

# Grade 10 Mathematics Lesson Plan

## Mean (Grouped)

<b>Strand:</b>	<b>Statistics and Probability</b>
<b>Sub-Strand:</b>	Grouped Data
<b>Specific Learning Outcome:</b>	Determine mean, mode and median of grouped and ungrouped data
<b>Duration:</b>	40 minutes
<b>Key Inquiry Questions:</b>	What is statistics? How do we represent data? How do we use statistics in day to day life?
<b>Learning Resources:</b>	CBC Grade 10 textbooks, calculators, chart paper, markers

### Phase 1: Problem-Solving and Discovery (15 minutes)

#### Anchor Activity: Pocket Money Analysis

**Objective:** Students work in groups to calculate the mean of grouped data by discovering the midpoint concept and the formula  $\bar{x} = \Sigma fx / \Sigma f$ .

Work in groups to analyze the following scenario:

The table below shows the amount of pocket money, in shillings, that parents give to students per week.

Pocket Money (Ksh)	Number of students
100–199	8
200–299	15
300–399	22
400–499	20
500–599	10

Tasks:

- 1. Determine the midpoint for each class interval. (Hint: Midpoint = (Lower + Upper) / 2)
- 2. Calculate the mean of pocket money given to students per week.

Discussion prompts for teachers:

- Can we find the exact mean since we don't have individual values?

- What value can we use to represent all students in the 100–199 range?
- How do we combine the midpoints with the frequencies?
- What does the mean tell us about typical pocket money?

## Phase 2: Structured Instruction (10 minutes)

### Key Takeaways

#### 1. What is Grouped Data?

Grouped data is data that has been organized into classes or intervals together with their frequencies. Instead of listing every single value, the observations are arranged into groups to make large data sets easier to analyze.

#### 2. Formula for Mean (Grouped Data)

$$\bar{x} = \Sigma fx / \Sigma f$$

Where:

- $x$  = Midpoint of the class interval
- $\bar{x}$  = the mean (pronounced "x-bar")
- $\Sigma fx$  = sum of the products of midpoint and frequency
- $\Sigma f$  = sum of frequencies (total number of data points)

#### 3. Midpoint Formula

$$\text{Midpoint} = (\text{Lower boundary} + \text{Upper boundary}) / 2$$

The midpoint is the average of the lower and upper boundaries of a class interval.

Example: For interval 100–199, Midpoint =  $(100 + 199) / 2 = 149.5$

#### 4. Step-by-Step Process

1. Step 1: Create a calculation table with columns: Class Interval, Midpoint ( $x$ ), Frequency ( $f$ ),  $fx$
2. Step 2: Calculate midpoint for each interval using  $(\text{Lower} + \text{Upper}) / 2$
3. Step 3: Multiply midpoint by frequency to get  $fx$
4. Step 4: Sum all frequencies:  $\Sigma f$  (total number of data points)
5. Step 5: Sum all  $fx$  values:  $\Sigma fx$  (total of all products)
6. Step 6: Apply the formula: Mean =  $\Sigma fx / \Sigma f$
7. Step 7: Verify that  $\Sigma f$  equals total number of observations

#### 5. Important Note

**The mean from grouped data is an ESTIMATE, not an exact value.**

We assume all values in an interval are at the midpoint. This is why the answer is approximate.

### Phase 3: Practice and Application (15 minutes)

#### Worked Example 3.1.43 (Employee Salaries)

Problem: A company records the monthly salaries (in KES) of 50 employees in a frequency distribution table below. Calculate the mean salary.

Salary Range (KES)	Number of Employees
20,000 – 29,999	3
30,000 – 39,999	5
40,000 – 49,999	7
50,000 – 59,999	10
60,000 – 69,999	9
70,000 – 79,999	6
80,000 – 89,999	5
90,000 – 99,999	3
100,000 – 109,999	2

#### Solution:

To calculate the mean, we first find the midpoint (x) of each class and multiply it by the frequency (f).

Salary Range (KES)	Midpoint (x)	Frequency (f)	fx
20,000 – 29,999	25,000	3	75,000
30,000 – 39,999	35,000	5	175,000
40,000 – 49,999	45,000	7	315,000
50,000 – 59,999	55,000	10	550,000
60,000 – 69,999	65,000	9	585,000
70,000 – 79,999	75,000	6	450,000
80,000 – 89,999	85,000	5	425,000
90,000 – 99,999	95,000	3	285,000
100,000 – 109,999	105,000	2	210,000
Total		$\Sigma f = 50$	$\Sigma fx = 3,070,000$

Calculation:

$$\bar{x} = \Sigma fx / \Sigma f = 3,070,000 / 50 = 61,400$$

**Therefore, the mean salary is 61,400 KES.**

## Phase 4: Assessment (5 minutes)

### Exit Ticket

1. A tea factory recorded the weight of tea leaves (in kg) delivered by 40 small-scale farmers in a single morning.

Weight (kg)	Frequency (Farmers)
10 – 19	5
20 – 29	8
30 – 39	15
40 – 49	10
50 – 59	2

Calculate the mean weight of tea leaves delivered per farmer.

2. A Sacco operating on the Nairobi-Thika route recorded the fares paid by passengers during peak hours on a rainy day.

Fare (KES)	No. of Passengers
50 – 99	20
100 – 149	45
150 – 199	30
200 – 249	5

Determine the mean fare paid by the passengers.

## Differentiation Strategies

### For Struggling Learners:

- Provide pre-filled calculation tables with midpoint column already completed.
- Use smaller datasets (3-5 intervals) to build confidence.
- Provide step-by-step worksheets with guided practice.
- Allow use of calculators for all calculations.
- Work in pairs with peer support.
- Provide formula cards as reference.
- Use simpler numbers (avoid large values like salaries).

### For Advanced Students:

- Explore datasets with more intervals (10-15 classes).
- Compare mean from grouped data vs ungrouped data to see estimation error.
- Investigate how changing class width affects the mean estimate.
- Calculate mean, median, and mode for the same grouped dataset.

- Research real-world applications: census data, economic indicators, quality control.
- Create their own grouped datasets from real data and calculate mean.

### Extension Activity: Comparing Grouped vs Ungrouped Mean

Scenario: Explore how grouping affects mean calculation accuracy.

Ungrouped Data: Test scores of 20 students:

45, 48, 52, 55, 58, 62, 64, 67, 68, 70, 72, 73, 75, 78, 80, 82, 85, 88, 90, 93

Tasks:

1. Calculate the exact mean using ungrouped data formula:  $\text{Mean} = \Sigma X / N$
2. Group the data into intervals: 40–49, 50–59, 60–69, 70–79, 80–89, 90–99
3. Create a frequency distribution table with midpoints
4. Calculate the mean using grouped data formula:  $\bar{x} = \Sigma fx / \Sigma f$
5. Compare the two means. How close are they? What is the difference?
6. Discuss: Why is there a difference? Which is more accurate? When would we use grouped data?

Expected Findings:

- Ungrouped mean: Exact value calculated from all 20 scores
- Grouped mean: Estimate based on midpoints
- Small difference between the two (usually 1-3 points)
- Difference comes from assuming all values in interval are at midpoint
- Ungrouped is more accurate but impractical for large datasets
- Grouped is practical for hundreds/thousands of data points
- Real-world: We accept small estimation error for convenience