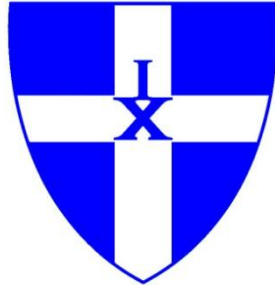


# THE KING'S SCHOOL, CANTERBURY



## SCHOLARSHIP ENTRANCE EXAMINATION

**February 2012**

### **MATHEMATICS 1**

**Time: 45 minutes (plus reading time)**

*Use the reading time wisely; gain an overview of the paper and start to think of how you will answer the questions.*

*Do as many questions as you can (clearly numbered) on the lined paper provided. Clearly name each sheet used. You are encouraged to attempt these questions in order.*

*The questions are not of equal length or mark allocation. Make sure you avoid spending too much time on any one question; don't get bogged down! Move on quickly if you get stuck. The paper is quite long; you are not necessarily expected to finish everything.*

*Some of the later questions are more difficult, but not necessarily longer. Some questions are designed to test your ability to work with unfamiliar ideas, or familiar ones with a twist. Don't give up!*

*You are expected to use a calculator where appropriate, but also you must show **full and clear working**, diagrams and arguments wherever you can. Marks will be awarded for method as well as answers. In fact, merely writing down an answer might score very few marks.*

*Complete questions are preferable to fragments. You can sometimes, however, manage to complete later parts of questions, even if you have failed to answer the earlier sections.*

*This paper has nine questions.*

- 1 Harry and Abby buy tickets to see the London 2012 Olympics.

Harry buys three tickets for the 100 metres finals and two tickets to the opening ceremony and pays £4187.

Abby buys four tickets to the 100 metres finals (of the same type as Harry's) and pays £2900.

How much does one of Harry's opening ceremony tickets cost?

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2

Chidera sits an examination which has a possible raw mark total of  $x$ . She achieves a raw mark score of 81 which is equivalent to  $x\%$ .

What is the value of  $x$ ?

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3

In another school, the scholarship examinations for English and mathematics used to be the same length (i.e. time allocation). Nowadays the mathematics examination is 40% longer whereas the English examination has decreased in duration by one quarter of the increase in mathematics. The English examination is now a 45-minute paper.

How long is the mathematics examination now?

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4

The Indian mathematician Srinivasa Ramanujan once approximated the circle constant  $\pi$  with the calculation

$$\sqrt[4]{9^2 + \frac{19^2}{22}}$$

- (a) Work this out and show all the decimal places on your calculator.
- (b) Using the  $\pi$  button on your calculator, work out the error in the above approximation.
- (c) What is this error as a percentage of the true value of  $\pi$  ?
- 

5 The equations

$$\begin{aligned} 3x - 8 &= 13 \\ px + 17 &= 3 \end{aligned}$$

have the same solution. What is the value of  $p$ ?

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6 Suppose we define a new operation  $\Delta$  as

$$(x\Delta y) = \frac{x - y}{x + y}$$

- (a) Work out the value of  $((1 \Delta 2) \Delta (3 \Delta 4))$ .
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(b) Work out in general the value of  $((x \Delta x) \Delta y)$  .

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7



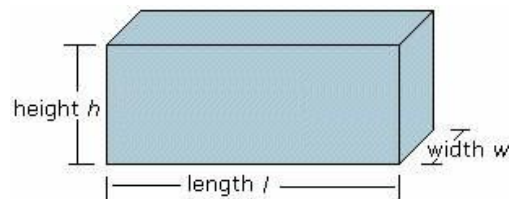
In an official factsheet giving information about the London 2012 Olympic Games, the following claim is made about the velodrome (cycling venue):

*“48,000 cubic metres of material were excavated to create the bowl for the velodrome – enough to fill 19 Olympic-sized swimming pools.”*

Let us check the arithmetic.

The dimensions of the main swimming pool in the Aquatics Centre are 50 m by 25 m with a depth of 3 m.

Assuming the pool is a cuboid, like this:



**NOT TO SCALE**

(a) Work out how many of these pools could be filled by the volume of material excavated given above.

(b) Compare your answer to the original claim.

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8

[Note for this question: 1 billion is 1000 million, and 1 trillion is 1000 billion]

UK Government debt has risen this January to a record £1.004 trillion from £883 billion a year ago.

(a) What percentage increase is this?

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The current debt total of £1.004 trillion represents 64.2% of UK gross domestic product.

- (b) Work out the UK gross domestic product. [Note that you do not need to know what gross domestic product means; it is just an amount of money.]
- (c) How high would a single pile of £20 notes totalling £1 trillion be? Give your answer using sensible units [you may use the fact that one £20 note is 0.113mm thick].
- (d) Compare your answer to a length or distance you know in real life.

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- 9 The table below shows the percentage of UK school pupils gaining a grade A\* - C when sitting any single GCSE examination.

Showing your reasoning and calculations clearly, work out an estimate of the year in which 100% of students will gain A\* - C in any single GCSE examination.

[You may use graph paper but it is not necessary to do this to achieve full marks.]

Year	% A*-C
2010	58.4
2009	57.2
2008	56.3
2007	55.2
2006	54.3
2005	53.4
2004	51.7
2003	50.2
2002	51.3
2001	50.1
2000	49.2
1999	48.1

**END OF PAPER**