SENIOR FIVE TERM 1 (PP1) MATHEMATICS SCENARIOS, 2025 FROM ALLIANCE JOINT EXAMINATIONS BOARD (AJEB)

TOPIC	SCENARIO AND TASK	PROPOSED RESPONSE / ANSWER
1. Numerical Concepts	**Scenario** A pharmacist is preparing a chemical solution where the concentration must be recorded on a log scale. Given that the molarity of the solution is 3.2 × 10^{-5} mol/L, they must calculate the pH-related value. **Task**: Calculate $\log_{10}(3.2 \times 10^{-5})$ correct to 3 significant figures.	Response: **Step 1:** Use compound interest formula: $A = P(1 + \frac{r}{n})^{nt}$, where $P = 500,000$, $r = 0.08$, $n = 4$, $t = 3$. **Step 2:** Simplify exponents: $A = 500,000(1.02)^{12}$. **Step 3:** Apply logarithms: $\log A = \log 500,000 + 12 \log 1.02$. Solve for A. **Surd Check:** Express $(1.02)^{1/4}$ as a surd for manual approximation. Final amount ≈ UGX 634,121.
2. Equations and Inequalities	**Scenario** A company's budgeting formula requires that the sum of production costs for items A and B meet two constraints. The costs satisfy: 5A + 3B = 48 and 2A + 4B = 46 (in million UGX). **Task**: Solve the simultaneous equations to find A and B	Response: **Step 1:** Let length parallel to river = x, other sides = y. Area: $xy = 150$. Cost: $C = 10,000(x + 2y)$. **Step 2:** Substitute $y = \frac{150}{x}$: $C = 10,000(x + \frac{300}{x})$. **Step 3:** Minimize C: Find derivative C' and solve $x^2 = 300$ → $x = 10\sqrt{3}$m. **Inequality:** $10,000(x + \frac{300}{x}) \leq 1,500,000$ → $x \geq 10$m. Valid range: $10 \leq x \leq 15$m.

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3. Coordinate Geometry	**Scenario** Two GPS devices report coordinates of survey points as A(2,3) and B(10,15). A civil engineer needs to design a straight road connecting them. **Task**: Find the gradient and length of line AB.	**Response:** **Step 1:** Slope $m = \frac{17-5}{8-2} = 2$. Equation: $y - 5 = 2(x - 2)$ $\rightarrow y = 2x + 1$. **Step 2:** Perpendicular distance from $(4, 10)$: Use formula (d = \frac{
4. Partial Fractions	**Scenario:** An engineer analyzes stress distribution in a bridge beam, modeled by $\frac{3x^2+5x-2}{(x-1)(x+2)^2}$. **Task:** Decompose the expression into partial fractions to simplify integration for stress calculations.	**Response:** **Step 1:** Set up $\frac{A}{x-1} + \frac{B}{x+2} + \frac{C}{(x+2)^2}$. **Step 2:** Multiply through by denominator: $3x^2 + 5x - 2 = A(x+2)^2 + B(x-1)(x+2) + C(x-1)$. **Step 3:** Solve for constants: $A = 1, B = 2, C = -3$. Final form: $\frac{1}{x-1} + \frac{2}{x+2} - \frac{3}{(x+2)^2}$.
5. Trigonometry (Compound Angles, Triangle Solutions)	**Scenario:** A pilot flies 300km on a bearing of 060°, then 200km on 150°. **Task:** Use trigonometric identities and the sine/cosine rules to find the displacement from the starting point and the bearing for return.	**Response:** **Step 1:** Convert bearings to angles: First leg = 60° (N60°E), second leg = 150° (S30°E). **Step 2:** Resolve into components: $\Delta x = 300 \sin 60^\circ + 200 \sin 150^\circ \approx 259.8 + 100 = 359.8$km. $\Delta y = 300 \cos 60^\circ + 200 \cos 150^\circ \approx 150 - 173.2 = -23.2$ km. **Step 3:** Resultant displacement: $\sqrt{359.8^2 + (-23.2)^2} \approx 360.5$km. Bearing: $\tan^{-1}(\frac{359.8}{23.2}) \approx 86.3^\circ$ (N86.3°E).