UNIVERSITY OF JOHANNESBURG

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| **FACULTY** | : Education |
| **DEPARTMENT** | : Childhood Education |
| **CAMPUS** | : SWC |
| **MODULE** | : MPMATB3<br>:Teaching Methodology and Practicum for Mathematics |
| **SEMESTER** | :Second |
| **EXAM** | :November 2019 |

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|---|---|---|---|
| **DATE** | : | **SESSION** | |
| **ASSESSOR(S)** | : Prof C Long & Dr K Fonseca | | |
| **DURATION** | : 2 HOURS | **MARKS** | : 100 |

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NUMBER OF PAGES: 6 PAGES

INSTRUCTIONS:

1. Answer ALL THE QUESTIONS.
2. Number your answers clearly.
3. Each question should take approximately 20 minutes.

**QUESTION 1: Dimensions for understanding mathematics**

1.1 Usiskin (2015) describes five dimensions for understanding mathematics from a learner's perspective. The first is the Skills-Algorithm dimension.

1.1.1 Describe the Skills-Algorithm dimension, and provide an example from within the *fractions domain* that illustrates this dimension. (4)

1.1.2 Give an example from the *number domain* to illustrate the Property-Proof dimension. (2)

1.1.3. In a textbook, the question states:

*Mrs Khumalo buys rice for the month of November. She estimates that for a family of four, she needs .250g per day. She works out how many kilograms she needs for the month.*

What dimension of understanding is the question drawing on? Give a reason for your answer. (2)

1.1.4 List the remaining two dimensions.

Explain how they can be applied to the problem in 1.1.3 (4)

**[12]**

**QUESTION 2: Reform Mathematics Education**

2.1 The *reality principle in Realistic Mathematics Education* aims at enabling students to apply mathematics. However, this application of mathematical knowledge is not only something that takes place at the end of a learning process, but also at the beginning. Rather than **starting with procedures, formulae or definitions to be applied later (Scenario 1), one must start with rich contexts that require mathematical organisation (Scenario 2).**

2.1.1 Give an example that illustrates each scenario. (6)

2.1.2 Describe the advantages, or disadvantages, of each scenario. (6)

2.2 According to the theory of conceptual fields, mathematical proficiency is developed through **encountering situations or problems that are carefully designed for the purpose of learning**. These constructed situations serve two purposes, the first is to illustrate a concept by providing a context, at the cognitive level of the child, and the second is to expand the existing conceptual structures of the child through extending the complexity of the mathematical situation beyond the child's current level of mastery (Long, 2011)

2.2.1 Rewrite this statement in your own words. [6]

2.2.2 Explain the two purposes with reference to "The Mealie Project". [6]

**[24]**

**QUESTION 3: Transition from number to variable**

3.1 Transition from number (arithmetic) to algebra is challenging for many children, as it requires them to make many adjustments. Kieran (2004) proposed five adjustments children need to make to transition from arithmetic to algebra. Name the five adjustments. (5)

3.2 "Adding three consecutive numbers together will always result in a number that is a multiple of 3".

Illustrate how you will use representations in a lesson in which you will teach the above mathematical task by:

3.1.1 Using a picture or a diagram to show that this statement is true. (3)

3.1.2 Using only symbols to prove the above statement is true. (3)

3.3 Explain why the sum of four consecutive numbers will always be even. (2)

**[13]**

**QUESTION 4: Transition from whole number to rational number**

4.1 Rational numbers differ from whole numbers in two important respects. List and explain two special properties of rational number. (4)

4.2 The symbol $\frac{3}{4}$ has many different meanings. Give an example for each of **two different meanings**. (6)

4.3 Children have numerous misconceptions about fractions. For instance, they think that a fraction such as $\frac{1}{5}$ is smaller than a fraction such as $\frac{1}{10}$ because 5 is less than 10. Conversely, children may be told the reverse – the bigger the denominator, the smaller the fraction.

4.3.1 Explain what are the implications for teaching such rule when teaching fractions. Give an example. (3)

4.3.2 Discuss how you would assist learners in comparing the magnitude of two or more fractions, using concrete manipulatives and representations. (3)

4.4 A Grade 6 class solved the problem: $2\frac{3}{5} - \frac{3}{4}$.

Two learners solved the problem differently.

| Carol | | Sipho | |
|---|---|---|---|
| | $2\frac{3}{5} - \frac{3}{4}$ | | $2\frac{3}{5} - \frac{3}{4}$ |
| | $= 2\frac{12}{20} - \frac{15}{20}$ | | =2.60 – 0.75 |
| | $=1\frac{17}{20}$ | | =1.85 |

Explain two methods of testing whether the answers are equivalent. (4)

4.4 Fractions, decimals and percentages:

4.4.1 Write twenty five-hundredths in decimal and percentage form. (2)

4.4.2 Compare decimal fractions and percentages. What have they in common and what is different? (4)

4.5 Some learners generally believe that a longer decimal is larger than a shorter decimal, and would select, for example, 3.63 as being larger than 3.8 because it is longer.

4.5.1 Explain a possible cause for this misconception. (2)

4.5.2 Explain how you would address this misconception so that learners can overcome it. Give practical mathematical examples. (3)

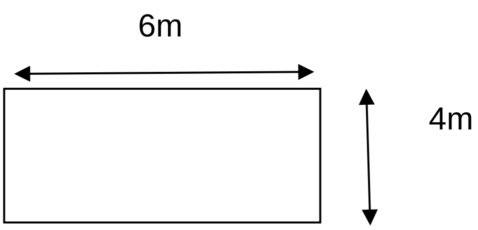
**[31]**

## QUESTION 5: Measurement

5.1. About 60 years ago South Africa changed from using miles to measure long distances, and yards, feet and inches to measure smaller distances, to the metric system. What are the advantages of using the metric system? (2)

5.2 The United States of America and the United Kingdom still use Customary Units, for example miles, and pounds. What could be a reason for not using the metric system? (2)

5.3 Palesa was asked to calculate the perimeter in the following activity:




5.3.1 Palesa gave the following answer: Perimeter = 24m. Explain what you would do to help children avoid making these errors. (3)

**[8]**

## QUESTION 6: Data handling and probability

6.1 Jane tossed a dice 60 times. Her results are shown in the table below.

6.1.1 Calculate the relative frequency for each of her results. (3)

6.1.2 Convert the fraction in the third column to a percentage. (3)

6.1.3 The total of the columns for i) relative frequency, and ii) percentage should be

i) ______ and ii) _________. (2)

| Number | Frequency | Relative frequency | Percentage |
|---|---|---|---|
| 1 | 12 | | |
| 2 | 15 | | |
| 3 | 12 | | |
| 4 | 10 | | |
| 5 | 5 | | |
| 6 | 6 | | |
| Total | | | |

6.2 Bibi says there is something wrong with these results. All six numbers should have the same answer.

Explain to Bibi about theoretical probability, and the relative frequency of empirical outcomes? (4)

**[12]**

**Total [100]**