

# Philosophy Theme 2 Paper – Philosophy of Mathematics

“Mathematics may be defined as the subject in which we never know what we are talking about, nor whether what we are saying is true.” Bertrand Russell (1917)

Mathematics is a rather special area of knowledge. On the one hand it seems to supply a certainty often missing in other disciplines. On the other, its methods—for example, the application of strict logical procedures to supposedly self-evident first principles—suggest a subject matter that is removed from the real world. It is hardly surprising then to find a variety of responses to mathematical knowledge, from astonishment at the beauty of some mathematical argument, to wonder at the power of mathematics to solve problems in the sciences or engineering, to frustration in the face of apparently meaningless symbols manipulated as part of a pointless game.

What is unarguable is the ability of mathematics to yield important knowledge about the world, often in conjunction with other areas of knowledge. Why mathematics should be so successful in this regard rests upon a number of questions concerning the nature of mathematics itself and its relation to the world and to human intelligence. Some mathematicians argue that their subject is a language, that it is, in some sense, universal or that there is great beauty to be found in it. What is clear, in any case, is that mathematics is a rich area of exploration.

In a well-constructed, typed essay of between 1,200-1,500 words, select, discuss, and evaluate one of the following questions concerning the philosophy and relevance of mathematics as it relates to knowledge. In your paper you must:

- **select** one of the following questions concerning the philosophy of mathematics
  - **interview** one mathematics teacher on campus regarding your question (this interview may count toward the word limit (but no more than 500 words) – be sure to include the questions and responses in your paper)
  - **evaluate** the relevance of your question as it relates to the nature of knowledge itself
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## **Nature of mathematics**

- Why is it that some mathematicians and students of mathematics feel that mathematics is in some sense “already there” to be discovered?
- Some educational systems make a distinction between pure mathematics and applied mathematics. Does this reflect a fundamental difference in approach to mathematical knowledge?
- It is sometimes said that mathematical reasoning is a process of logical deduction. If this is true, and if the conclusion of a proof must always be implied by (contained in) its premises, how can there ever be new mathematical knowledge?

## **Mathematics and the world**

- We can use mathematics successfully to model real-world processes. Is this because we create mathematics to mirror the world or because the world is intrinsically mathematical?
- Some major advances in physics, for example, discoveries of elementary particles, have come about through arguments involving the beauty, elegance or symmetry of the underlying mathematics. What does this tell us about the relationship between the natural sciences, mathematics and the natural world?
- Is mathematics better defined by its method or by its subject matter?
- Is mathematics invented or discovered?

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## **Mathematics and knowledge claims**

- What do mathematicians mean by mathematical proof, and how does it differ from good reasons in other areas of knowledge?
- What are the roles of empirical evidence and inductive reasoning in establishing a mathematical claim?
- Are all mathematical statements either true or false?
- Can a mathematical statement be true before it has been proven?
- It has been argued that we come to know the number 3 through examples such as three oranges or three cups. Does this support the independent existence of the number 3 and, by extension, numbers in general? If so, what of numbers such as 0, -1,  $i$  (the square root of -1) and a trillion? If not, in what sense do numbers exist?

## **Mathematics and the knower**

- Can mathematics be characterized as a universal language?
  - To what extent is mathematics a product of human social interaction?
  - Why is it that mathematics is considered to be of different value in different cultures?
  - How would you account for the following features that seem to belong particularly to mathematics: some people learn it very easily and outperform their peers by years; some people find it almost impossible to learn, however hard they try; most outstanding mathematicians supposedly achieve their best work before they reach the age of 30?
  - What counts as understanding in mathematics? Is it sufficient to get the right answer to a mathematical problem to say that one understands the relevant mathematics?
  - Are there aspects of mathematics that one can choose whether or not to believe?
  - What is the role of faith in mathematics?
  - Do the terms “beauty” or “elegance” have a role in mathematical thought?
  - How have technological innovations, such as developments in computing, affected the nature and practice of mathematics?
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