to the lesson and to complete the worksheet or questions, either in groups or individually
- Worksheets and questions based on video lessons can be used as short assessments or exercises
- Ask learners to watch a particular video lesson for homework (in the school library or on the website, depending on how the material is available) as preparation for the next day's lesson; if desired, learners can be given specific questions to answer in preparation for the next day's lesson

1. Revising Measures of Central Tendency

This lesson revises the definitions and how to calculate measures of central tendency for ungrouped data. This includes the mean, median and mode.

2. Grouping Data

This lesson shows how to group large sets of data in class intervals. It also shows how to write class intervals as inequalities.

3. Central Tendency of Grouped Data

This lesson shows how to find the mean, median and mode of grouped data. This requires slightly different skills to ungrouped data.

4. Introducing Measures of Dispersion

We look at the range, interquartile range, semi interquartile range and discuss percentiles. We touch on the box and whisker diagram to help explain the positioning of the quartiles.

5. Bias in Sample Selection

This lesson illustrates the abuse of statistics. We identify potential sources of bias, errors in measurement, and potential uses and misuses of statistics and its effects.

6. Bias in Surveys

This is an important part in the series that illustrates the abuse of statistics. We identify potential sources of bias, errors in measurement, and potential uses and misuses of statistics and its effects.

7. Misrepresenting Data

This lesson focuses on misrepresented data in advertisements and newspaper articles. It shows the importance of analysing common statements and to be critical of the underlying assumptions.

Resource Material

1. Revising Measures of Central Tendency	https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php	Tutorial on measures of central tendency.
	http://studyjams.scholastic.com/studyjams/jams/math/data-analysis/mean-average.htm	Mean; step by step approach to data analysis plus there are little games and fun activities to be tried.
2. Grouping Data	http://www.mathgoodies.com/lessons/graphs/compare_graphs.html	Comparing statistical graphs: there are printable worksheets, puzzles and maths games in addition to the teaching guides.
	http://www.youtube.com/watch?v=YeiJl5Z30M8&feature=related	Video on how to group data.
	http://www.mindset.co.za/learn/node/57473	Essential terminology and exam tips.
3. Central Tendency of Grouped Data	http://www.emathzone.com/tutorial/basic-statistics/frequency-distribution.html	<i>Mathzone</i> has information on basic statistics as well as definitions and examples.
	http://chandoo.org/wp/2009/06/01/statistical-distributions/	Learn how to use MS Excel to set up frequency distribution tables.
4. Introducing Measures of Dispersion	http://www.mathgoodies.com/lessons/vol8/range.html	The range of a set of data: there are printable worksheets, puzzles and maths games in addition to the teaching guides on this site.
	http://www.education.com/study-help/article/measures-dispersion-numerical-data-answer/	Practice questions on measures of dispersion for data.
5. Bias in Sample Selection	http://www.mathsisfun.com/data/quartiles.html	This site focus on quartiles has printable worksheets and maths games.
6. Bias in Surveys	http://en.wikipedia.org/wiki/Sampling_bias	This offers advanced enrichment on sampling bias.

7. Misrepresenting Data	http://en.wikipedia.org/wiki/Misuse_of_statistics	This Wikipedia link discusses how statics can be misused.
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Task

Question 1

Consider the following results for a class test out of twenty. Calculate the mode, mean and median marks:

10, 11, 11, 12, 12, 12, 14, 14, 14, 16, 17, 18, 18, 19, 20

Question 2

2.1 Lesego wants a mean mark of at least 70% for Math. If she writes 6 tests in total and gets a mean of 61% for the first five tests, what is the minimum mark she must get in the 6th test to get a mean of at least 70%?

2.1 Based on your answer, will she be able to get 70% for the year?

Question 3

The mass in kilograms of sixteen bodybuilders is shown. Work out the estimated mean, estimated median and the modal interval.

Mass	Frequency
$150 < x \leq 155$	3
$155 < x \leq 160$	4
$160 < x \leq 165$	7
$165 < x \leq 170$	2

Question 4

Shown are the percentages of a group of learner's marks for a test.

60 85 55 60 65 65 70 73 75 80 81 85 90 95 85 100 60 81 60 75 70 91 85 64
85 75 100 75 70 90 80 60 90 70

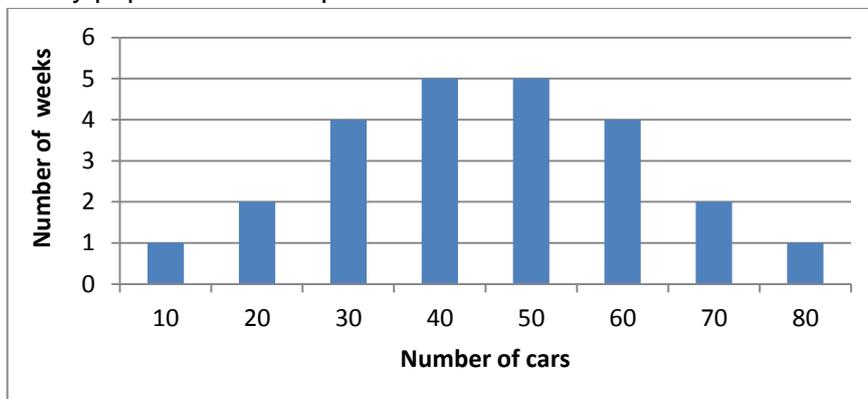
4.1 Is the data discrete or continuous?

4.2 Find the median, lower and upper quartiles and the inter-quartile range.

4.3 Find the 80th percentile and explain what it tells you about the marks.

Question 5

Calculate the five number summary for the bar graph which shows the number of cars sold per week by a very popular dealership.



Question 6

Draw a box and whisker diagram to illustrate the five number summary for the data given:
1; 2; 5; 8; 9; 10; 10; 15; 15; 16; 19; 20; 20; 21; 24

Question 7

State whether the following are True or False and give a reason for your answer:

- 7.1 The median is the 2nd quartile, the 5th decile and the 50th percentile.
- 7.2 The median is the measure of central tendency that is most affected by outliers.

Question 8

Calculate the semi-interquartile range of the data shown:
21; 34; 53; 43; 27; 38; 20; 32; 13; 42; 55

Task Answers

Question 1

10, 11, 11, 12, 12, 12, 14, 14, 14, 16, 17, 18, 18, 19, 20

Mode= 12 and 14 as both occur three times (bimodal)

$$\text{Mean} = \frac{10+11+11+12+12+12+14+14+14+16+17+18+18+19+20}{15} = \frac{218}{15} = 14.53$$

Median = 14 (middlemost number when odd number of data are arranged in ascending order)

Question 2

2.1 Total marks for first five tests = $5 \times 61\% = 305\%$

Total she must get for all six tests to get 70% = $6 \times 70\% = 420\%$

\therefore She needs to get a minimum mark of: $420\% - 305\% = 115\%$

2.2 No she will not be able to get 70 % because she needs to get more than 100% for the last test, which is not possible.

Question 3

Mass	Midpoint (X)	Frequency	f X
$150 < x \leq 155$	152,5	3	457.5
$155 < x \leq 160$	157,5	4	630
$160 < x \leq 165$	162,5	7	1137,5
$165 < x \leq 170$	167,5	2	335
		n=16	= 2560

Mean: $\bar{X} = \frac{\sum(f \cdot X)}{n}$

$$\bar{X} \approx \frac{2560}{16} = 160kg$$

Median $\approx 162,5kg$ median lies in the interval $160 < x \leq 165$

Modal interval: $160 < x \leq 165$ this is the class interval with the highest frequency.

Question 4

4.1 Discrete

4.2 First order the data:

4.3 60 60 60 60 60 64 65 65 70 70 70 70 73 75 75 75 75 80 80 81 81 85 85 85 85
85 90 90 90 91 95 100 100

Median= 75 = 65 = 85 IQR= 20

4.4 Position of the 80th percentile = 0,8 $34 = 27,2 \approx 27$

Therefore the 80th percentile = 85

This means that approximately 80 percent of the marks were less than 85%

Question 5

Min sold = 10

$$= \text{---} = 30$$

M = --- = 45

$$= \text{---} = 60$$

Max sold = 80

Question 6

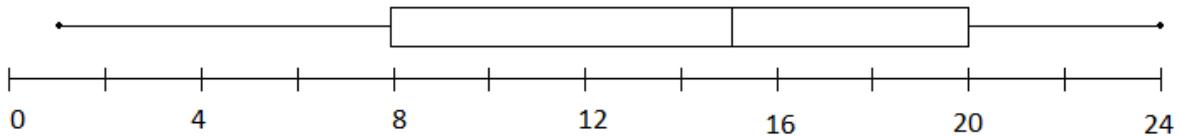
1; 2; 5; 8; 9; 10; 10; 15; 15; 16; 19; 20; 20; 21; 24

The minimum value = 1

Median = 15

The maximum value = 24

The box and whisker diagram:



Question 7

7.1 True:

M = Q_2 Quartiles divide data into quarters and two quarters is equal to one half.

M = 5th decile, deciles divide data into tenths and the 5th decile is in the middle of the data set.

M = 50th percentile, percentiles divide the data into 100's so the 50th percentile is in the middle of the data.

7.2 False:

The mean is the measure of central tendency most affected by outliers because it is calculated by using all the data values.

Question 8

13; 20; 21; 27; 32; 34; 38; 42; 43; 53; 55

Median = 34

Lower quartile = 21

Upper quartile = 43

IQR = 43 - 21 = 22

The semi-interquartile range is half the size of the IQR

$$\text{semi-IQR} = \text{---} = 11$$

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