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

1. If \( \$1 = 100 \) new pence, find the total cost of the following items:
   - 27 litres of petrol \( @ 9 \) new pence per litre
   - 4\(\frac{1}{2}\) metres of cloth \( @ 56 \) new pence per metre
   - 3\(\frac{3}{4}\) kilograms of tomatoes \( @ 30 \) new pence per kilogramme

2. (a) In a supermarket a piece of cheese weighing \( \frac{8}{3} \) ounces is marked \( 15 \), \( 10 \)d. Another piece of the same type of cheese weighs \( 5\frac{2}{3} \) ounces and is marked \( 10 \), \( 5 \)d. Which piece is being sold at the cheaper rate?

3. If \( A = \{1, 2, 3, 4\} \), \( B = \{1, 3, 5\} \), \( C = \{1, 3, 5\} \), write out the elements of each of the following sets:
   - \( A \cap B \)
   - \( B \cup C \)
   - \( A \cap C \)
   - \( A \cap (B \cup C) \)

4. (a) (i) Express the denary number 200 in binary notation.
    (ii) Find the sum of the following binary numbers: \( 111_2 \), \( 100_2 \), \( 101_2 \), \( 1_2 \).

5. (a) \( x \) is a number between 2 and 3. Write down the following numbers in order of size putting the smallest number first:
   - \( 2 \), \( x \), \( 3 \), \( \frac{5}{2} \), \( \frac{7}{4} \).

(b) Graph on the number line the solution set of
   \[ \{x \mid x - 3 \leq -1, \, x \in \mathbb{Z}\} \cup \{x \mid x + 2 > 1, \, x \in \mathbb{Z}\} \]

6. (a) Find the factors of
   - \( 2 \), \( t \), \( 1 \), \( 2 \), \( 3 \), \( 6 \).
   - \( (x - 2y) - 2y + x \).

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

7. (a) Solve the simultaneous equations
   - \( x - y = 1 \), \( x = 2y + 1 \).

(b) Show that \( x = (\sqrt{5} - 1) \) 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 to the spokes which pointed at the other pegs:
   \( (a, c) \), \( (b, i) \), \( (c, 4) \), \( (d, 3) \), \( (e, 1) \).

   (b) Each couple \( (x, y) \) in the set below satisfies the equation \( x = \frac{y}{2} - \frac{1}{2} \). Fill in the blanks in the following four couples:
   \( \{(2, \_\), \( (\_\), \( (\_\), \( (\_\), \( (\_\), \( (\_\), \( (\_\), \( (\_\), \( (\_\), \( (\_\) \).

10. (a) \( S_1, S_2, S_3 \) are three sequences as follows:
    - \( S_1 = 2, 4, 8, 16, 32, \ldots (6n - 3), \ldots \)
    - \( S_2 = 2, 4, 8, 16, \ldots (-1)^n + 5, \ldots \)
    - \( S_3 = 2, 4, 8, 16, \ldots (-1)^n + 2^n, \ldots \)

    (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 \( \frac{1}{2} \) the height of the previous fall, find the height of the fourth bounce.