

# SEVENOAKS SCHOOL



## SIXTH FORM ENTRANCE TEST For entry into Higher Mathematics in September 2023

# MATHEMATICS Higher Level

NAME (IN CAPITALS): .....

School: .....

Curriculum: .....

(eg (I)GCSE, MYP, your national curriculum or Not Studied)

**Time allowed:** 30 minutes

**Equipment needed:** Pen, pencil, eraser

**Information for candidates:**

Calculators are NOT allowed.

This paper consists of six questions, each will explore a different topic. Part A will be problems solvable with standard knowledge of the topic. Part B present you with more challenging problems to solve.

Hints are given for each part; they are intended to give you a starting idea only and are by no means the only way to start and solve the problem.

There are five marks awarded per question. Correct answers with no / poor workings will receive zero marks.

You are not expected to finish the paper, and as a result, you are advised to spend time on 3-5 questions only.



## PART A

A1. Find all solutions for  $y$  that satisfy

$$\frac{y^3-9y^2+8y}{y-1} + \frac{3y^2+10y-8}{3y-2} = -2.$$

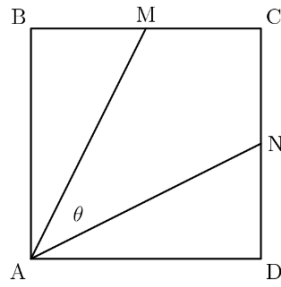
*(Hint: Consider factorising first)*

A2. Find the sum of the series  $-3 + 7 - 5 + 12 - 7 + 17 - \dots - 43 + 107$ .

*(Hint: Consider collecting terms, you may find the formula  $S_n = \frac{n}{2}(2a + (n - 1)d)$  helpful)*

A3.  $ABCD$  is a square and  $M$  and  $N$  are the midpoints of  $BC$  and  $CD$  respectively.

Find the exact value of  $\sin \theta$ .



(Hint: Consider the area of a triangle, you may find the formula  $Area = \frac{1}{2}ab \sin C$  useful)

## PART B

- B1. Let  $f$  be a function satisfying  $f(xy) = \frac{f(x)}{y}$  for all positive real numbers  $x$  and  $y$ . If  $f(500) = 3$ , what is the value of  $f(600)$ ?

*(Hint: Consider an appropriate number factorisation)*

- B2. In an arithmetic sequence  $t_1, t_2, t_3, \dots, t_{47}$ , the sum of the odd numbered terms is 1272. What is the sum of all 47 terms in the sequence?

*(Hint: You may find the formula  $S_n = \frac{n}{2}(U_1 + U_n)$  helpful)*

B3. Without the use of calculus, and if  $x$  is real, compute the maximum value of

$$\frac{3x^2+9x+17}{3x^2+9x+7}.$$

*(Hint: Consider splitting the numerator to form two fractions)*