McMaster University

Student Number |__|__|__|__|__|__|__|__|__|__|

Surname(Family Name) _____

Given Name _____

TERM TEST #1

MATH 1ZC3

All sections
Version #1

Instructors: Christopher Mclean, Subhajit Mishra, James Rooney

YOU ARE RESPONSIBLE FOR ENSURING THAT YOUR COPY OF THE PAPER IS COMPLETE. BRING ANY DISCREPANCY TO THE ATTENTION OF YOUR INVIGILATOR.

Examination Duration: 1.25 hours (75 minutes)

Exam Instructions:

MULTI VERSION exam

Materials Permitted In The Exam Venue:

(No electronic aids are permitted e.g. laptops, phones)

Materials To Be Supplied To Students:

1 x Optical Scan Answer Sheet (Scantron)

Scrap Paper

Instructions To Students:

This exam consists of **19** multiple choice questions, worth **1 mark each**.

For all questions, mark the answer in pencil on the OMR answer sheets according to the OMR instructions on page 2. Only solutions on the scan card will be graded.

A blank answer is an automatic zero for any question, even if the correct solution is circled on the question itself. Incorrect or multiple answers are also worth zero marks. No negative marks or part marks will be assigned.

OMR EXAMINATION - STUDENT INSTRUCTIONS

NOTE: IT IS YOUR RESPONSIBILITY TO ENSURE THAT THE ANSWER SHEET IS PROPERLY COMPLETED. YOUR EXAMINATION RESULT DEPENDS UPON PROPER ATTENTION TO THESE INSTRUCTIONS.

The scanner, which reads the sheets, senses the bubble-shaded areas by their non-reflection of light. 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 sensed. Erasures must be thorough or the scanner may still sense a mark. Do **NOT** use correction fluid on the sheets. Do **NOT** put any unnecessary marks or writing on the answer sheet.

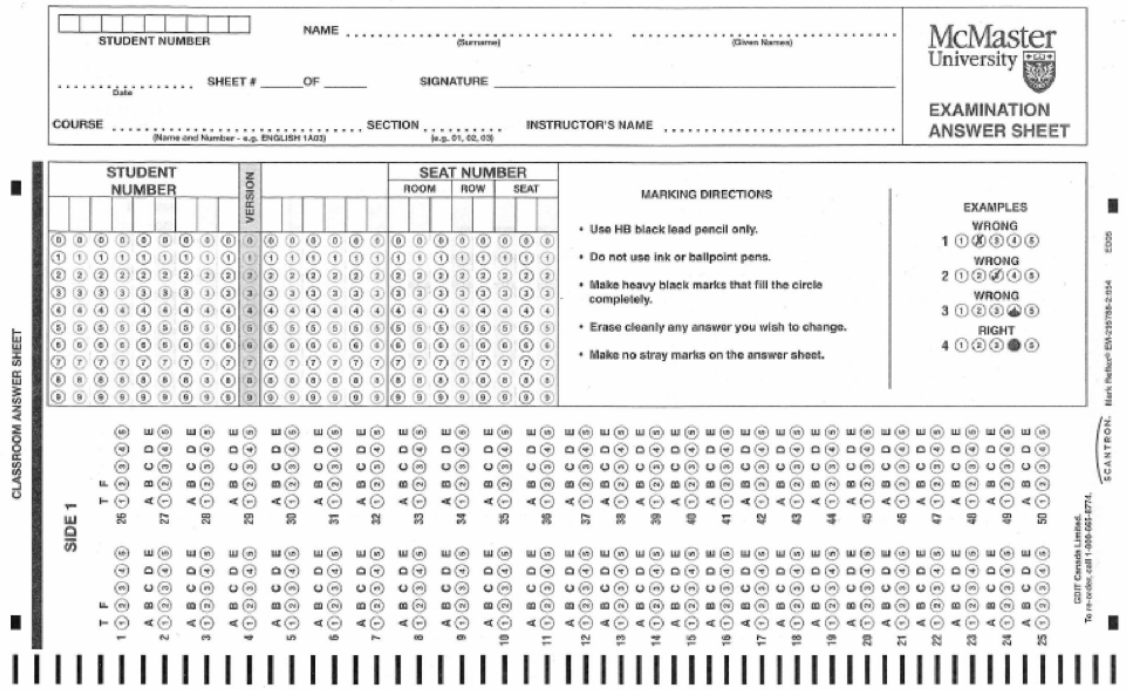
1. On side 1 (red side) of the form, in the top box, in **pencil**, print your student number **(NOTE: 9 digits)**, name, course name, section number, instructor name and date in the spaces provided. Then you **MUST** sign in the space marked SIGNATURE.

2. In the second box, with a pencil, mark your student number, exam version number, and course section number in the space provided and fill in the corresponding bubble numbers underneath.

3. To indicate your answers, mark only **ONE** choice from the alternatives (1,2,3,4,5 or A,B,C,D,E) provided for each question. If there is a True/False question, enter response of 1 (or A) as True, and 2 (or B) as False. The question number is to the left of the bubbles. Make sure that the number of the question on the scan sheet is the same as the question number on the test paper.

4. Pay particular attention to the Marking Directions on the form.

5. Begin answering questions using the first set of bubbles, marked “1”.



1. Which of the following is the inverse of the matrix: $P = \begin{bmatrix} 2 & 4 \\ -1 & 3 \end{bmatrix}$

a) $\begin{bmatrix} \frac{3}{10} & \frac{1}{10} \\ -\frac{2}{5} & \frac{1}{5} \end{bmatrix}$ **b)** $\begin{bmatrix} \frac{1}{5} & \frac{1}{10} \\ -\frac{2}{5} & \frac{3}{10} \end{bmatrix}$ **c)** $\begin{bmatrix} 3 & 1 \\ -4 & 2 \end{bmatrix}$ **d)** $\begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix}$ **e)** $\begin{bmatrix} \frac{3}{10} & -\frac{2}{5} \\ \frac{1}{10} & \frac{1}{5} \end{bmatrix}$

---

2. If A is a 5x3 matrix, B is 3x5, and C is 3x3, which one of the following computations is defined?

a) $B + 3A$ **b)** $BC + \mathrm{I}$ **c)** $2C + BA$ **d)** $2AB + 3C$ **e)** $A(B + C)$

---

3. Which one of the following matrices is in Row Echelon Form, but NOT Reduced Row Echelon Form?

a) $\begin{bmatrix} 1 & 1 & -1 \\ 0 & 1 & 1 \\ 0 & 0 & 2 \end{bmatrix}$ **b)** $\begin{bmatrix} 0 & 1 & -1 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$ **c)** $\begin{bmatrix} 1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ **d)** $\begin{bmatrix} 1 & 3 & 0 \\ 0 & 1 & -2 \\ 0 & 1 & 0 \end{bmatrix}$ **e)** $\begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 0 & 0 \end{bmatrix}$

---

4. Find all solutions of the linear system given by:

$$\begin{aligned} x + 2y - 2z &= 3 \\ 3x + 7y - 3z &= 6 \\ 4x + 9y - 5z &= 9 \end{aligned}$$

a) $\begin{aligned} x &= 9 - 2t \\ y &= -3 - t \\ z &= t \end{aligned}$ **b)** $\begin{aligned} x &= 9 + 8t \\ y &= -3 - 3t \\ z &= t \end{aligned}$ **c)** $\begin{aligned} x &= 8 + 9t \\ y &= -3 - 3t \\ z &= 0 \end{aligned}$ **d)** $\begin{aligned} x &= 17 \\ y &= -6 \\ z &= 1 \end{aligned}$ **e)** *No Solution*

5, Evaluate det(A) if det(B) = 4, det(C) = −1 and $B^T AC^3 = \begin{bmatrix} 2 & -2 \\ -1 & 2 \end{bmatrix}$.

a) 3/4 **b)** 1/4 **c)** 1/36 **d)** −8 **e)** −1/2

---

6. Solve for A if $(2B^{-1}AC)^{-1} = D$.

a) $\frac{1}{2} B\, D^{-1} C^{-1}$ **b)** $2B\, D^{-1} C^{-1}$ **c)** $\frac{1}{2} C^{-1} B\, D^{-1}$ **d)** $2C^{-1}\, D^{-1} B$ **e)** $\frac{1}{2} C\, D\, B^{-1}$

---

7. Find the element in row 3, column 2 of the matrix adj *B*, given $B = \begin{bmatrix} 3 & -1 & 2 \\ 1 & 1 & 0 \\ 2 & 2 & -1 \end{bmatrix}$.

a) 0 **b)** 4 **c)** –7 **d)** –8 **e)** 2

---

8. Find the determinant of the matrix $M = \begin{bmatrix} -3 & 1 & 3 & -2 \\ 0 & -1 & -3 & 5 \\ -3 & 1 & 7 & 3 \\ 0 & 0 & 0 & 5 \end{bmatrix}$

a) 60 **b)** –4 **c)** 0 **d)** 17 **e)** 5

---

9. Given the matrix $M = \begin{bmatrix} a & d & g \\ b & e & h \\ c & f & i \end{bmatrix}$ has an inverse, $M^{-1} = \begin{bmatrix} 2 & 7 & 1 \\ 2 & -13 & -2 \\ 3 & 0 & -5 \end{bmatrix}$ solve the system:

(Note that *a, b, c ,d, e, f, g, h, i* are all real valued constants.)

$$\begin{aligned} a\,x + d\,y + g\,z &= 3 \\ b\,x + e\,y + h\,z &= 1 \\ c\,x + f\,y + i\,z &= 2 \end{aligned}$$

a) $x = 1$, $y = 4$, $z = 0$ **b)** $x = 15$, $y = -11$, $z = -1$ **c)** $x = t - 1$, $y = 2t - 5$, $z = 13$ **d)** $x = 12$, $y = -2$, $z = 5$ **e)** $x = 76$, $y = 4$, $z = -39$

---

10. A matrix in Matlab is given by `A = [ 1 3 7; -2 5 2 ]`. What is the output of the command `A ( : , 2 )` ?

a) ans =
```
 1  3  7  2
-2  5  2  2
```
b) ans =
```
 3
 5
```
c) ans =
```
 3  7
 5  2
```
d) ans =
```
 1  3
-2  5
```
e) ans =
```
-2  5  2
```

---

11. Let *P* = *QR*, where $R = \begin{bmatrix} 2 & 1 \\ 1 & -3 \end{bmatrix}$ and $Q = \begin{bmatrix} 1 & 3 \\ 2 & 5 \\ -2 & -1 \end{bmatrix}$. What is the value of p_{32}?

a) –3 **b)** 7 **c)** 4 **d)** 1 **e)** Undefined

---

12. Using the cofactor expansion, we can calculate the determinant of the matrix $A = \begin{bmatrix} 0 & 5 & 2 \\ a & 1 & 2 \\ b & 4 & 3 \end{bmatrix}$.

If |A| = 9, which of the following are possible values of a and b?

a) $a = -3$ $b = 7$ **b)** $a = 1/7$ $b = 1$ **c)** $a = 1$, $b = 2$ **d)** $a = -1$ $b = 2$ **e)** $a = 3$ $b = 7$

---

13. If we know: $A = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$, $B = \begin{bmatrix} 3a & 3b & 3c \\ 2a-g & 2b-h & 2c-i \\ 2d+3g & 2e+3h & 2f+3i \end{bmatrix}$ and $\det(A) = 6$, compute $\det(B)$.

a) 36 **b)** −1/2 **c)** −72 **d)** 1 **e)** Cannot be determined

---

14. Which of the following statements must **always** be true for any nxn matrices A, and B:

I) $A^{\mathrm{T}}\mathbf{x} = \mathbf{0}$ has only the trivial solution means A can never be the product of elementary matrices.

II) $(AB)\mathbf{x} = \mathbf{b}$ is consistent for all nx1 matrices, $\mathbf{b}$, then $B\mathbf{x} = 0$ has only the trivial solution.

a) I only **b)** II only **c)** Both I and II **d)** Neither I nor II **e)** Who knows!

---

15. Find the values b_1, b_2 such that the following system is consistent.

$$2x + 3y - z = b_1$$
$$6x + 9y - 3z = b_2$$

a) $2b_2+3b_1 = 0$ **b)** $b_2-3b_1 \neq 0$ **c)** $2b_2+3b_1 \neq 0$ **d)** $b_2-3b_1 = 0$ **e)** System inconsistent for all b_1, b_2

---

16. Which of the following are elementary matrices?

I) $\begin{bmatrix} 1 & 0 \\ -1 & 3 \end{bmatrix}$ II) $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ III) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

a) III only **b)** II only **c)** I and II **d)** I and III **e)** II and III

---

17. A matrix W is a skew-symmetric matrix if $W = -W^{\mathrm{T}}$. Which of the following are true always statements if A, B are skew-symmetric?.

I) $\mathrm{tr}(A) = 0$ II) $(A - 2I)$ is skew symmetric III) If A,B commute, AB is skew symmetric

a) II and III **b)** I and III **c)** I and II **d)** II only **e)** I only

---

18. For given matrices A, and $\mathbf{b}$, we know $A\mathbf{x} = \mathbf{b}$ when $\mathbf{x} = \begin{bmatrix} 1 \\ 3 \\ 9 \end{bmatrix}$, and $A\mathbf{x} = \mathbf{0}$ when $\mathbf{x} = \begin{bmatrix} -1 \\ 2 \\ 6 \end{bmatrix}$. Which of the following must also be a solution to $A\mathbf{x} = \mathbf{b}$?

a) $\begin{bmatrix} -2 \\ -3 \\ -9 \end{bmatrix}$ **b)** $\begin{bmatrix} 1 \\ 8 \\ 24 \end{bmatrix}$ **c)** $\begin{bmatrix} 0 \\ 5 \\ 15 \end{bmatrix}$ **d)** $\begin{bmatrix} 2 \\ 6 \\ 18 \end{bmatrix}$ **e)** No such solution exists

---

19. Which of the following statements must **always** be true for any invertible 3x3 matrices, A and B?

I) $\det(2A) = 8\det(A)$ II) $\det(B^{-1}) = 1/\det(B)$ III) $\det(A+B) = \det(A)+\det(B)$

a) I only **b)** II only **c)** I and II **d)** I and III **e)** II and III

Don't forget to fill in the bubbles corresponding to both your student number <u>and</u> the version number on the scantron!

You are writing VERSION 1.

END OF TEST