

MTH1126 - FINAL EXAM

Date September 9, 2026 Exam time: 120 minutes

NAME: _____

STUDENT ID NUMBER: _____

General instructions:

- No discussion is allowed in the exam room.
- No electronic devices (except calculator) are allowed.

PROBLEM	POINTS	SCORE
A1	4	
A2	4	
A3	4	
A4	4	
A5	4	
A6	4	
A7	4	
A8	4	
A9	4	
A10	4	
B1	15	
B2	10	
B3	15	
B4	10	
B5	10	
TOTAL	100	

PART A: Multiple choice or Short answer

(4 marks for each correct answer/choice)

Problem A1. Find a power series representation for

$$f(x) = \frac{1}{1+x/2}.$$

Include the interval of convergence. _____

Problem A2. Find an equation of the ellipse with foci $(\pm 3, 0)$ and vertices $(\pm 5, 0)$.

Answer (exact value): _____

Problem A3. Set up an integral representing the length of

$$x = t - \cos t, \quad y = 2 + \sin t, \quad 0 \leq t \leq \pi.$$

Circle the best answer.

A. $\int_0^\pi \sqrt{(1 + \sin t)^2 + \cos^2 t} \, dt$

B. $\int_0^\pi \sqrt{(1 - \sin t)^2 + \cos^2 t} \, dt$

C. $\int_0^\pi \sqrt{(t - \cos t)^2 + (2 + \sin t)^2} \, dt$

D. A, B, C are incorrect

Problem A4. Find the foci and asymptotes of

$$16x^2 - 9y^2 = 144.$$

Foci: _____ Asymptotes: _____

Problem A5. Convert $(-1, \sqrt{3})$ from Cartesian to polar coordinates.

A. $(2, 2\pi/3)$ B. $(2, \pi/3)$ C. $(\sqrt{2}, 2\pi/3)$ D. A, B, C are incorrect

Problem A6. Find

$$\sum_{n=1}^{\infty} \frac{4}{n(n+4)}.$$

Answer (exact value): _____

Problem A7. Let $r = 1 + \sin \theta$. Find the slope of the tangent line at $\theta = 0$.

A. 1 B. -1 C. 0 D. A, B, C are incorrect

Problem A8. Find the area enclosed by

$$x = t^2 + 3t, \quad y = t, \quad 0 \leq t \leq 1,$$

and the x -axis.

A. $\frac{13}{6}$ B. $\frac{11}{6}$ C. $\frac{7}{3}$ D. A, B, C are incorrect

Problem A9. Find the positive r such that

$$\sum_{n=1}^{\infty} r^n = 2.$$

Answer (exact value): _____

Problem A10. Find

$$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n4^n}.$$

A. $\ln \frac{5}{4}$ B. $\ln \frac{4}{3}$ C. $\ln 4$ D. Divergence

PART B: WRITE YOUR FULL ANSWERS

Problem B1. (15 points) A curve C is defined by

$$x = 1 + 3 \sin t, \quad y = 4 \cos t.$$

(a) Find the points where $x = 2$, and the slope at the first-quadrant point.

(b) Find all points where the tangent is horizontal or vertical.

(c) Let R be the part of the interior of C in the first quadrant. Set up integrals for the volume obtained by rotating R about the x -axis and about the y -axis. Do not evaluate.

Problem B5. (10 points) Solve

$$xy'' + 4y' = 20x^2, \quad x > 0,$$

using the substitution $u = y'$.

Problem B3. (15 points) Find the radius and interval of convergence of

$$\sum_{n=1}^{\infty} \frac{5^n (x+1)^n}{2n+3}.$$

Problem B4. (10 points)

(a) Prove that

$$\sum_{n=1}^{\infty} \frac{(-1)^n}{n+2}$$

is convergent.

(b) Approximate its sum using the first eight terms and estimate the error.

Problem B5. (10 points) Find the sum of

$$\sum_{n=0}^{\infty} \frac{(x+2)^n}{(n+3)!}.$$

Express the result using elementary functions.

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