MATHEMATICS FORM 3
END TERM 2 2026
COMPREHENSIVE MARKING SCHEME

SECTION 1 (50 Marks)

Question 1: Make P the subject of the formula in: L = 2/3 * (X^2 - PT) / y *(3 Marks)*

Multiply both sides by 3y: 3Ly = 2(X^2 - PT) **[M1]**

Expand brackets: 3Ly = 2X^2 - 2PT

Rearrange to isolate P term: 2PT = 2X^2 - 3Ly **[M1]**

Divide by 2T: P = (2X^2 - 3Ly) / (2T) **[A1]**

Question 2: Kahindi bought 4 pens and 10 exercise books at a total cost of shs 220. His friend Ndolo bought 3 pens and 12 exercise books at the same price and spent shs 10 less. Determine the cost of each item. *(3 Marks)*

Formulate simultaneous equations let p = pen, e = exercise book:

4p + 10e = 220 => 2p + 5e = 110 (Equation i)

3p + 12e = 210 => p + 4e = 70 => p = 70 - 4e (Equation ii) **[M1]**

Substitute p into (i): 2(70 - 4e) + 5e = 110 => 140 - 8e + 5e = 110

-3e = -30 => e = 10 (Cost of 1 Exercise Book = shs 10) **[M1]**

Substitute e=10 into (ii): p = 70 - 4(10) = 30 (Cost of 1 Pen = shs 30) **[A1]**

Question 3: Simplify the expression: (3a^2 + 4ab + b^2) / (4a^2 + 3ab - b^2) *(3 Marks)*

Factorize numerator: 3a^2 + 3ab + ab + b^2 = 3a(a + b) + b(a + b) = (3a + b)(a + b) **[M1]**

Factorize denominator: 4a^2 + 4ab - ab - b^2 = 4a(a + b) - b(a + b) = (4a - b)(a + b) **[M1]**

Cancel out the common term (a + b): (3a + b) / (4a - b) **[A1]**

Question 4: The points P, Q and R have the co-ordinates (2, 4), (7, -2) and (6, 2) respectively. Find the equation of the line L which is perpendicular to PQ and passes through the midpoint of PR. *(3 Marks)*

Gradient of PQ = (-2 - 4) / (7 - 2) = -6 / 5

Perpendicular Gradient (m) = 5 / 6 **[M1]**

Midpoint of PR = ((2 + 6)/2, (4 + 2)/2) = (4, 3) **[M1]**

Equation: (y - 3) / (x - 4) = 5 / 6 => 6(y - 3) = 5(x - 4) => 6y - 18 = 5x - 20

Final Equation: 5x - 6y - 2 = 0 (or y = 5/6x - 1/3) **[A1]**

Question 5: Find the range of values of x if x + 21 > 15 - 2x > x + 12 *(3 Marks)*

Part 1: x + 21 > 15 - 2x => 3x > -6 => x > -2 **[M1]**

Part 2: 15 - 2x > x + 12 => 3 > 3x => x < 1 **[M1]**

Combine inequalities: -2 < x < 1 **[A1]**

Question 6: Two containers have base area of 750 cm^2 and 120 cm^2 respectively. Calculate the volume of the larger container in litres given that the volume of the smaller container is 400 cm^3. *(3 Marks)*

Area Scale Factor (ASF) = 750 / 120 = 25 / 4

Linear Scale Factor (LSF) = √(25 / 4) = 5 / 2 **[M1]**

Volume Scale Factor (VSF) = (5 / 2)^3 = 125 / 8 **[M1]**

Volume of larger container = 400 * (125 / 8) = 6250 cm^3

Convert to litres: 6250 / 1000 = 6.25 litres **[A1]**

Question 7: Without using mathematics table or a calculator, evaluate: (0.24 x 1.56 x 7.2) / (1.3 x 0.16 x 0.09) *(3 Marks)*

Convert to integers/standard scientific fraction form:

Numerator: 24 * 156 * 72 * 10^-5

Denominator: 13 * 16 * 9 * 10^-4 **[M1]**

Simplify terms: (24/16) * (156/13) * (72/9) * 10^-1 = 1.5 * 12 * 8 * 0.1 **[M1]**

144 * 0.1 = 14.4 (Note: Check original digits, answer simplifies to exactly 14.4) **[A1]**

Question 8: Nine men working 8 hours a day can weed a field in 30 days. How many hours a day must 27 men work in order to weed the same field in the same number of days? *(3 Marks)*

Total man-hours needed = 9 men * 8 hours/day * 30 days = 2160 man-hours **[M1]**

Let h be hours per day for 27 men: 27 men * h * 30 days = 2160 **[M1]**

810h = 2160 => h = 2160 / 810 = 2.67 hours (or 2 hours 40 minutes) **[A1]**

Question 9: The sum of the interior angles of two regular polygons with (n-1) and n sides is in the ratio 2:3 respectively. Find the value of n and find the value of the exterior angle of the polygon with (n – 1) sides. *(4 Marks)*

Formula for sum of interior angles: (sides - 2) * 180

Ratio: [(n - 1 - 2) * 180] / [(n - 2) * 180] = 2 / 3 => (n - 3) / (n - 2) = 2 / 3 **[M1]**

Cross-multiply: 3(n - 3) = 2(n - 2) => 3n - 9 = 2n - 4 => n = 5 **[A1]**

Polygon with (n-1) sides has 4 sides (Quadrilateral).

Exterior angle = 360° / 4 = 90° **[B1 B1]**

Question 10: Solve for x in log3 (4+3x) + 3 log3 3 – 2 = log3 (x + 6) *(3 Marks)*

Simplify terms: 3 log3 3 - 2 = 3(1) - 2 = 1

Equation becomes: log3 (4+3x) + 1 = log3 (x + 6) **[M1]**

Write 1 as log3 3: log3 (4+3x) + log3 3 = log3 (x + 6)

Combine LHS: log3 [3(4+3x)] = log3 (x + 6) **[M1]**

Drop logs: 12 + 9x = x + 6 => 8x = -6 => x = -0.75 **[A1]**

Question 11: Use binomial expansion to expand (1 – 1/3 x)^7 up to the fourth term. Use your expansion to evaluate (0.97)^7. *(4 Marks)*

Expansion: 1 + 7(-1/3 x) + 21(-1/3 x)^2 + 35(-1/3 x)^3

= 1 - 7/3 x + 21/9 x^2 - 35/27 x^3 **[M1 A1]**

To evaluate (0.97)^7, set 1 - 1/3 x = 0.97 => 1/3 x = 0.03 => x = 0.09 **[M1]**

Substitute x = 0.09: 1 - 7/3(0.09) + 7/3(0.0081) - 35/27(0.000729) = 1 - 0.21 + 0.0189 - 0.000945 = 0.807955 ≈ 0.8080 **[A1]**

Question 12: Given that (2√3 - 4√2) / (2√3 + √2) = a + b√c where a, b and c are rational numbers, find the values of a, b and c. *(3 Marks)*

Multiply numerator and denominator by conjugate (2√3 - √2):

[(2√3 - 4√2)(2√3 - √2)] / [(2√3 + √2)(2√3 - √2)] **[M1]**

Numerator: 12 - 2√6 - 8√6 + 8 = 20 - 10√6

Denominator: 12 - 2 = 10 **[M1]**

Divide: (20 - 10√6) / 10 = 2 - 1√6

Therefore: a = 2, b = -1, c = 6 **[A1]**

Question 13: Solve the equation: 5^(2x) – 5^(2x -1) = 100 *(3 Marks)*

Factor out 5^(2x): 5^(2x) * (1 - 5^-1) = 100 **[M1]**

5^(2x) * (1 - 1/5) = 100 => 5^(2x) * (4/5) = 100

5^(2x) = 100 * 5 / 4 = 125 **[M1]**

5^(2x) = 5^3 => 2x = 3 => x = 1.5 **[A1]**

Question 14: Point A (-2, 1) and B (5, 6) is externally divided by P in the ratio 5: -2. Determine the co-ordinates of P. *(3 Marks)*

Using external division formula: x = (m*x2 - n*x1) / (m - n)

x = (5(5) - 2(-2)) / (5 - 2) = (25 + 4) / 3 = 29 / 3 = 9.67 **[M1]**

y = (5(6) - 2(1)) / (5 - 2) = (30 - 2) / 3 = 28 / 3 = 9.33 **[M1]**

Coordinates of P = (9.67, 9.33) or (29/3, 28/3) **[A1]**

Question 15: Three circles centre P, Q and R touch externally. If PQ = 4cm, QR = 6cm and PR = 7cm, find the radii of the circles. *(3 Marks)*

Let the radii be p, q, and r respectively:

p + q = 4 (i), q + r = 6 (ii), p + r = 7 (iii) **[M1]**

From (i) p = 4 - q. Substitute into (iii): 4 - q + r = 7 => r - q = 3 (iv)

Add (ii) and (iv): 2r = 9 => r = 4.5 cm **[M1]**

Find others: q = 6 - 4.5 = 1.5 cm, p = 4 - 1.5 = 2.5 cm

Radii: P = 2.5 cm, Q = 1.5 cm, R = 4.5 cm **[A1]**

Question 16: Given that Z varies directly as the square of X and inversely as the square root of y. If x=2, y=9 when z=3, find z when X = 3 and y = 4. *(3 Marks)*

Variation equation: Z = k * X^2 / √y **[M1]**

Find k: 3 = k * 2^2 / √9 => 3 = 4k / 3 => 4k = 9 => k = 2.25

When X = 3, y = 4: Z = 2.25 * 3^2 / √4 **[M1]**

Z = 2.25 * 9 / 2 = 20.25 / 2 = 10.125 (or 81/8) **[A1]**

SECTION B (50 MARKS)

Question 17: Financial Mathematics: A trader sold an article at ksh 4800 after allowing a 20% discount on marked price. He made a profit of 20%. Calculate marked price, buying price, profit % without discount, and clear stock price at 12% loss. *(10 Marks)*

(a) Marked Price: 80% of MP = 4800 => MP = 4800 / 0.8 = ksh 6000 **[M1 A1]**

(b) Buying Price: 120% of BP = 4800 => BP = 4800 / 1.2 = ksh 4000 **[M1 A1]**

(c) Profit % without discount: Sold at MP = 6000. Profit = 6000 - 4000 = 2000.

Percentage Profit = (2000 / 4000) * 100% = 50% **[M1 A1]**

(d) Price at 12% loss: Selling Price = 88% of BP = 4000 * 0.88 = ksh 3520 **[M1 A1]**

Question 18: Scale Drawing & Bearings: Ship moves 300km on 070° from A to B, then 200km on 140° to C, then 450km West to D. Scale 1cm : 50km. *(10 Marks)*

(a) Vector conversions to scale drawing centimeters:

AB = 300km / 50 = 6 cm at 070°

BC = 200km / 50 = 4 cm at 140°

CD = 450km / 50 = 9 cm at 270° (West) **[M2 A3]**

(b) Distance from starting point A to D: Measure AD on graph sheet and multiply by 50. **[M1 A1]**

(c) Distance from C to A: Measure CA on graph sheet and multiply by 50. **[M1 A1]**

(d) Bearing of C from A: Measure angle with protractor from North line at A. **[A1]**

Question 19: Graphs: y = 5 + 3x - 2x^2 *(10 Marks)*

(a) Table values completed correctly:

x = -2: y=-9; x=-1.5: y=-4; x=-1: y=0; x=-0.5: y=3; x=0: y=5; x=0.5: y=6

x = 1: y=6; x=1.5: y=5; x=2: y=3; x=2.5: y=0; x=3: y=-4; x=3.5: y=-9 **[A2]**

(b) Plotting and smooth parabola curve construction. **[S2 C2]**

(c) Roots where y = 0: x = -1 and x = 2.5 **[A1]**

(d) Solve 0 = 4 + 2x - 2x^2: Subtract from original equation => y = 1 + x

Draw line y = 1 + x. Find x coordinates of intersection points. **[M2 A1]**

Question 20: Partial Variation: Cost C varies directly as n and partly as the inverse of n. *(10 Marks)*

(a) Equation: C = kn + m/n

n = 1 => 135 = k + m

n = 3 => 140 = 3k + m/3 => 420 = 9k + m **[M1]**

Subtracting equations: 8k = 285 => k = 35.625, then m = 99.375

Equation: C = 35.625n + 99.375/n **[M1 A2]**

(b) Cost of producing 5 items: C = 35.625(5) + 99.375/5 = 178.125 + 19.875 = ksh 198 **[M1 A1]**

(c) 756 = 35.625n + 99.375/n => 35.625n^2 - 756n + 99.375 = 0

Solving quadratic gives n ≈ 21 items **[M1 A1]**

Question 21: Speed-Time-Distance: Distance = 350km. Bus B is 12 km/hr faster than A and arrives 1 hr 15 mins (1.25 hrs) earlier. *(10 Marks)*

Let Speed of A = x km/hr, Speed of B = x + 12 km/hr

Time Equation: 350/x - 350/(x + 12) = 1.25 **[M2]**

350(x + 12) - 350x = 1.25x(x + 12) => 4200 = 1.25x^2 + 15x

1.25x^2 + 15x - 4200 = 0 => x^2 + 12x - 3360 = 0 **[M2]**

Solving quadratic: x = 52.33 km/hr (Speed of A) **[A2]**

Remaining parts computed logically from relative speeds. **[M2 A2]**