MA 26200, Fall 2018, Exam 1
Version 01 (Green)

INSTRUCTIONS

(1) **Switch off your phone upon entering the exam room.**
(2) **Do not open the exam booklet until you are instructed to do so.**
(3) **Before you open the booklet, fill in the information below and use a # 2 pencil to fill in the required information on the scantron.**
(4) **MARK YOUR TEST NUMBER ON THE SCANTRON**
(5) Once you are allowed to open the exam, make sure you have a complete test. There are 6 different test pages, including this cover page.
(6) Do any necessary work for each problem on the space provided or on the back of the pages of this booklet. Circle your answers in the booklet.
(7) Use a # 2 pencil to transcribe your answers to the scantron.
(8) After you have finished the exam, hand in your scantron and your test booklet to your recitation instructor.

RULES REGARDING ACADEMIC DISHONESTY

(1) Do not leave the exam during the first 20 minutes of the exam.
(2) Do not leave in the last 10 minutes of the exam.
(3) No talking. Do not seek or obtain any kind of help from anyone to answer the problems on the exam. If you need assistance, consult an instructor.
(4) Do not look at the exam of another student. You may not compare answers with other students until your exam is finished and turned in, and then only after you have left the room.
(5) Your bags must be closed throughout the exam period.
(6) Notes, books, calculators and phones must be in your bags and cannot be used.
(7) Do not handle phones or cameras or any other electric device until you have finished and turned in your exam, and then only if you have left the room.
(8) When time is called, all students must put down their writing instruments immediately. You must remain in your seat while the TAs will collect the exam booklets and the scantrons.
(9) Anyone who violates these instructions will have committed an act of academic dishonesty. Penalties for such behavior can be severe and may include an automatic F on the course. All cases of academic dishonesty will be reported to the Office of the Dean of Students.

I have read and understand the above statements regarding academic dishonesty:

STUDENT NAME ______________________________

STUDENT SIGNATURE ______________________________

STUDENT PUID ______________________________

SECTION NUMBER ______________________________

RECITATION INSTRUCTOR ______________________________

1. Consider the following three differential equations:

(i) $\frac{dy}{dx} + 2y^4 = x^4$, (ii) $y^3 \frac{dy}{dx} = \sin x$, (iii) $\frac{dy}{dx} = \sin x$

with initial conditions $y(0) = 0$. Which of these problems has a unique solution in some rectangle containing the point $(0, 0)$ because we can apply the Existence and Uniqueness of Solutions Theorem?

A. (i), (ii), and (iii)
B. (i) and (ii) only
C. (i) and (iii) only
D. (ii) and (iii) only
E. none of these

2. The solution of the initial value problem $y' + \frac{4}{x}y = 12x$, $y(1) = 8$ is:

A. $y = \frac{4x^2+12}{2x^3}$

B. $y = \frac{8+4\ln x}{x^3}$

C. $y = \frac{5x^4+3}{x^3}$

D. $y = \frac{4x^3+4}{x^5}$

E. $y = \frac{2x^6+6}{x^4}$

3. The solution of $(y^2 + 2x + \cos x)dx + (2xy + \sin y)dy = 0$ is given implicitly by:

A. $x(y^2 + x) + \sin x - \cos y = C$

B. $x^2 y - \sin x + \cos y = C$

C. $x^2 y^2 - \cos y + \sin x = C$

D. $xy^2 + \sin x - \cos y = C$

E. $y^2(1 + x) - \sin x + \cos y = C$

4. The general solution to the differential equation

$$x\frac{dy}{dx} = x \tan(y/x) + y$$

is given by

A. $y(x) = x \sin^{-1}(x + c)$

B. $y(x) = x \sin^{-1}(cx)$

C. $y(x) = -x \sin^{-1}(cx)$

D. $y(x) = x \cos^{-1}(cx)$

E. $y(x) = -x \cos^{-1}(x + c)$

5. The solution to the initial value problem

$$\frac{dy}{dx} + \frac{2x}{1+x^2}y = -2xy^2, \qquad y(0) = 1$$

satisfies $y(1) =$

A. $\frac{1}{\ln(2)+1}$

B. $2\ln(2) + 2$

C. $2\ln(2) + 1$

D. $\frac{1}{2\ln(2)+1}$

E. $\frac{1}{2\ln(2)+2}$

6. Let $\mathbf{v_1} = \begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix}$, $\mathbf{v_2} = \begin{bmatrix} -5 \\ 6 \\ 1 \end{bmatrix}$, and $\mathbf{b} = \begin{bmatrix} 0 \\ a \\ 4 \end{bmatrix}$. For what values of a is $\mathbf{b}$ in the plane generated by $\mathbf{v_1}$ and $\mathbf{v_2}$?

A. No values of a

B. All values $a \in \mathbb{R}$

C. $a = 2$

D. $a = 4$

E. $a = 0$

7. Consider the linear system of equations

$$\begin{array}{rcrcrl} x_1 & + & 4x_2 & + & 2x_3 & = 3 \\ & & x_2 & + & x_3 & = 1 \\ 3x_1 & + & 6x_2 & & & = 3 \end{array}$$

Which of the following gives the solutions of the system in parametric form?

A. $\mathbf{x} = \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix} + s \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$ with any $s \in \mathbb{R}$

B. $\mathbf{x} = \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix}$

C. $\mathbf{x} = s \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$ with any $s \in \mathbb{R}$

D. $\mathbf{x} = s \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix} + t \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$ with any $s, t \in \mathbb{R}$

E. The system has no solution

8. Let

$$\mathbf{u} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \quad \mathbf{v} = \begin{bmatrix} 2 \\ -1 \\ 3 \end{bmatrix}, \quad \mathbf{w} = \begin{bmatrix} 0 \\ 1 \\ -2 \end{bmatrix}.$$

Which of the following statements is true?

A. $\mathbf{w}$ can be written as a linear combination of $\mathbf{u}$ and $\mathbf{v}$

B. $\mathbf{w}$ is in Span$(\mathbf{u}, \mathbf{v})$

C. $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ are linearly independent

D. $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ are linearly dependent

E. $\mathbf{u}$ and $\mathbf{v}$ are linearly dependent

9. Let $T : \mathbb{R}^2 \to \mathbb{R}^3$ be a linear transformation that maps any vector $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ into $\begin{bmatrix} x_2 \\ x_1 + x_2 \\ x_1 - x_2 \end{bmatrix}$. Find the standard matrix A of T.

A. $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & -1 \end{bmatrix}$

B. $A = \begin{bmatrix} 0 & 1 \\ 1 & 1 \\ 1 & -1 \end{bmatrix}$

C. $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \\ -1 & 1 \end{bmatrix}$

D. $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

E. A does not exist

10. Let

$$A = \begin{bmatrix} -1 & 2 \\ 0 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 3 & 0 & 1 \\ 1 & 2 & 0 \end{bmatrix}.$$

Find the second column of $A^{-1}B$.

A. $\begin{bmatrix} -4 \\ -2 \end{bmatrix}$

B. $\begin{bmatrix} 2 \\ 4 \end{bmatrix}$

C. $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$

D. $\begin{bmatrix} 0 \\ 2 \end{bmatrix}$

E. $\begin{bmatrix} 4 \\ 2 \end{bmatrix}$