



**OUNDLE SCHOOL**

**MAIN ACADEMIC SCHOLARSHIP 2008**

**MATHEMATICS**

**PAPER 1**

**1½ hours.**

**CALCULATORS ARE NOT ALLOWED FOR THIS PAPER.**

**INSTRUCTIONS TO CANDIDATES.**

*You may answer the questions in any order.*

*You are not expected to have time to do all the questions.*

*Choose those questions which you think you can answer best.*

***Remember to show your working and clearly show the method you are using.***

*Some questions are longer than others.*

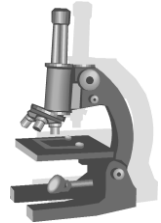
*The number of marks for each question is shown in square brackets.*



1. Work out
- a)  $28 + 53$
  - b)  $13 \times 47$
  - c)  $1300 \times 4700$
  - d)  $0.13 \times 0.47$
  - e)  $2008 \div 8$
  - f)  $2008 \div 0.08$
  - g)  $\sqrt{\frac{2008}{5.02}}$

[12]

2. A scientist is studying some cells which are on a slide. After an hour, one third of the cells have split into two. After another hour, a fifth of the new number of cells have divided into two. At this point there are 36 more cells than at the start of the experiment. If there were  $n$  cells initially, form an equation in  $n$  and hence calculate the final number of cells on the slide.



[8]

3. If  $s = x - x^2$ ,  $t = x^2 - x^3$ , and  $u = \frac{1-x}{x}$ ,

i) find the values of  $s$ ,  $t$  and  $u$  in each of the cases:

a)  $x = 2$       b)  $x = \frac{1}{2}$       c)  $x = -2$

ii) find a formula for  $u$  in terms of  $s$  and  $t$  in a way which does not use  $x$ . [13]

4. A whole number is said to be in “oddball form” if it is written as an odd number multiplied by a power of 2.

e.g. 12 in oddball form is  $3 \times 2^2$ , and 120 in oddball form is  $15 \times 2^3$ .

Write in oddball form:      a) 40      b) 96

Work out the answer to these calculations, giving the answer in oddball form:

- c)  $3 \times 2^4 + 7 \times 2^4$
- d)  $5 \times 2^6 - 3 \times 2^5$
- e)  $8 \times (3 \times 2^9)$
- f)  $11 \times 2^{100} + 13 \times 2^{102}$
- g)  $\sqrt{81 \times 2^{100}}$

[12]

5. Find a 3-digit number such that if you multiply it by 3 and add 1, the answer is the original number with its digits reversed.

[7]

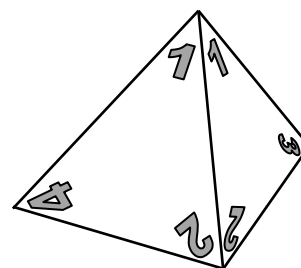
6. [In this question, you should clearly show the steps of your working and the approximations you make.]
- a) Estimate to 1 significant figure the value of  $\frac{\sqrt{78}+3.48 \times 2.13}{0.912^2}$ .
- b) Is it true that more than 5 million seconds have elapsed since the start of 2008 until the time you are doing this exam?
- c) Is it possible for a person to drink enough in a lifetime to empty a swimming pool? [Note:  $1\text{m}^3 = 1000 \text{ litres}$ .] [14]

7. The harmonic mean,  $H$ , of two numbers  $x$  and  $y$  is found by using:

$$\frac{2}{H} = \frac{1}{x} + \frac{1}{y}$$

- a) Find the harmonic mean of 3 and 4.
- b) Find the harmonic mean of  $\frac{4}{5}$  and  $\frac{6}{7}$ .
- c) If  $x$  is a positive number such that the harmonic mean of 6 and  $x$  is greater than 2, deduce the possible range of values of  $x$ . [12]

8. Roger rolls two tetrahedral dice, and adds the score on the two dice. Carol rolls **three** tetrahedral dice and adds the scores. All dice are numbered 1–4; the diagram shows a tetrahedral die where a 1 has been rolled.



Find the probability that:

- a) Roger scores 4.
- b) Roger scores more than 5.
- c) Carol scores 3.
- d) Carol scores 7. [15]
9. If you write down the whole numbers from 1 to 100 inclusive,
- a) how many times will you write the digit 0?
- b) how many times will you write the digit 7?
- c) how many times will you write the digit 1?
- If one of the 100 numbers is taken at random, what is the probability that
- d) it is divisible by 7?
- e) it is divisible by either 5 or 7 (or both)?
- f) it is divisible by at least one of 2, 3 or 5? [16]
10. Place the digits 1, 2, 3, 4, 5, 6, 7, 8, 9 in an order so that the first  $n$  digits form a number divisible by  $n$  for all values  $n$  from 1 to 9. [e.g. if the digits are ordered "abcdefghi", then 2 must divide the number written as "ab", 3 must divide "abc", 7 must divide "abcdefg", etc...]

---

**END OF EXAMINATION**