Mathematics KSSM Form 2

Intensive Revision: Chapter 1 & Chapter 2 (Incl. KBAT)

1. Quick Notes: The "First Principles" Approach

Chapter 1: Patterns and Sequences

- **Pattern:** A specific rule that a set of numbers follows (e.g., $+2$, $\times 3$, -5).
- **Sequence:** A list of numbers arranged in a specific order based on a pattern.
- **Fibonacci Numbers:** Start with 1, 1. Every next number is the sum of the previous two ($1, 1, 2, 3, 5, 8, 13 \ldots$).
- **Algebraic Expression (n-th term, T_n):** Think of it as a "machine". If the rule is $+3$ every time, the formula involves $3n$. E.g., for $3, 6, 9$, $T_n = 3n$.

Chapter 2: Factorisation and Algebraic Fractions

- **Expansion (Building the Area):** Multiplying out brackets. Think of it as finding the Area of a rectangle if you know its sides.
  - Single: $a(b + c) = ab + ac$
  - Double: $(a + b)(c + d) = ac + ad + bc + bd$ (FOIL method)
  - Perfect Square: $(a \pm b)^2 = a^2 \pm 2ab + b^2$
- **Factorisation (Finding the Sides):** The exact reverse of expansion. Given the Area, what were the side lengths?
  - Common Factors: $4x + 8 = 4(x + 2)$
  - Difference of Squares: $a^2 - b^2 = (a + b)(a - b)$
  - Quadratic ($ax^2 + bx + c$): Use cross-multiplication or inspection.
- **Algebraic Fractions:** They follow the *exact same rules* as primary school fractions. You MUST find a common denominator to add ($+$) or subtract ($-$).

Mastery Challenge: 50 Questions

Work quickly and accurately. Show all your workings in the spaces provided below each question.

Part A: Chapter 1 - Patterns and Sequences (25 Questions)

Determine the next two terms for the sequences:

1. $3, 7, 11, 15, \ldots, \ldots$

2. $100, 90, 80, 70, \ldots, \ldots$

3. $2, 4, 8, 16, \ldots, \ldots$

4. $144, 72, 36, 18, \ldots, \ldots$

5. $1, 4, 9, 16, 25, \ldots, \ldots$

Fibonacci & Pascal's Triangle:

6. Find the next two Fibonacci numbers: $2, 2, 4, 6, 10, \ldots, \ldots$

7. Complete the sequence: $0, 1, 1, \ldots, 3, 5, \ldots$

8. The 3rd row of Pascal's Triangle is $1, 2, 1$. What is the 4th row?

9. What is the sum of the numbers in the 4th row of Pascal's Triangle?

10. Find the missing number in Pascal's Triangle: $1, 4, \ldots, 4, 1$.

Describe the pattern in words:

11. $4, 9, 14, 19, \ldots$

12. $50, 45, 40, 35, \ldots$

13. $3, -6, 12, -24, \ldots$

14. $0.1, 0.01, 0.001, \ldots$

15. $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \ldots$

Find the n-th term (T_n) algebraic expression:

16. $4, 8, 12, 16, \ldots$

17. $1, 3, 5, 7, \ldots$

18. $5, 10, 15, 20, \ldots$

19. $1^2, 2^2, 3^2, 4^2, \ldots$

20. $10, 20, 30, 40, \ldots$

Evaluate and Solve:

21. Given $T_n = 3n - 1$, find the 5th term (T_5).

22. Given $T_n = n^2 + 2$, find T_4.

23. For $5, 10, 15, 20 \ldots$, find the 20th term.

24. If $T_n = 4n$, find the value of n when $T_n = 48$.

25. A sequence of triangles is made of matches. The pattern is $3, 5, 7, 9 \ldots$. How many matches are needed for the 10th triangle?

Part B: Chapter 2 - Factorisation and Algebraic Fractions (25 Questions)

Expand the following brackets:

26. $4(x+3)$

27. $-3(2y-5)$

28. $x(x+7)$

29. $3ab(a-2b)$

30. $-2p(4p-3q+1)$

31. $(x+2)(x+4)$

32. $(m-3)(m+5)$

33. $(2y+1)(y-4)$

34. $(x+5)^2$

35. $(3k-2)^2$

Factorise completely:

36. $6x+18$

37. $15a^2b-10ab$

38. x^2-36

39. $4y^2-25$

40. $2m^2-18$

41. $x^2+7x+10$

42. $x^2-8x+15$

43. $x^2+2x-24$

44. $2x^2+5x+3$

45. $3x^2-10x+8$

Simplify the following algebraic fractions:

46. $\frac{3x}{7}+\frac{2x}{7}$

47. $\frac{x}{3}-\frac{x}{4}$

48. $\frac{2}{5a}+\frac{1}{10a}$

49. $\frac{x^2-9}{x+3}$

50. $\frac{2m}{3n} \times \frac{9n^2}{4m^2}$

Part C: HOTS / KBAT Challenge (10 Questions)

These questions require you to apply your knowledge to new situations. Think from First Principles!

51. **[Real-world Sequence]** Ali saves RM 3 in the first week, RM 7 in the second week, and RM 11 in the third week, following a consistent pattern. In which week will he save exactly RM 47 for that specific week?

52. **[Visual Pattern]** A pattern of regular hexagons is formed using matchsticks. The first hexagon uses 6 matches, two joined hexagons use 11 matches, and three joined hexagons use 16 matches. Formulate an algebraic expression (T_n) for this pattern and find the number of matches needed to form 20 joined hexagons.

53. **[Pascal's Triangle Logic]** The sum of the numbers in the n-th row of Pascal's Triangle is given by the formula 2^{n-1} (assuming the very first tip '1' is the 1st row). Which row of Pascal's triangle has a sum of 256?

54. **[Physics Application]** A bouncing ball drops from a height of 100 cm. Each time it bounces, it reaches half of its previous height. Write down the sequence of the first 4 bounce heights. Is this an arithmetic sequence? Why or why not?

55. **[Fibonacci Application]** A certain species of plant grows branches in a Fibonacci sequence month by month: 1, 1, 2, 3, 5... In which month will the plant first exceed 50 branches?

56. **[Area & Expansion]** A rectangular garden has a length of $(3x + 2)$ meters and a width of $(2x - 1)$ meters. Inside the garden, there is a square pond with sides of

x meters. Write an expanded algebraic expression for the area of the grass (the garden excluding the pond).

57. **[Perimeter & Factorisation]** The area of a rectangular whiteboard is given by the quadratic expression $(2x^2 + 11x + 12)$ cm^2. By factorising this expression, determine the length and the width of the whiteboard in terms of x. Then, find its perimeter in terms of x.

58. **[Volume & Factorisation]** A 3D printed rectangular storage box has a volume of $(x^3 - 9x)$ cm^3. If its height is x cm, find the expressions for its length and width by factorising completely.

59. **[Algebraic Fractions - Speed]** A remote-controlled car travels a distance of $(x^2 - 16)$ meters in $(x - 4)$ seconds. Find the simplified algebraic expression for the speed of the car. If $x = 10$, what is the actual speed of the car in m/s?

60. **[First Principles Logic]** Simplify the expression: $\frac{1}{x-3} - \frac{6}{x^2-9}$. *Bonus:* Explain logically why x cannot be equal to 3 or -3 in this mathematical scenario.

— END OF REVISION —

"A problem well-stated is a problem half-solved." - Charles Kettering