UNIVERSITY OF JOHANNESBURG

FACULTY	:	Education
DEPARTMENT	:	Science and Technology Education
CAMPUS	:	APK
MODULE	:	CURRENT ISSUES IN MATHEMATICS EDUCATION (HCIME0Y)
SEMESTER	:	Second
EXAM	:	November 2020

ASSESSOR(S)	:	DR V RAMDHANY		
MODERATOR	:	PROF S BANSILAL (UKZN)		
DURATION	:	SUBMISSION	**MARKS**	: 100

NUMBER OF PAGES: 6

INSTRUCTIONS:

1. Answer ALL the questions.
2. Number your answers exactly as they appear in this question paper.
3. Use Arial font, font size 12 and 1.5 line spacing.
4. Please submit your answer sheet under “Assessments” on Blackboard.
5. Each question is accompanied by readings (literature sources).
6. You are also encouraged to refer to your learning guide as an additional source.
7. Attach the reference list.

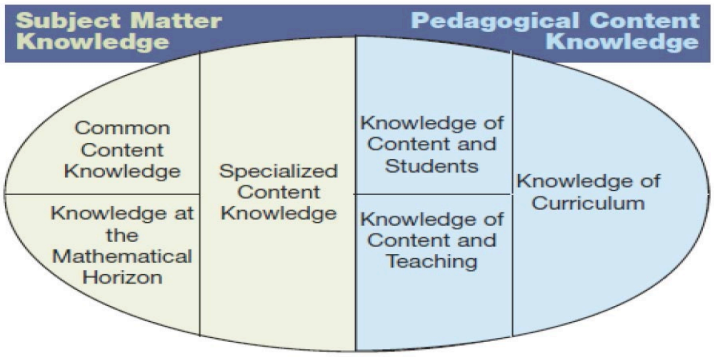
QUESTION 1: Teacher knowledge and PCK

Readings:

Shulman, L.S. (1986). Those Who Understand: Knowledge Growth in Teaching. *Educational Researcher*, *15*(2), pp. 4-14.

Ball, D.L.; Thames, M.H.; & Phelps, G. (2008). Content knowledge for teaching: What makes it so special? *Journal of Teacher Education, 59*(5), 389–407.

Shulman (1986) conceptualised pedagogical content knowledge (PCK) as a special kind of knowledge for teaching and which only teachers need to have. Ball, Thames and Phelps (2008) used Shulman's PCK as the foundation for their mathematical knowledge for teaching (MKT) framework. Their famous 'egg diagram' is seen here:



1.1 What was Shulman's motivation for his concept of PCK? In your answer, refer to his notion of "missing paradigm". (5)

1.2 Examine Ball et al.'s (2008) PCK categories and discuss how they have expanded on Shulman's original definition. (12)

1.3 As a mathematics teacher, it is important to know how to identify learners' errors and address their misconceptions. Explain which of Ball et al.'s (2008) categories address this type of teacher's knowledge, and how. (8)

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QUESTION 2: Theories of teaching mathematics

Reading:

Barnes, H. (2004). Realistic mathematics education: Eliciting alternative mathematical conceptions of learners. *African Journal of Research in Mathematics, Science and Technology Education*, *8*(1), 53–64.

According to CAPS (p. 8), "*Real life problems should be incorporated into all sections whenever appropriate. Examples used should be realistic and not contrived. Contextual problems should include issues relating to health, social, economic, cultural, scientific, political and environmental issues whenever possible*."

This extract makes reference to realistic mathematics education, or RME, which was conceptualised by Hans Freudenthal in the Dutch tradition and which advocates for organising or mathematising subject matter, taken from reality.

2.1 Discuss RME theory critically, by focusing on the extract and using the following points to guide you:

a) What the theory means, in your own words; (5)

b) The three principles undergirding RME; and (15)

c) The benefits of using RME when teaching mathematics (5)

[25]

QUESTION 3: Assessment in mathematics

Readings:

Bohlmann, C. A., Prince, R. N., & Deacon, A. (2017). Mathematical errors made by high performing candidates writing the National Benchmark Tests. *Pythagoras,38*(1), 1-10.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of educational research*, *77*(1), 81-112

The following extract is taken from the CAPS document:

"Assessment should be both informal … and formal …. In both cases, regular feedback should be provided to learners to enhance the learning experiences".

(CAPS, 2011, p. 51)

3.1 Discuss the extract critically, by focusing on the following:

a) What is the difference between formative and summative assessments? (6)

b) Which, in your opinion, is more important in mathematics teaching and learning: formative or summative assessment? Provide reasons for your choice. (5)

c) The value of feedback in enhancing learner understanding. (4)

3.2 When asked to simplify an algebraic expression, a learner presented the following answer:

$$\frac{10 + 4x}{2x} = 10 + 2x$$

Analyse the learner's answer fully by using the following guiding points:

a) What steps did the learner take to arrive at the answer? (5)

b) Discuss, with motivation, whether you think this was an careless error, or whether this learner has a misconception. (5)

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QUESTION 4: Teacher reflection

Reading:

Thompson, N., & Pascal, J. (2012). Developing critically reflective practice. *Reflective Practice, 13*(2), 311-325.

This has been a difficult year for teachers and learners, especially with the move to an online mode of teaching and learning. It has therefore been extremely important for teachers to reflect deeply on the factors which impact their practice and learners' performance.

4.1 Provide a definition of teacher reflection. (3)

4.2 Schön (1983) distinguished between reflection *in* action and reflection *on* action, while Thompson and Thompson (2008) argue for *breadth* and *depth* of reflection. Discuss each of these different types of teacher reflection, by highlighting their advantages for teachers. (12)

4.3 Read through the following scenario titled Peter's failed lesson. Use the four (4) types of reflection in question 4.2 above to analyse the scenario and offer some advice to Peter on how to improve his lesson. (10)

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Scenario

Peter's failed lesson

Peter had a well-prepared lesson plan to teach the Grade 8 Natural sciences class how electricity works. He arrived for his lesson with all his notes and knew exactly what he was going to say.

"We are going to earn how electricity works and how to build an electric circuit. It is not difficult to build an electric circuit , as long as you follow the rules and the step-by-step guide, which we are now going to go through."

All the learners looked at him expectantly, which he took as a good sign. "Yes, they are all interested…"

"First, you need a cell and a conductor. You can take a battery and a light bulb out of a torch and use the conducting wires to make a circuit."

Peter carried on with his explanations and all the learners were jotting down notes.

"This is really going well. The learners are interested and they seem to be following my explanations."

"Are there any questions?"

No one had any questions, and Peter, confident that everybody had understood his clear explanations, concluded the class: "As homework, just follow these steps and rules, and draw a series of parallel electric circuits."

On his way out, Peter was walking behind two of the learners who were talking among themselves without noticing that Peter could overhear them: "Busi, did you understand anything of what the teacher said about electricity? I have no idea what he was saying, and I cannot do my homework. May I come to your house this afternoon and we can do it together?" "Well, I didn't understand anything either. I think my older brother may be able to explain it to me. Or maybe your father? I have no idea what to do."

(Gravett and De Beer, 2015).