

MATH141 – Mathematics 1C, Part 1

SAMPLE

Mid-Session Test

Student Name: _____ *Student Number:* _____

Tutorial Group: _____ *Day & Time:* _____ *Tutor:* _____

Instructions

Time Allowed: 90 minutes

Do NOT remove the Answer Sheet from the Question Section.

- *All questions are to be attempted:
25 Multiple choice questions (25 marks).*
 - *Working is to be done in the Question Section.*
 - *Answers are to be marked on the page entitled Answer Sheet by completely shading the box with the letter of your chosen response.*
 - *Answers should also be marked on the Question Section.*
 - *Write your name on both the Question Section and the Answer Sheet.*
 - *At the end of the test return the complete test paper, including the Answer Sheet.*
-

Calculators are permitted.

A one-page, A4-sized, doubled-sided summary sheet is permitted.

This test paper is NOT to leave this room.

1. Given that

$$A = \begin{pmatrix} 2 & 0 & 5 \\ 4 & -1 & 7 \end{pmatrix},$$

the value of

$$\sum_{i=1}^2 \sum_{j=1}^3 a_{ij} \delta_{ij}$$

is given by

- (a) 1.
- (b) 17.
- (c) Does not exist.
- (d) 0.
- (e) 7.

2. Given that

$$A = \begin{pmatrix} 2 & 1 \\ 1 & -2 \\ 3 & 4 \end{pmatrix},$$

the elementary matrix E such that

$$EA = \begin{pmatrix} 5 & 5 \\ 1 & -2 \\ 3 & 4 \end{pmatrix}$$

is given by

- (a) $\begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$.
- (b) $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$.
- (c) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$.
- (d) $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$.
- (e) None of these.

3. Given that

$$A = \begin{pmatrix} 4 & 9 \\ 3 & 7 \end{pmatrix},$$

the inverse matrix, A^{-1} , is given by

(a) $\begin{pmatrix} 7 & -9 \\ -3 & 4 \end{pmatrix}$.

(b) $\begin{pmatrix} \frac{1}{4} & \frac{1}{9} \\ \frac{1}{3} & \frac{1}{7} \end{pmatrix}$.

(c) $\begin{pmatrix} -4 & 3 \\ 9 & -7 \end{pmatrix}$.

(d) Does not exist.

(e) None of these.

4. Given matrices $A_{5 \times 4}$, $B_{4 \times 5}$ and $C_{4 \times 4}$ with their orders indicated by their subscripts, which of the following operations are valid?

(i) AB (ii) AC (iii) BC (iv) $(BA)^T + C$ (v) $(AB)^T + C$

(a) (i), (ii) and (iv) only.

(b) (i), (ii) and (v) only.

(c) (i), (ii), (iv) and (v) only.

(d) None of them.

(e) All of them.

5. Given that

$$A = \begin{pmatrix} 2 & 7 & 4 & 0 \\ 1 & 3 & 2 & 1 \\ 2 & 6 & 5 & 4 \end{pmatrix},$$

the reduced row echelon form for A is given by

(a) $\begin{pmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & 2 \end{pmatrix}$.

(b) $\begin{pmatrix} 1 & 3 & 2 & 1 \\ 0 & 1 & -1 & -4 \\ 0 & 0 & 1 & 2 \end{pmatrix}$.

(c) $\begin{pmatrix} 1 & 3 & 2 & 1 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & 2 \end{pmatrix}$.

(d) $\begin{pmatrix} 1 & 0 & 0 & 7 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & 2 \end{pmatrix}$.

(e) None of these.

6. Given that

$$A = \begin{pmatrix} 1 & 0 & 3 \\ 2 & -5 & 4 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 3 & -1 & 6 \\ 0 & 4 & 5 \end{pmatrix},$$

AB^T is given by

(a) $\begin{pmatrix} 21 & 15 \\ 35 & 0 \end{pmatrix}$.

(b) $\begin{pmatrix} 21 & 35 \\ 15 & 0 \end{pmatrix}$.

(c) Does not exist.

(d) $\begin{pmatrix} 3 & 0 & 9 \\ 7 & -20 & 13 \\ 16 & -25 & 38 \end{pmatrix}$.

(e) $\begin{pmatrix} 3 & 7 & 16 \\ 0 & -20 & -25 \\ 9 & 13 & 38 \end{pmatrix}$.

7. Let $A = \begin{pmatrix} 1 & 2 \\ 3 & 0 \\ -2 & 6 \end{pmatrix}$. Then the identity matrix I such that $AI = A$ is given by

(a) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$.

(b) $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$.

(c) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$.

(d) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{pmatrix}$.

(e) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$.

8. Determine for what values of k the system given by

$$\begin{aligned} 3x + 2y &= 11 \\ 6x + ky &= 21 \end{aligned}$$

has

(i) a unique solution. (ii) no solutions. (iii) infinitely many solutions.

(a) (i) $k \neq 4$; (ii) $k = 4$; (iii) no k .

(b) (i) no k ; (ii) $k \neq 4$; (iii) $k = 4$.

(c) (i) $k = 4$; (ii) no k ; (iii) $k \neq 4$.

(d) (i) all k ; (ii) no k ; (iii) no k .

(e) None of these.

9. The sum

$$\sum_{k=1}^{20} \left(\frac{1}{k} - \frac{1}{k+2} \right)$$

is given by

- (a) $\frac{325}{231}$.
- (b) $\frac{53}{44}$.
- (c) $\frac{419}{462}$.
- (d) $\frac{1069}{924}$.
- (e) $\frac{21}{22}$.

10. Given that

$$\begin{pmatrix} 1 & 7 & 1 \\ 4 & 8 & 7 \\ 2 & 7 & 9 \end{pmatrix} \text{ and } \underline{b} = \begin{pmatrix} 4 \\ 20 \\ 23 \end{pmatrix},$$

the solution to $A\underline{x} = \underline{b}$ is given by

- (a) $\begin{pmatrix} 5 \\ -2 \\ 3 \end{pmatrix}$.
- (b) $\begin{pmatrix} -4 \\ 4 \\ 0 \end{pmatrix}$.
- (c) $\begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix}$.
- (d) Does not exist.
- (e) None of these.

11. If a function is defined by the rule

$$f(x) = \begin{cases} 0 & x \leq -3, \\ -2 & -3 < x < 0, \\ x & x \geq 0. \end{cases}$$

then $f(-3) + f(-1) + f(3)$ is equal to

- (a) 1.
- (b) 0.
- (c) -1.
- (d) $-2 + x$.
- (e) -2.

12. Let $A = \{x \in \mathbb{R} : x > 0\}$, $B = \{x \in \mathbb{R} : -2 \leq x \leq 2\}$ and $C = \{x \in \mathbb{R} : x < 1\}$. The set $A \cap B \cap C$ is given by

- (a) $\{x \in \mathbb{R} : 0 < x < 1\}$.
- (b) $\{x \in \mathbb{R} : 1 < x \leq 2\}$.
- (c) $\{x \in \mathbb{R} : -2 \leq x < 1\}$.
- (d) $\{x \in \mathbb{R} : 0 < x \leq 2\}$.
- (e) $\{x \in \mathbb{R} : x \geq -2\}$.

13. A circle in the coordinate plane has tangent lines $x = 2$ and $y = 5$, and radius 3. The equation of the circle is given by

- (a) $(x + 1)^2 + (y - 2)^2 = 9$.
- (b) $(x - 2)^2 + (y - 5)^2 = 9$.
- (c) $(x - 3)^2 + (y - 3)^2 = 9$.
- (d) $x^2 + y^2 = 9$.
- (e) None of these.

14. The values of x which satisfy the equation

$$\frac{x - 2}{3x + 4} = \frac{2x - 3}{x + 1}$$

are

- (a) $\pm\sqrt{2}$.
- (b) $2, \frac{2}{3}$.
- (c) $-\frac{4}{3}, -1$.
- (d) $2, -1$.
- (e) $2, -\frac{3}{4}$.

15. The expression $\frac{b^{5/3} \cdot \sqrt[3]{b}}{b^3}$ is equal to

- (a) None of these.
- (b) $\sqrt[6]{b}$.
- (c) $b^{13/6}$.
- (d) $\sqrt[3]{b^5}$.
- (e) $b^{-5/3}$.

16. The value of $\cos(\operatorname{arccot} 2)$ is given exactly by

- (a) $\frac{2}{\sqrt{5}}$.
- (b) $\frac{1}{\sqrt{5}}$.
- (c) 2.
- (d) $\frac{1}{2}$.
- (e) $\cos 2$.

17. Which of the following statements is true?

- (a) If $f(2) = 0$, then $x - 2$ is a factor of $f(x)$.
- (b) If $f(2) = 0$, then $x + 2$ is a factor of $f(x)$.
- (c) If $f(2) = 0$, then $f(x) = 0$.
- (d) If $f(2) = 0$, then $f(x)$ has no factors.
- (e) None of these statements are true.

18. The expression $\sin(3A - B) + \sin(A + 3B)$ is equal to

- (a) $2 \sin(2A + B) \cos(A - 2B)$.
- (b) $\sin(4A + 2B)$.
- (c) $2 \cos(A + B) \sin\left(\frac{A - B}{2}\right)$.
- (d) $\sin 3A - \sin B + \sin A + \sin 3B$.
- (e) $2 \sin(A + B) \cos(A - 2B)$.

19. If x is a real number, then $3^x + 3^x + 3^x$ equals

- (a) 3^{x+1} .
- (b) 3^{3x} .
- (c) 9^x .
- (d) 9^{3x} .
- (e) None of these.

20. $\frac{xy}{25x^2 - y^2} + \frac{2x^2y}{10x^2y + 2xy^2}$ can be simplified to

- (a) $\frac{5x^2}{(5x - y)(5x + y)}$.
- (b) $\frac{xy + 2x^2y}{(25x^2 - y^2)(10x^2y + 2xy^2)}$.
- (c) $\frac{x}{(1 - y)(5x + y)}$.
- (d) $\frac{5x^2}{(25x^2 - y^2)(10x^2y + 2xy^2)}$.
- (e) $\frac{10x^2y}{(5x - y)(5x + y)}$.

21. The largest possible domain for the function $f(x) = \sqrt{\ln x - 1}$ (where $f(x)$ is real-valued) is

- (a) $[e, \infty)$.
- (b) \mathbb{R} .
- (c) $(0, \infty)$.
- (d) $[1, \infty)$.
- (e) Not able to be determined.

22. Let f be the function given by $f(x) = (2x - 1)/(x + 2)$. The range of f is

- (a) $(-\infty, 2) \cup (2, \infty)$.
- (b) $(-\infty, \infty)$.
- (c) $(0, \infty)$.
- (d) $(-\infty, 2) \cup (-2, \infty)$.
- (e) $\{-1, 1\}$.

23. If $f(x) = \sqrt{x}$ and $g(x) = \sqrt{4 - x^2}$, then $(f + g)(x)$ and its domain are given by

- (a) $\sqrt{x} + \sqrt{4 - x^2}; [0, 2]$.
- (b) $\sqrt{x} + \sqrt{4 - x^2}; (0, 2)$.
- (c) $\sqrt{x + (4 - x^2)}; [0, 2]$.
- (d) $x + (4 - x^2); (0, 2)$.
- (e) $\sqrt{x} + \sqrt{4 - x^2}; [0, 2)$.

24. The value of the limit $\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x^2 - 1}$ is

- (a) $\frac{3}{2}$.
- (b) 0.
- (c) 1.
- (d) 2.
- (e) Non-existent.

25. The value of $\lim_{x \rightarrow 1} \frac{x^4 - 1}{x - 1}$ is

- (a) 4.
- (b) 0.
- (c) 1.
- (d) 2.
- (e) Non-existent.

MATH141 – Mathematics 1C, Part 1

SAMPLE

Mid-Session Test

Student Name: _____ Student Number: _____

Answer Sheet

Completely fill in the appropriate box for each question:

1. A B C D E
2. A B C D E
3. A B C D E
4. A B C D E
5. A B C D E
6. A B C D E
7. A B C D E
8. A B C D E
9. A B C D E
10. A B C D E
11. A B C D E
12. A B C D E
13. A B C D E
14. A B C D E
15. A B C D E
16. A B C D E
17. A B C D E
18. A B C D E
19. A B C D E
20. A B C D E
21. A B C D E
22. A B C D E
23. A B C D E
24. A B C D E
25. A B C D E