SECTION A  (55 MARKS)

1. The average of 12, 19, 28, x and 51 is 30. Find x. (2 marks)

2. Simplify \((\sqrt{2} + \sqrt{3})^2\) (3 marks)

3. [Diagram of triangle with angles 60°, 40°, and 80°]

   The line segments AB and CE are parallel. Calculate the values of x, z and y. Give reasons. (3 ½ marks)

4. Given that \(x = 3\) and \(y = 4\), find the value of \(A\) if \(\frac{2l}{A} = \frac{1}{x} + \frac{1}{y}\) (3 marks)

5. \(A = \{x : x\ is\ a\ factor\ of\ 12\}\ and\ 
B = \{0; 2; 4; 8\}. List the members of \(A, A \cap B, A \cup B\) and \((A \cap B)\) (4 marks)

6. Factorise and simplify: \(\frac{4x^2 - 1}{4x^2 - 4x + 1}\) (3 marks)

7. [Diagram of circle with line segments]

   In the figure, line segments AB = 4 cm and BC = 3 cm and angle ABC = 90°. Calculate the circumference of the circle. \((\pi = 3.14)\) (3½ marks)
8. Given the points: A (5; -3) and B (-6; 5) calculate the coordinates of the Point M, the mid-point of the line segment AB. (3 marks)

9. Calculate the volume of a sphere whose radius is 3cm. (π = 3.14) (3 ½ marks)

10. ABCD is a square.
   (a) How many lines of symmetry does the figure have? (2 marks)
   (b) Find the images of points A, B, C and D when they are reflected along line AC. (2 marks)

11. Calculate: 3203_{four} + 1111_{two} and express the answer in base six. (4 marks)

12. Consider triangles ABC and A'B'C'. If \( \overline{BC} \parallel \overline{B'C'} \), \( \overline{AB} = 2.4 \text{ cm}, \)
\( \overline{AC} = 3.6 \text{ cm}, \overline{BC} = 3 \text{ cm}, \overline{AB'} = 3.6 \text{ cm}, \) calculate the lengths of \( \overline{AC'} \) and \( \overline{B'C'} \). (5 marks)

13. Simplify: \( \frac{3x^3y^3 + 12x^2y^5}{9x^2y^4} \). (3 marks)

14. Find the images of points: X (-2; 4) and Y (0; 1) under translation \( T = \begin{pmatrix} -2 \\ 3 \end{pmatrix} \).
   What can you conclude about the line segments \( XY \) and \( X'Y' \)? (4 marks)

15. (a) Solve the simultaneous equations
    \[
    \begin{align*}
    2x + y + 1 &= 0 \\
    x - y - 7 &= 0
    \end{align*}
    \] (3 marks)
    (B) Determine the equation of a straight line which passes through \((-1, -1)\) and \((2; 5)\). (3 ½ marks)
SECTION B (45 MARKS)

16. (a) If \( f(x) = 2x + 1 \) and \( g(x) = x^2 - 2 \), calculate
   (i) \( g(f(x)) \)  
   (ii) \( g(f(-2)) \)  

(b) If \( P(x) = 2x^3 + 9x^2 + 7x - 6 \)
   (i) Divide \( p(x) \) by \( 2x - 1 \)
   (ii) If \( p(x) = 0 \), find the values of \( x \).

17. (a) Solve \( 2+3 (5-x) < 20 \), \( x \in \mathbb{R} \), and illustrate the answer on a number line

(b) Solve the inequalities graphically by shading the wanted region.
   \( x - y + 3 \geq 0 \)
   \( x + y - 7 \leq 0 \)

18. If \( \vec{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix} \) and \( \vec{b} = \begin{pmatrix} -12 \\ 6 \end{pmatrix} \), calculate \( 2 \vec{a} - 0.5 \vec{b} \)

(b) The points \( a(-3;2) \), \( b(2;-3) \) and \( c(6,1) \) are in a cartesian plane
   (i) Determine the column vectors of \( \vec{ab} \), \( \vec{ac} \) and \( \vec{bc} \)
   (ii) Calculate the length of \( \vec{ac} \), \( \vec{ab} \) and \( \vec{bc} \)
   (iii) Hence or otherwise show that triangle abc is right angled triangle at \( b \).

19. A tourist is organising a trip to Rwanda for a certain period. He has to choose between two places. The first place is to stay at Kibuye at a cost of 3000frw per day. The second place is to stay at Gisenyi at a cost of 2500 frw per day plus 5000 frw non-refundable booking-fee.
   (a) How much money would be spend in each case in 8 days (5marks)
   (b) Suppose he wants to stay for \( x \) days, find the expression of the
expenditure in each case (5 marks)
(c) Which time will the cost of staying at any of the two places be the same? (5 marks)

20. Below is a histogram of heights in cm of a group of students.

(a) Find the centres of classes (middle numbers) (3 marks)
(b) Using the information from the graph make a frequency table (6 marks)
(c) Determine the modal class (1 mark)
(d) Calculate the average height of the group. (5 marks)