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INTERMEDIATE CERTIFICATE EXAMINATION, 1963.

MATHEMATICS (Algebra).

WEDNESDAY, 12th JUNE. — Morning, 10 to 12.30.

ALL questions to be answered.
Mathematical Tables may be obtained from the Superintendent.

1. In the case of each of the following algebraic statements, say for what value (or values) of x the statement is true:

(*i*) $4x - 2 = 22$;

(*ii*) $x^2 = x$;

(*iii*) $x^2 - 1 = (x + 1)(x - 1)$;

(*iv*) $2x - 1$ is greater than 7 and at the same time is less than 17.

(28 marks.)

2. Solve the following equations:

(*i*) $x^2 - 8x = 273$;

(*ii*) $\begin{cases} 2x + 3y = 19, \\ 3x - 2y = 9. \end{cases}$

(28 marks.)

3. (*i*) Show that $x = -1$ satisfies the equation $x^3 - 5x^2 + 2x + 8 = 0$.

(*ii*) Factorise fully $a^3 - 5a^2 + 2a + 8$.

(*iii*) Find the value of k so that the following equation will be an identity:

$$x^3 - y^3 = (x - y)^3 + kxy(x - y).$$

(28 marks.)

4. A man buys an article for £200 and sells it to a dealer at a profit of x per cent. The dealer makes a profit of $2x$ per cent when he sells the article for £264. Find the value of x.

(28 marks.)

5. If $x - \frac{1}{x} = 1$, prove that

(*i*) $x^2 + \frac{1}{x^2} = 3$,

(*ii*) $x^3 - \frac{1}{x^3} = 4$.

(28 marks.)

6. (*i*) Show that $x = 1 + \sqrt{2}$ satisfies the equation $x^3 - 5x - 2 = 0$.

(*ii*) Write down the values of 3^3, $16^{\frac{1}{2}}$, $\log_2 8$, $\log_8 2$.

(*iii*) If $\log_{10} b = a$, express 10^{a+1} and 10^{2a} in terms of b.

(30 marks.)

7. Write down the values of $(120 - x)$ and of $(1200 - x^2)$ for the following values of x: 0, 5, 10, 15, 20, 25, 30.

Draw a graph of $\frac{1200 - x^2}{120 - x}$ for values of x from 0 to 30.

Solve, by means of your graph, or otherwise, the following problem: A cyclist travels a distance of 20 miles in 120 minutes. If he cycles at $\frac{x}{60}$ miles per minute for the first x minutes and then completes the journey at 5 miles per hour, find the value of x.

(30 marks.)