Appendix – the questionnaire (condensed)

Engineering students' mathematical views and performance in mathematics

1. Introduction

This questionnaire is related to a study to be carried out at the Universities of X, Y, and Z, and it aims at surveying engineering students' views of mathematics and how they are related to their performance in solving mathematical problems.

It is important that you try to answer the following questions as thoroughly as possible. Including this introduction, the questionnaire contains four different sections on four pages. In each section, we ask you kindly to read the given instructions carefully. For further information, please do not hesitate to contact us.

Thank you very much for participating in our study!

(Authors' names)

2. Background information

2.1. Your gender: ☐ Female ☐ Male ☐ Other/I do not want to answer

2.2. How many years is it since you last studied mathematics? _____

2.3. Is your mathematical background from secondary school (R1+R2) or from a precourse in mathematics?

☐ Secondary school ☐ Precourse

2.4. What is your study programme?

_____

Indicate how much you agree with the following statements.

	1=strongly disagree	2=disagree	3=not disagree, not agree	4=agree	5=strongly agree
2.5. In school, I was good in mathematics.					
2.6. In school, I was able to understand the most of it what was expected from us in mathematics.					
2.7. I really like studying mathematics.					
2.8. I am motivated to study mathematics mostly because it is useful to my other studies.					
2.9. I want to succeed as well as possible in my mathematics studies.					
2.10. I would be ready to suspend my hobbies in order to have enough time to prepare myself for exams in mathematics.					
2.11. I could do extra exercises to guarantee that I succeed well in mathematics exam.					
2.12. Even if it was not compulsory I would study mathematics because every engineer must know some mathematics.					
2.13. If I pass a mathematics course with a low grade, I want to take the exam again.					
2.14. Mathematics is full of interesting problems and results.					

3. Your views of what mathematics is

Spend a minute on reflecting what is essential in mathematics, or how the essence of mathematics could be described in short, and then answer how much you agree with the following statements.

	1=strongly disagree	2=disagree	3=not disagree, not agree	4=agree	5=strongly agree
3.1. A very important feature of mathematics is that it can be used to describe real world.					
3.2 It is not mathematics if it cannot be proved theoretically in an exact way.					
3.3. Mathematics is a collection of formulas and concepts.					
3.4. Mathematics is solving problems.					
3.5. The purpose of mathematics is to maintain functionality in the society and improve people's life.					
3.6. Mathematics is discovering structures and regularities.					
3.7. The main task of mathematics is to give the correct rules for calculations.					
3.8. A very important feature of mathematics is that all concepts are defined in a precise and clear way.					

3.9. Below there is four different metaphors to describe what mathematics is. Choose one (and only one) that fits best with your ideas.

Toolbox	Applications	Problem solving	Exact reasoning

4. Some exercises

4.1: A store has a 40% off sale on headphones. With this discount, the price of one pair of headphones is NOK/SEK 360. What is the original price of the pair of headphones?

4.2: Simplify $\frac{3x^2-5x+2}{x^2-1}$.

4.3: Simplify $(2a^3)^3 - 3(a^2)^3$.

4.4. Suppose that sequence (a_n) satisfies the rule $a_{n+1} = 2a_n + 1$ (i.e. the next element equals two times the previous element plus one) for all $n = 1,2,3,\cdots$. Is it increasing? Explain why.

4.5. In a medical test, a researcher studies a sample of a fluid daily and finds out that a number N of bacteria in a nanolitre of the fluid follows the formula
$$N(x) = \frac{4x^3}{2^x},$$
where x is the number of the days the medicine has been applied on the fluid. Explain whether the medicine is effective against the bacteria or not.

4.6. Define what it means if a given function is decreasing. Explain why the function
$$f(x) = -3x^2 - 1,$$
is decreasing. Here $D_f = \mathbb{R}^+$ (i.e. the domain of f is the set of positive numbers).

4.7. Is it possible to find an increasing or decreasing function f such that its values (i.e. values of $f(x)$) are between -1 and 0 whenever the value of the variable x is an odd number? Explain your answer.