Mathematics 1B03 Test 1

Dr. Bradd Hart Oct. 8, 2013

Last Name:____________________________ Initials:_________

Student No.:____________________________

- The test is 50 minutes long.
- The test has 8 pages and 15 multiple-choice questions printed on BOTH sides of the paper.
- Pages 6 through 8 contain no questions and can be used for rough work.
- You are responsible for ensuring that your copy of the paper is complete. Bring any discrepancies to the attention of the invigilator.
- Select the one correct answer for each question and enter that answer onto the scan card provided using an HB pencil. Each question is worth one mark and the total number of marks is 15. There is no penalty for a wrong answer.
- No marks will be given for the work in this booklet. Only the answers on the scan card count for credit. You must submit this test booklet along with your answer sheet.
- You may use a Casio fx-991 calculator; no other aids are not permitted.

It is your responsibility to ensure that the answer sheet is properly completed. Your test results depend upon proper attention to these instructions.

The scanner determines your choice of answer by sensing areas of non-reflection. In order for your answer to be read, a heavy mark must be made, completely filling the circular bubble, with an HB pencil. Marks made with a pen or felt-tip marker will **NOT** be seen by the scanner. Erasures must be thorough or the scanner may still sense a mark. Do **NOT** use correction fluid.

- Print your name, student number, course name, and the date in the space provided at the top of Side 1 (red side) of the form. Then the sheet **MUST** be signed in the space marked SIGNATURE.
- Mark your student number in the space provided on the sheet on Side 1 and fill the corresponding bubbles underneath.
- Mark only **ONE** choice (A, B, C, D, E) for each question.
- Begin answering questions using the first set of bubbles, marked “1”.

1. If the following matrix

$$\begin{pmatrix} 1 & 0 & 1 & 2 & -1 & 2 \\ 0 & 1 & -1 & 1 & 0 & -1 \\ 0 & 0 & 0 & 1 & 1 & 1 \end{pmatrix}$$

is the augmented matrix for a linear system in the variables x_1, x_2, x_3, x_4, x_5 then the general solution of this system is

A) $\begin{aligned} x_1 &= 2 \\ x_2 &= -1 \\ x_3 &= 0 \\ x_4 &= 1 \\ x_5 &= 0 \end{aligned}$ B) $\begin{aligned} x_1 &= 2 \\ x_2 &= -1 \\ x_3 &= s \\ x_4 &= 1 \\ x_5 &= t \end{aligned}$ C) $\begin{aligned} x_1 &= -s + 3t \\ x_2 &= s + t - 2 \\ x_3 &= s \\ x_4 &= 1 - t \\ x_5 &= t \end{aligned}$

D) $\begin{aligned} x_1 &= 2 + s + t \\ x_2 &= -1 + s + t \\ x_3 &= s \\ x_4 &= 1 + t \\ x_5 &= t \end{aligned}$ E) The system is inconsistent.

2. Let

$$A = \begin{pmatrix} 2 & 1 & 8 & 1 \\ 0 & -1 & -2 & 1 \\ 1 & 1 & 5 & 1 \end{pmatrix}$$

What is the reduced row echelon form of A?

A) $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}$ B) $\begin{pmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ C) $\begin{pmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & 0 \end{pmatrix}$

D) $\begin{pmatrix} 1 & 0 & 3 & 0 \\ 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ E) None of the above

3. If A, B and C are matrices such that the computation $(B^T AC)^T$ yields a 5×7 matrix and AC is 3×5 then B is

A) 3×5 B) 7×3 C) 3×7 D) 5×7 E) none of these.

continued ...

4. Suppose that a 2×2 matrix A satisfies $(A - I)^{-1} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$. Then A is

A) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ B) $\begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}$ C) $\begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix}$

D) $\begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ E) None of the above

5. Which of the following statements are true?

(a) All leading 1's in a matrix in row echelon form must occur in different columns.

(b) For all square matrices A and B of the same size, $(A+B)^2 = A^2 + 2AB + B^2$.

A) Both B) Neither C) (a) D) (b)

6. The inverse of

$$\begin{pmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{pmatrix}$$

is

A) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ B) $\begin{pmatrix} 1 & -2 & -3 \\ 0 & 1 & -2 \\ 0 & 0 & 1 \end{pmatrix}$ C) $\begin{pmatrix} 1 & -2 & 1 \\ 0 & 1 & -2 \\ 0 & 0 & 1 \end{pmatrix}$

D) $\begin{pmatrix} 1 & 2 & -1 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{pmatrix}$ E) This matrix is not invertible.

7. What conditions on a and b mean the linear system

$$\begin{aligned} 3x + 2y &= 2 \\ ax + ay &= b \end{aligned}$$

is inconsistent?

A) $a = 0, b \neq 0$ B) $a \neq 0, b = 0$ C) $a = b = 0$

D) $a \neq 0, b \neq 0$ E) None of these

continued ...

8. For what values of x is

$$\begin{pmatrix} x-1 & x^2 & x^4 \\ 0 & x+2 & x^3 \\ 0 & 0 & x-4 \end{pmatrix}$$

invertible?

A) For all x B) For all $x \neq 0$ C) For all $x \neq 1, -2, 4$
D) For all $x \neq 1, 2, 4$ E) None of these

9. The curve $y = ax^2 + bx + c$ passes through the points $(-1, 1), (0, 2)$ and $(1, 5)$. The value of b is

A) 0 B) 1 C) 2 D) 3 E) 4

10. Which of the following statements are true?

(a) Every elementary matrix is invertible.

(b) If A and B are square matrices such that $AB = I$ then $BA = I$

A) Both B) Neither C) (a) D) (b)

11. The determinant of

$$\begin{pmatrix} 2 & 1 & -1 \\ 0 & 1 & 3 \\ -1 & 3 & 0 \end{pmatrix}$$

is

A) 0 B) 22 C) -22 D) 1 E) None of these

continued ...

12. The determinant of

$$\begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix}$$

is

A) 0 B) -1 C) 4 D) -4 E) None of these

13. If $\det(A) = -2, \det(B) = 3$ and $\det(C) = 4$ then $\det(A^T BC^{-1})$ is

A) -24 B) -6 C) $-\frac{3}{8}$ D) $-\frac{3}{2}$ E) None of these

14. Given the two matrices:

$$A = \begin{pmatrix} a & b & c \\ d & e & f \\ g & h & i \end{pmatrix} \qquad B = \begin{pmatrix} 3a - 3d & 3b - 3e & 3c - 3f \\ a + g & b + h & c + i \\ 2d & 2e & 2f \end{pmatrix}$$

and that $\det B$=6, find $\det A$.

A) 6 B) 1 C) -1 D) 36 E) None of these.

15. Which of the following statements are true?

(a) For all square matrices A and B, $\det(A + B) = \det(A) + \det(B)$.

(b) For every $n \times n$ matrix A, $A\,\mathrm{adj}(A) = \det(A)I_n$.

A) Both B) Neither C) (a) D) (b)

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