

APPM 1340**Exam 1****Fall 2026****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

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. Identify all value(s) of x , if any, for which the rational expression $\frac{x^2 + 7x + 10}{x^2 + 2x - 15}$ is undefined.

ii. Fully simplify the expression in part (i).

(b) Find all solutions, if any, of the following equations.

i. $x^{-1}(x^2 - 3x + 2) = 0$

ii. $x^{5/2} = 9x^{1/2}$

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

$$\frac{\frac{x+2}{7}}{\frac{1}{x^2} + \frac{1}{x-1}}$$

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

- (d) Solve the inequality $-5 < 2 - x \leq -3$. 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 $(-6, 1)$, 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 B.

(b) Find the center and radius of the circle whose equation is $x^2 + y^2 + 8y = 9$.

Hint: Complete the square.

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

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

(b) Evaluate $\tan\left(\frac{5\pi}{6}\right)$

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 $15^\circ = 45^\circ - 30^\circ$ to find the exact value of $\cos(15^\circ)$.

(b) For a circle with a radius of 6 inches, what is the area of a circular sector having a central angle of 50° ? Fully simplify your answer and include the correct unit of measurement.

5. (14 pts) Consider a hot-air balloon that is hovering directly above a point A on a flat horizontal field. Suppose that you are lying on another point B on that same field, where the horizontal distance between points A and B is 200 feet. Use the following variable assignments:

- Let y represent the vertical height, in feet, of the balloon above point A.
- Let D represent the straight-line (diagonal) distance, in feet, between point B and the balloon.
- Let θ represent the angle, in radians, between the field and your line of sight from point B to the balloon.

(a) Draw a right triangle to depict the situation, including correct labels for the angle θ and the corresponding side lengths y , D , and 200 of the triangle.

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

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

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:

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

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