GRADE 8

Data handling

Class Activity 1

You have been asked to investigate what the favourite sport is of the learners in your school. Think about how you are going to do it, and then answer the following questions about the methods you are going to use:

1) What **data** do you want to collect?
2) How do you **plan** to collect you data? Explain how you would go about it.
3) If you collected data initially as **raw data,** how would you record this data?
4) What form of **data collection could** you use?
    a) Could you have used a **census**? Explain why or why not.
    b) Could you have used a **sample survey**? Explain why or why not.
    c) Could you have used an **experiment**? Explain why or why not.
    d) Could you have used an **observational study**? Explain why or why not.

Class Activity 2

Jane wants to find out what is the favourite sport of children in the Western Cape. She spends a week asking every learner she sees at her school what their favourite sport is. She tallies up the information and decides that Athletics is the favourite sport.

My school			
Favourite sport	**Boys**	**Girls**	**Total**
Athletics	34	25	59
Soccer	39	5	44
Netball	2	30	32
Softball	15	12	27
Cricket	16	4	20
No Favourite sport	10	11	21
Other	8	6	14

She decides to check up on her findings. She goes to the South African Census@School website and finds the following table:

Western Cape			
Favourite sport	**Male**	**Female**	**Total**
Soccer	6 931	775	7 706
Netball	135	5 626	5 761
Athletics	1 957	2 058	4 015
No Favourite sport	722	1 409	2 131
Rugby	1 276	44	1 319
Unspecified	595	476	1 071
Volleyball	293	435	728
Cricket	450	59	509
Dance Sport	80	387	467
Softball	185	281	465

1) How big is Jane's sample?
2) Did Jane take a random sample?
3) Did Jane collect her data in an appropriate way? Explain.
4) What are the top five favourite sports according to Jane's survey?
5) What are the top five favourite sports according to the Census@School table?
6) How does Jane's finding that athletics is the favourite sport in her school compare with the Census@School findings?
7) Is Jane's table representative of the whole of South Africa? Explain.
8) Is the Census@School table representative of the whole of South Africa? Explain.

ORGANISING DATA

Example

A class of Grade 8 students was asked which South African soccer team they support. The results were recorded in the frequency table below using tally marks**.** Complete the table:

Soccer Team	Tally	Frequency
Kaizer Chiefs	𝍸 𝍸 ||	12
Orlando Pirates	𝍸 |||	
Mamelodi Sundowns		10
Cape Town City		
TOTAL		**35**

EXERCISE 1:

Given below are the heights (in centimetres) of 16 Grade 8 boys in a Western Cape school as recorded in the 2009 Census@School:

160, 148, 155, 158, 150, 158, 146, 158, 158, 152, 140, 148, 158, 155, 148, 158

1) Write a list of the boys' heights in ascending order.
2) Which height is the most common?
3) How many learners are shorter than 150 cm?
4) How many learners are taller than 170 cm?

Organizing data

Organise the list of heights (in centimetres) of 15 Grade 8 boys in a Western Cape school given above into a tally table.

Height in cm	Tally	Frequency

STEM AND LEAF DIAGRAM CLASS ACTIVITY 3

The members of your class got the following marks in a mathematics test:

1) Organise the data using a stem and leaf diagram.
2) Write down 3 conclusions you can reach about the marks.

Marks scored in a mathematics test

32	56	45	78	77	59	65	54
54	39	45	44	52	47	50	52
40	69	72	36	57	55	47	33
39	66	61	48	45	53	57	56
55	71	63	62	65	58	55	51

stem	leaf
3	
4	
5	
6	
7	

Grouped Frequency tables: Exercise 2

1) The maths marks of a class of Grade 8 learners are given below.
   a) Copy the following table and use it to organise the marks.

Mathematics Marks
32; 56; 45; 78; 77; 59; 65; 54; 54; 39; 45; 44; 52; 47; 50; 52;
51; 40; 69; 72; 36; 57; 55; 47; 33; 39; 66; 61; 48; 45; 53; 57

Mathematics marks	Tally	Frequency
$30 < m \leq 40$		
$40 < m \leq 50$		
$50 < m \leq 60$		
$60 < m \leq 70$		
$70 < m \leq 80$		

   b) How many learners got 50 or less for the test

2) Lerato wanted to do a survey about the height in metres of learners in her Grade 8 class.

Heights of the Grade 8 learners in metres					
1,82	1,64	1,71	1,86	1,64	1,67
1,73	1,76	1,84	1,52	1,63	1,65
1,80	1,67	1,71	1,64	1,58	1,81
1,67	1,74	1,69	1,56	1,68	1,74
1,79	1,83	1,69	1,58	1,57	1,73

a) Use intervals $1{,}50 < x \leq 1{,}55$; $1{,}55 < x \leq 1{,}60$; etc to draw a grouped frequency table for Lerato's data.

Heights of learners	Tally	Frequency
$1{,}50 < x \leq 1{,}55$		
$1{,}55 < x \leq 1{,}60$		
$1{,}60 < x \leq 1{,}65$		
$1{,}65 < x \leq 1{,}70$		
$1{,}70 < x \leq 1{,}75$		
$1{,}75 < x \leq 1{,}80$		
$1{,}80 < x \leq 1{,}85$		
$1{,}85 < x \leq 1{,}90$		
		30

b) How many learners are taller than 1,75m?

3) In a class in a school in Mpumalanga, Census@School recorded the time that 30 learners spent watching TV in a week. Their answers (to the nearest hour) are given below:

12	20	13	15	22	3
6	24	20	15	9	12
5	6	8	30	7	12
14	25	2	6	12	20
18	3	18	8	9	20

a) Draw a stem and leaf diagram to organise this data.
b) Write down three conclusions about the data.

4) The metro bus company in Durban did a survey to find out how many learners used a particular bus to come to school in town. They counted the number of learners on the bus each time it arrived in town. The numbers are given below:

11	25	60	58	55	16	23	2	44	26
49	8	14	24	7	16	47	5	30	34
9	33	10	21	1	56	32	19	6	1
21	42	9	35	25	55	37	52	15	7
31	25	6							

a) Draw a grouped frequency table to organise the data. You will need to think of appropriate group intervals.

Number of learners on the bus	Tally	Number of buses
0 – 10		
11 –20		
21 –30		
31–40		
41 –50		
51 –60		
TOTAL		

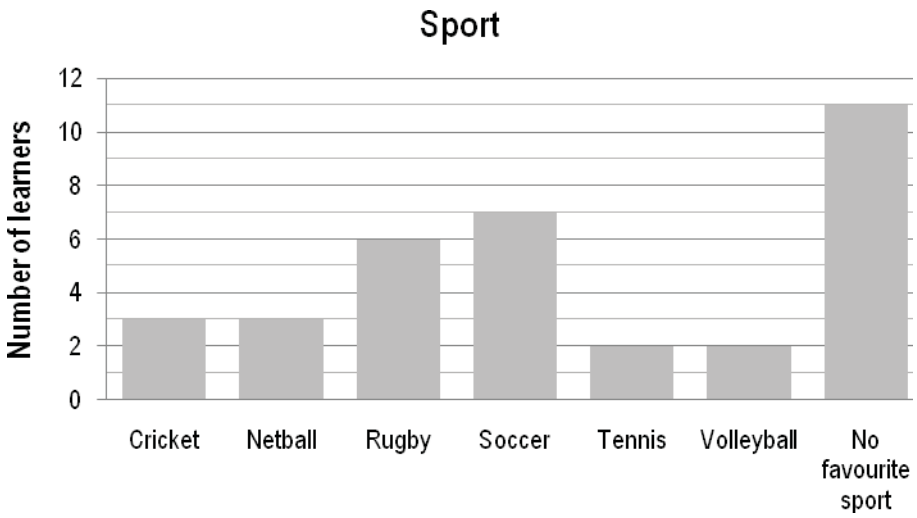
b) Why do you think the bus company might want to know the numbers of learners on the bus?

MEASURE OF CENTRAL TENDANCY:

Class activity 4 Mode

1) The following data set contains the heights of the ten learners in centimetres. 138, 161, 121, 170, 170, 165, 142, 160, 140, 182
   a) Rank the heights from the lowest to the highest.
   b) Which is the smallest height(the shortest learner)?
   c) How many learners are taller than 160 centimetres?
   d) How many learners are 170 centimetres tall?
   e) What height is the mode?

2) Grade 8 learners had to say which sport is their favourite sport at school. The frequency of the learners who selected a particular sport is represented in the bar graph below. Study the graph and answer the questions.



a) How many learners played cricket?
b) How many learners played volleyball?
c) Which category was selected by most learners?
d) Which sport or sports were chosen by the fewest learners?
e) What is the mode category indicated by the learners?

Exercise 3 **Mean**

1) The following data set consists of the ages (in years) of 5 learners:

9, 15, 11, 18,19

a) What is the sum of the ages of the learners?
b) What is mean of the ages?

2) The data set below contains the ages of a few learners in years.

9, 15, 9, 15, 17, 15, 11, 18, 15, 19

a) The ages of how many learners are in this data set?
b) What is the sum of the ages of the learners?
c) What is mean of the ages?
d) What is the mean of the first 5 ages?

3) The following data set contains the heights of learners in centimetres.

138, 161, 121, 170, 170, 165, 142, 160, 140

a) What is the mean height of the learners in this data set? Give your answer correct to 2 decimal places.

b) What is the mean height of the first 6 learners in the data set?

Exercise 4 **Median**

Example

What is the median of each of the following sets of numbers?

a) 1, 7, 9, 4, 3, 5, 8, 3, 2

b) 2, 5, 7, 9, 10, 4, 12, 1, 15, 3

Solution

a) First order (or rank) the numbers in the data set from the smallest to the greatest number:

1, 2, 3, 3, 4, 5, 7, 8, 9

There are 9 items in the data set. The middle item is the number 4.

So the median = 4

b) First order (or rank) the scores from the smallest to the greatest number. The data set looks as follows: 1, 2, 3, 4, 5, 7, 9, 10, 12, 15

There are 10 scores in this data set.

There is not only one score in the middle, but there are two, namely 5 and 7. In this case, you add the two numbers in the middle and divide the sum by two

(2) to calculate the median:

Median = $\frac{5+7}{2} = 6$

NOTE: The median of this data set is 6, although the 6 did not actually appear in the data set.

Exercise 5

1) The following data set contains the ages, in years, of a few learners.

   9, 15, 11, 18, 19

   a) How many ages of learners are in this data set?
   b) Is the number of ages an odd or an even number?
   c) Rank the ages from the smallest to the biggest.
   d) What is the median of the ages?

2) The data set below contains the ages of a few learners.

   9, 15, 9, 15, 17, 15, 11, 18, 15, 19

   a) Describe all the steps that you would take to calculate the median of the ages.
   b) What is median of the ages?

3) The following data set contains the heights of Grade 8 learners in metres.

   1,81; 1,53; 1,6; 1,5; 1,28; 1,65; 1,75; 1,58; 1,13; 1,68; 1,77

   a) Rank the heights of the learners from the smallest to tallest.
   b) How many heights of learners are in this data set?
   c) What is the median height in metres of the learners?

4) Grade 8 learners were asked how long it took them to travel to school. The following data set contains these times (in hours).

   0,50; 0,58; 0,67; 0,75; 0,50; 0,83; 1,00; 1,33; 0,58

   a) Rank the travelling times from the shortest to the longest.
   b) How many travelling times are in this data set?
   c) What is the travelling time of the
      (i) 3^{rd} learner?
      (ii) 7^{th} learner?
      (iii) 8^{th} learner?

d) Which learner(s) travelled 30 minutes to get to school?

e) What is the position of the learner who travels 0,75 hours to get to school?

f) What is the position of the modal travelling time?

g) What is the modal travelling time (in hours)?

5)

a) A data set has 121 ordered data values. In which position will the median be

b) A data set has 502 ordered data values. Explain how you will determine the median's position and how you will calculate the median

6) Thembi makes the following statement. "The median of a data set with 40 ordered data values is in the 20^{th} position." Is this a valid statement? Explain your answer.

MEASURE OF DISPERSION:

Range

The difference between the highest value and the lowest value in a data set is called the range.

Range = highest value – lowest value

Example

Find the range of the following ranked data set: 1, 2, 3, 4, 5, 7, 9, 10, 12, 15

Solution

The lowest value is 1 and the highest value is 15.

So the Range = highest value – lowest value

= 15 – 1

= 14

Exercise 6

1) The following data set contains the ages of a few learners: 9, 15, 11, 18, 19

a) Write the ages in order.

b) What is the highest age?

c) What is the lowest age?

d) What is the difference between the highest age and the lowest age?

e) What is the range of this data set?

2) The following data set contains the ages of a few learners. 9, 15, 9, 15, 17, 15, 11, 18, 15
   a) What is the highest age?
   b) What is the lowest age?
   c) What is the range of this data set?

3) The data set below contains the heights of learners in centimetres.
   138, 161, 121, 170, 170, 165, 142, 160, 140, 182
   a) What is the height of the tallest learner in this data set?
   b) What is the height the shortest learner in this data set?
   c) What is the range of the heights in the data set

4) Learners were asked how many minutes they travelled to school every day.
   They answered as follows: 10, 45, 11, 5, 20, 10, 5, 24
   a) What is the shortest travelling time?
   b) What is the longest travelling time?
   c) What is the range of travelling times?

Extreme values

Extreme values are unexpectedly large or small values in a data set

Example

The lengths (in centimetres) of the right feet of a group of 8-year old learners are:
13, 18, 18, 19, 20, 20, 20, 21, 22, 31
What do you notice about this data set?

Exercise 7

1) A group of learners was asked to say how many minutes it took them to travel to school every day.
   They answered as follows: 45, 5, 20, 50, 13, 15, 18, 15, 90, 5, 15, 25, 15, 4
   a) How many values are in the data set?
   b) Rank the travelling times.
   c) Identify the outliers(s) and say why you think they are outliers.

2) In the Census@School survey, learners had to say how many children in their home were still at school. The results are given in the following table:

Household	Boys	Girls
1	1	1
2	1	1
3	3	1
4	1	2
5	1	1
6	2	0
7	1	2
8	2	1
9	0	0
10	0	1
11	1	2
12	12	1
13	1	3
14	3	3
15	1	4

a) Which household had the highest number of school-going boys?

b) Which household had the highest number of school-going girls?

c)

(i) Which household has the fewest school-going children?

(ii) How many children are school-going in this household?

(iii) How did you determine your answer?

(iv) Is this answer possible?

d)

(i) Which household has the most school-going children?

(ii) How many children are school-going in this household?

(iii) Is this answer possible?

e) Are there any outliers among the boys? Why do you say so?

f) Are there any outliers among the girls? Why do you say so?

3) The heights (in centimetres) of Grade 9 learners are given in the table below:

169	181	145	159	160
171	165	109	168	170
173	176	140	178	155
150	170	162	146	151

a) Rank the heights from shortest to tallest.

b) How many heights are in the data set?

c) What is the modal height?

d) What is the median of the heights?

e) What is the mean of the heights of the learners?

f) What is the range of the heights?

g) Identify an outlier in the data.

h) Delete the outlier value from the data and recalculate the mean of the data to 1 decimal place. What do you notice about the original mean and the new mean?

i) Did the mode and the median change when you deleted the outlier?

Probability

Example

Suppose you throw a fair die.

1) List all the possible outcomes
2) List the favourable outcomes for the event
   a) Getting a 4
   b) Getting an even number

Solution

1. The possible outcomes are 1, 2, 3, 4, 5 and 6
2. a) The favourable outcome of "getting a 4" is 4
   b) The favourable outcomes of "getting an even number" are 2, 4 and 6

Class Activity 1

1) Randomly select a card from the following five cards.

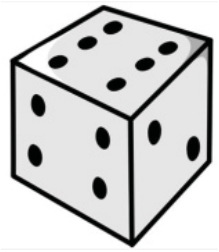
M	A	T	H	S

   a) List all the possible outcomes.
   b) List all the favourable outcomes for the following events:
   Event G: Getting a T
   Event H: Getting a vowel
   Event J: Getting a consonant

2) Randomly select a card from this "hand" of cards.
   a) List all the possible outcomes.
   b) List all the favourable outcomes for the following events:
   Event K: Getting a 7
   Event L: Getting a heart
   Event M: Getting a picture card
   Event N: Getting a diamond.



Example 1



An ordinary die is rolled. What is the probability of getting:

a) a 6?
b) an odd number?
c) a 2 or 3?

Solution

The possible outcomes on an ordinary die are: 1; 2; 3; 4; 5; and 6. The total number of possible outcomes is 6.

a) The favourable outcome is 6. The number of favourable outcomes is 1.

$P(6) = \frac{1}{6} \approx 0,17 \approx 16,7\%$

b) The favourable outcomes are 1; 3 and 5. The number of favourable outcomes is 3.

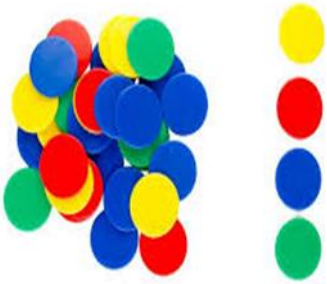
$P(\text{even}) = \frac{3}{6} = \frac{1}{2} \approx 0,5 \approx 50\%$

c) The favourable outcomes are 2 and 3. The number of favourable outcomes is 2.

$P(2 \text{ or } 3) = \frac{2}{6} = \frac{1}{3} \approx 0,33 \approx 33,3\%$

Exercise 1

1) A bag contains a red counter, a blue counter and a green counter. A counter is taken from the bag at random.



a) What are the possible outcomes?
b) What is the probability of taking:
   (i) A red counter?
   (ii) A red or green counter?
   (iii) A counter that is not blue?
   (iv) A pink counter?

2) A bag contains 3 red sweets and 7 green sweets. A sweet is taken from the bag at random.

a) What are the possible outcomes?
b) Are you more likely to get a red or green sweets?
c) What is the probability of taking:
   (i) A red sweet?
   (ii) A green sweet?

3) This fair spinner is used in a game. The player spins the arrow.



a) What are the possible outcomes?

b) What is the probability that the arrow:

(i) will land on 3?

(ii) will land on 2 or 5?

4) The letters of the word PROBABILITY are written on separate cards of the same size.

The cards are shuffled and dealt, face down, onto a table. A card is selected at random.

a) What are the possible outcomes?

b) What is the probability that the card shows:

(i) The letter T?

(ii) The letter B?

5) A card is randomly taken from a full pack of 52 playing cards with no jokers.

- Diamonds and Hearts are red cards
- Clubs and Spades are black cards
- The Ace is the same as the number 1
- The picture cards are Jack, Queen and King.

What is the probability that the card that is taken is:

a) A red card?

b) A heart?

c) The Ace of hearts?

6) A bag contains 4 red counters, 3 white counters and 3 blue counters. A counter is taken from the bag at random.

a) How many possible outcomes are there?

b) What is the probability that the counter is:

(i) Red?

(ii) White or blue?

(iii) Red, white or blue?

(iv) Green?

Exercise 2

1) In an experiment a gardener planted 40 daffodil bulbs. 36 of these daffodil bulbs produced flowers.
Use these results to find the relative frequency that a daffodil bulb will produce a flower.



Use the formula

$$\text{Relative frequency} = \frac{\text{Number of bulbs producing flowers}}{\text{Total number of bulbs planted}}$$

2) 

Thandi keeps a record of her chess games with Helen. Out of the first 30 games, Helen wins 21 games.

a) Use the results to work out
   (i) the relative frequency that Helen wins

   Use the formula:

$$\text{Relative frequency} = \frac{\text{Number of games won by Helen}}{\text{Number of games played}}$$

   (ii) the relative frequency that Thandi wins

b) Use the two relative frequencies to predict whether Thandi will win her next game of chess with Helen.

3) The results of games of chess played by four children at a chess club are shown in this table.

Player	Games won	Games drawn	Games lost
Alfred	4	2	6
Busi	8	1	7
Fikile	3	0	1
Pieter	9	2	9

a) Calculate the number of games that each player plays.

b) Calculate the relative frequency of a win for each player. Use the formula:

$$\text{Relative frequency of a win} = \frac{\text{Number of games won}}{\text{Number of games played}}$$

c) If Alfred plays Pieter, who do you think is more likely to win? Explain your answer.