SHERBORNE SCHOOL

ENTRANCE SCHOLARSHIP EXAMINATION 1970

Mathematics II

(2 hours)

Answer Question 1 and as many others as possible. Credit will be given for complete answers rather than many parts, and for methods, presentation and working where appropriate.

1. (i) If 'a' is a whole number, what is the number three less than twice its square? What is the difference between this number and twice the square of three less than 'a'?

(ii) The equations of two lines are $2x + y = 3$ and $y = 2$ and the lines cut at P. Why must $2x + y - 3 + k(y - 2) = 0$ be the equation of a straight line through P, for all values of k? What is k if this line is to be a line parallel to the y – axis? What is k if the line is to be one of the original lines?

(iii) $x = \dfrac{A + B}{C - D}$ where x, A, B, C, D are always positive.

Which of the following changes will certainly decrease x?
(1) A and C are kept the same, B and D are decreased.
(2) C and D are kept the same, A is increased and B decreased.
(3) A and B are kept the same, C and D are increased.
(4) B is kept the same, A and C are increased, D is decreased.
(5) A, B, C, D are all increased.

(iv) Explain the difference between congruent and similar figures.

(v) What are the properties of a triangle that make it so important in building, architecture and engineering.

(vi) Find to 1 significant figure: $\sqrt{\dfrac{215 \times 2{\cdot}92}{98{\cdot}5 \times 89{\cdot}5}}$

(vii) Water pours through a cylindrical pipe of radius 4 in. at 24 ft./sec., into a cylindrical tub of radius 2 ft. How fast is water rising in the tub.

[TURN OVER]

It is sometimes possible to be certain of an overall profit by staking appropriately on each horse and it can be proved that this profit is best when it is the same whichever horse wins and equals $(k - 1) \times$ total stake where $k = \dfrac{1}{p + q + r + s}$

and $p = \dfrac{1}{a + 1}$, $q = \dfrac{1}{b + 1}$ etc.

The odds on four horses in a race are 6:1, 7:2, 2:1 and 5:2. Show that it is possible to be sure of winning

$$\frac{1}{62} \times \text{total stake.}$$

What proportion of the total stake should be put on each horse?