APPM 1340

Exam 1

Fall 2025

Name	
Instructor Richard McNamara	**Section** 150

This exam is worth 100 points and has **5 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

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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. (25 pts) Parts (a) - (d) are not related to each other.

   (a) i. Fully simplify the rational expression $\dfrac{x^2 + 2x - 3}{x^2 - 5x + 4}$.

   ii. Identify all value(s) of x, if any, for which the original expression is undefined.

   iii. Identify all value(s) of x, if any, for which the simplified expression is undefined.

   (b) Find all solutions, if any, of the equation $x^{9/4} + 6x^{1/4} = 5x^{5/4}$.

(c) Fully simplify the following complex fraction by expressing it as a rational expression (a quotient of two polynomials):

$$\frac{\frac{1}{x+1} + \frac{2}{x+2}}{\frac{3}{x+3}}$$

You may express the polynomials in either factored form or expanded form.

(d) Solve the inequality $x^2 > 10 - 3x$. Express your answer using interval notation.

2. (25 pts) Parts (a) and (b) are not related to each other.

  (a) For parts i-iii, let point A be $(-3, -1)$, let point B be $(2, 2)$, 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 $x^2 - 8x + y^2 = 20$.

Hint: Complete the square.

3. (20 pts) Parts (a) and (b) are not related to each other.

    (a) If $\sin \theta = 3/4$ and θ is on the interval $(\pi/2, \pi)$, find the value of $\cot \theta$.

    (b) Evaluate $\csc\left(\dfrac{7\pi}{6}\right)$

4. (16 pts) Parts (a) and (b) are not related to each other.

   (a) Use the trigonometric identity for $\cos(\alpha + \beta)$ and the fact that $75° = 30° + 45°$ to find the exact value of $\cos(75°)$.

   (b) On a circle of radius r, the length of the arc subtended by an angle of $15°$ is $7\pi/4$ inches. Find the value of r, including the correct unit of measurement.

5. (14 pts) Suppose that you are standing on a flat horizontal path that leads to the base of a mountain, and that the top of the mountain is 1000 feet directly above the mountain's base. Use the following variable assignments:

- Let x represent the horizontal distance, in feet, between you and the base of the mountain
- Let D represent the straight-line (diagonal) distance, in feet, between you and the top of the mountain
- Let θ represent the angle, in radians, between the path and your line of sight to the top of the mountain

(a) Draw a right triangle to depict the situation, including correct labels for the angle θ and the corresponding side lengths x, D, and 1000.

(b) Find an expression for x in terms of D. Your expression should not include the variable θ.

(c) Find an expression for D in terms of θ. Your expression should include a trigonometric function and it should not include the variable x.

END OF EXAM

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

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:

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