APPM 1340
Exam 1
Fall 2024

Name	
Instructor Richard McNamara	**Section** 150

This exam is worth 100 points and has **4 problems**.

Make sure all of your work is written in the blank spaces provided. If your solutions do not fit, there is additional space at the end of the test. Be sure to **make a note** indicating the page number where the work is continued or it will **not** be graded.

Show all work and simplify your answers. Name any theorem that you use. Answers with no justification will receive no points unless the problem explicitly states otherwise.

Notes, papers, calculators, cell phones, and other electronic devices are not permitted.

There is a **FORMULA SHEET** on the **LAST PAGE** of this exam

End-of-Exam Procedure

1. Go to the designated area to scan and upload your exam to Gradescope.
2. Verify that your exam has been correctly uploaded and all problems have been labeled.
3. Hand the physical copy of your exam to a proctor.
4. Have a proctor swipe your BuffOne card.

1. (21 pts) Parts (a) - (d) are not related.

   (a) Identify the domain of the function $f(x) = \dfrac{x^2 - x + 3}{\sqrt{4 - x^2}}$. Express your answer using interval notation.

   (b) The function $\dfrac{x - 1}{\left(\dfrac{x - 2}{x + 1}\right)}$ has been expressed as a complex fraction.

      i. Identify the domain of the function. You do **not** need to express your answer using interval notation.

      ii. Simplify the expression for $g(x)$ by replacing the complex fraction with a rational expression (polynomial over polynomial).

(c) Solve the inequality $-4 \leq -3x + 5 < 11$. Express your answer using interval notation.

(d) Find all solutions, if any, of the equation $x^{8/3} = 8x^{2/3} - 2x^{5/3}$.

2. (29 pts) Parts (a) and (b) are not related.

   (a) For parts i-iii, let point A be $(1, 2)$, let point B be $(3, -3)$, let segment AB be the line segment connecting points A and B, and let point M be the midpoint of segment AB.

      i. Find the (x, y) coordinates of point M.

      ii. Find the length of segment AB.

      iii. Find an equation of the line that is perpendicular to segment AB and passes through point A.

(b) Find the center and radius of the circle whose equation is $x^2 - 8x + 16 + y^2 + 2y + 1 = 7$.

3. (28 pts) Parts (a) - (c) are not related.

(a) If $\cot\theta = 3$ and θ is on the interval $(\pi, 3\pi/2)$, find the value of $\cos\theta$.

(b) Evaluate $\sin\left(\frac{5\pi}{3}\right)$

(c) A ladder is leaning against a vertical wall. Suppose the ladder and the floor form a 70° angle and the bottom of the ladder is 4 feet from the base of the wall. Express the length L of the ladder in terms of the given measurements. Include the correct unit of measurement. Your answer should include a trigonometric function.

4. (22 pts) Parts (a) - (c) are not related.

   (a) Find all values of x in the interval $[0, 2\pi]$ that satisfy the following equation:

$$(\cos x)\left(2\cos^2 x - 1\right) = 0$$

(b) A circular sector of radius 3 has an area of $3\pi/5$. What is the central angle of the sector? Express your answer in **degrees**.

(c) Is the function $h(x) = (x^2 + 1)^3$ odd, even, or neither? Justify your answer by using the definition of odd and/or even functions.

END OF EXAM

Your Initials _____

ADDITIONAL BLANK SPACE

If you write a solution here, please clearly indicate the problem number.

Potentially Useful Formulas

Sector of a circle:

Arc length: $L = \theta r$

Area: $A = \frac{1}{2}\theta r^2$

Pythagorean identities:

$\sin^2\theta + \cos^2\theta = 1$
$\tan^2\theta + 1 = \sec^2\theta$
$1 + \cot^2\theta = \csc^2\theta$

Sums and differences:

$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \cos\alpha\sin\beta$
$\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \mp \sin\alpha\sin\beta$

Double-angle formulas:

$\sin 2\theta = 2\sin\theta\cos\theta$
$\cos 2\theta = \cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta$