

Six questions to be answered. All questions carry equal marks.

N is the set of natural numbers. Z is the set of integers. Q is the set of rational numbers.

1. If £1 = 100 new pence, find the total cost of the following items:

- 27 litres of petrol @ 9 new pence per litre
- 4.5 metres of cloth @ 58 new pence per metre
- 3.75 kilogrammes of tomatoes @ 36 new pence per kilogramme
- Sweets and chocolate @ 11 new pence.

If 6% discount is allowed, find the total cost of the items.

2. (a) Calculate the simple interest on £350 for 4 years at 5.5% per annum.

(b) In a supermarket a piece of cheese weighing $8\frac{3}{4}$ ounces is marked 1s. 10d. Another piece of the same type of cheese weighs $5\frac{1}{2}$ ounces and is marked 1s. 2d. Which piece is being sold at the cheaper rate?

3. If $A = \{1, z\}$, $B = \{z, 3, 4\}$, $C = \{1, 3, f\}$, write out the elements of each of the following sets:

- (i) $A \cap B$ (ii) $B \cup C$ (iii) $A \setminus C$ (iv) $C \setminus A$ (v) $A \cap (B \cap C)$.

Is it possible to find a set X such that $A \cup X = B$? Give a reason.

4. (a) (i) Express the denary number 200 in binary notation.

(ii) Find the sum of the following binary numbers 111; 1,100; 101; 11; 1. Check your answer by converting to denary notation.

(b) The population of a certain country is given as 1.7×10^7 persons. The capital city in that country has a population of 2.1×10^6 persons. Write down the population of the rest of the country in the form $a \cdot 10^n$ where $1 \leq a < 10$ and $n \in \mathbb{Z}$.

5. (a) x is a number between 2 and 3. Write the following numbers in order of size putting the smallest number first:

$$x; 1 - x; \frac{x-1}{x}; \frac{1-x}{x}.$$

(b) Graph on the number line the solution set of

$$\{x \mid x - 3 \leq -1, x \in \mathbb{Z}\} \cap \{x \mid x + 2 \geq 1, x \in \mathbb{Z}\}.$$

6. (a) Find the factors of

(i) $t^2 - t - 12$

(ii) $a(x - 2y) - 2y + x.$

(b) Solve the equation $\frac{1-x}{1+x} = 3\frac{1}{2}.$

7. (a) Solve the simultaneous equations

$$x - y = 3y + 1$$

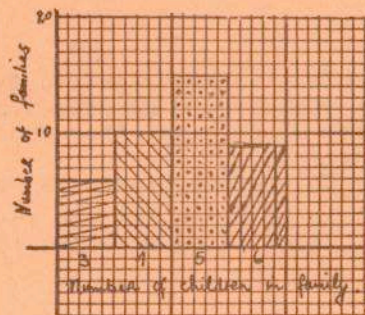
$$x = 5y.$$

(b) Show that $x = (\sqrt{3} - 1)$ is a solution of the equation $x^2 + 2x - 2 = 0.$

8. The bar-chart shows the number of families in a locality which have 3 children, 4 children, 5 children or 6 children per family.

Use the bar chart to answer the following:

- (i) What is the most common number of children in the families?
 (ii) How many families have fewer than the most common number of children?



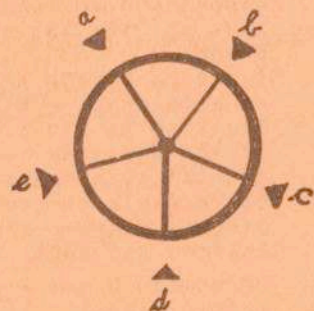
9. (a) The diagram shows a wheel which has 5 spokes and which is lying on the ground near 5 pegs a, b, c, d, and e. Each spoke points at a peg.

The wheel is rotated on its axle. The couple (a, c) means that the spoke which pointed at a before the rotation now points at c. By filling in the missing components in these couples indicate what happens the spokes which pointed at the other pegs:

$$\{(a, c), (b, \quad), (c, \quad), (d, \quad), (e, \quad)\}.$$

(b) Each couple (x, y) in the set below satisfies the equation $y = x - \frac{1}{x}$. Fill in the blanks in the following four couples: x

$$\{(2, \quad), (\frac{1}{2}, \quad), (\quad, 0), (\quad, 0)\}.$$



10. (a) S_1, S_2, S_3 are three sequences as follows:-

$$S_1 = 3, 6, 15, 21, \dots (6n - 3), \dots$$

$$S_2 = \frac{1}{2}, -\frac{3}{4}, \frac{5}{8}, -\frac{7}{16}, \dots (-1)^{n+1} \frac{n}{n+1}, \dots$$

$$S_3 = 2, -4, 8, -16, \dots (-1)^{n+1} 2^n, \dots$$

(i) Write down the 6th and 7th terms in each sequence.

(ii) In which sequence do the terms always get larger and larger.

(b) A ball drops from a table 3 feet high and bounces several times on the floor. If each bounce is $\frac{2}{3}$ the height of the previous fall, find the height of the fourth bounce.