O.S.D.A.V. Public School, Kaithal.

May Unit Test. 2025-2026

Class : XII

Subject: Applied Mathematics

Set-A

Time 1 hr. 30 min. **M.M. 40**

General Instructions:

All questions are compulsory. This question paper has 5 sections. Section A has 11 questions of 1 mark each. Section B has 3 questions of 2 marks each. Section C has 3 questions of 3 marks each. Section D has 2 question of 5 mark each. Section E has 1 question of 4 marks.

SECTION - A

1. 6^{10} mod5 is equal to:

   a. 2 b. 1 c. 3 d. 0

2. The solution of $-4 < 3+2x \leq 11$, $x \in R$ is:

   a. [-2, 3] b. (-2, 3] c. [-3, 3) d. (-3, 3]

3. If A is a square matrix and $|A| = 2$, then the value of $|AA'|$ is equal to:

   a. 1 b. 2 c. 3 d. 4

4. If $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ such that $A^{-1} = kA$, then the value of k is:

   a. 19 b. $\frac{1}{19}$ c. 5 d. 20

5. In a 2 k.m. race, P can give Q a start of 200m and R a start of 560m. Then in the same race, Q can give R a start of _____m.

   a. 200m b. 250m c. 400m d. 450m

6. The last two digits of 2^{20} are:

   a. 67 b. 76 c. 20 d. 22

7. Objective function of a L.P.P. is:

   a. a relation between two variables b. Constant

   c. a function to be optimized d. none of these

8. Last three digits of the product 5142 x 7466 are:

   a. 127 b. 182 c. 172 d. 192

9. Infeasibility means that the number of solutions to the L.P.P. that satisfies all constraints are:

   a. Infinite solution b. At least one solution

   c. Zero d. None of these.

10. The following questions consist of two statements – Assertion (A) and Reason(R). Answer these questions selecting the appropriate option given below:

a. Both A and R are true and R is the correct explanation for A.

b. Both A and R are true but R is not the correct explanation for A.

c. A is true but R is false. d. A is false but R is true.

Assertion: If A and B are symmetric matrices of same order, then AB – BA is also a symmetric matrix.

Reason: Any square matrix A is said to be skew symmetric if A = -A', where A' is the transpose of matrix A.

11. Assertion: If A is an invertible matrix of order 3 and |A|=5, then |adj.A|=25.

Reason: If A is non-singular matrix of order n, then $|adj.A|=|A|^{n-1}$.

Section B

12. In a 200 meters race, A beats B by 35 m 7 seconds. Find the time taken by A to complete the race.

13. Solve the following inequation:

$\frac{x-1}{x+3} > 2$, $x \neq -3$

14. Solve the following equations by using cramer's rule:

$2x + 3y = 1$

$5x + 7y = 2$

Section C

15. If $A = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$ verify that $A^2 - 5A - 14\,I = 0$ and hence find A^{-1}.

16. Two pipes can fill a tank in 16 minutes and 18 minutes respectively. A third pipe can empty the tank at the rate of 12 litres/minute. If all the pipes working together can fill the empty tank in 20 minutes, what is the capacity of the tank?

17. A man goes 12k.m. downstream and comes back to starting point by swimming non-stop in 3 hours. If the speed of stream is 3k.m./h, find the speed with which the man can swim in still water.

Section D

18. If $A = \begin{bmatrix} 3 & 1 & 2 \\ 3 & 2 & -3 \\ 2 & 0 & -1 \end{bmatrix}$, find A^{-1}. Hence solve the system equations:

$3x + 3y + 2z = 1$

$x + 2y = 4$

$2x – 3y – z = 5$

19. A manufacturer produces two products A and B. Both the products are processed on two different machines. The available capacity of first machine is 12 hours and that of second machine is 9 hours per day. Each unit of product A requires 3 hours on both machines and each unit of product B requires 2 hours on first machine and 1 hour on second machine. Each unit of product A is sold at Rs. 7 profit and that of B at a profit of Rs. 4. Find the production level per day for maximum profit graphically.

Section E

20. A manufacturer produces three stationary products: Pencils, Erasers and Sharpeners which he sells in two markets. His annual sales are indicated below:

Market	Products (in numbers)		
	Pencil	Eraser	Sharpener
A	10,000	2000	18,000
B	6000	20,000	8,000

The unit sale price of Pencil, Eraser and Sharpener are Rs. 25, Rs. 15 and Rs. 10 respectively, and unit cost of the above three commodities are Rs. 20, Rs. 10 and Rs. 5 respectively.

Based on the above information answer the following, using matrices:

i. Find the total revenue of market A.

ii. Find the total revenue of market B.

iii. Find the cost incurred in markets A and B.

OR

Find the profits in markets A and B.

O.S.D.A.V. Public School, Kaithal.
May Unit Test 20254-2026
Class : XII
Subject: Applied Mathematics

Set-B

Time 1 hr. 30 min. **M.M. 40**

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SECTION - A

1. 3^{15} mod7 is equal to:
   a. 6 b. 5 c. 3 d. 7
2. If $x \in R$, $|x|<9$ then:
   a. $x \geq 9$ b. $-9 < x < 9$ c. $x \leq -9$ d. $-9 \leq x \leq 9$
3. If A is a square matrix and $|A| = 2$, then the value of $|AA'|$ is equal to:
   a. 1 b. 2 c. 3 d. 4
4. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$, Value of α for which $A^2 = B$ is:
   a. $\alpha = 1$ b. $\alpha = 2$ c. $\alpha = 0$ d. does not exist
5. In a 2 k.m. race, P can give Q a start of 200m and R a start of 560m. Then in the same race, Q can give R a start of _____m.
   a. 200m b. 250m c. 400m d. 450m
6. The unit digits of 3^{50} is:
   a. 7 b. 9 c. 8 d. 4
7. Objective function of a L.P.P. is:
   a. a relation between two variables b. Constant
   c. a function to be optimized d. none of these
8. Last three digits of the product 5142 x 7466 are:
   a. 127 b. 182 c. 172 d. 192
9. Infeasibility means that the number of solutions to the L.P.P. that satisfies all constraints are:
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10. The following questions consist of two statements – Assertion (A) and Reason(R). Answer these questions selecting the appropriate option given below:
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Assertion: If A and B are symmetric matrices of same order, then AB – BA is also a symmetric matrix.

Reason: Any square matrix A is said to be skew symmetric if A = -A', where A' is the transpose of matrix A.

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Reason: If A is non-singular matrix of order n, then $|adj.A|=|A|^{n-1}$.

SECTION - B

12. In a 200 meters race, A beats B by 35 m 7 seconds. Find the time taken by A to complete the race.

13. Solve the following inequation:
$\frac{x-1}{x+3} > 2$, $x \neq -3$

14. Solve the following system of equations by using Cramer rule:
$5x + 2y = 3$
$3x + 2y = 5$

SECTION - C

15. If $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$, $f(x) = x^2 - 2x - 3$. Show that $f(A) = 0$, hence find A^{-1}.

16. Two pipes can fill a tank in 16 minutes and 18 minutes respectively. A third pipe can empty the tank at the rate of 12 litres/minute. If all the pipes working together can fill the empty tank in 20 minutes, what is the capacity of the tank?

17. A man goes 12k.m. downstream and comes back to starting point by swimming non-stop in 3 hours. If the speed of stream is 3k.m./h, find the speed with which the man can swim in still water.

SECTION - D

18. If $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ find AB. Use it to solve the following system of equations:

$x - y = 3$
$2x + 3y + 4z = 17$
$y + 2z = 7$

19. A manufacturer produces two products A and B. Both the products are processed on two different machines. The available capacity of first machine is 12 hours and that of second machine is 9 hours per day. Each unit of product A requires 3 hours on both machines and each unit of product B requires 2 hours on first machine and 1 hour on second machine. Each unit of product A is sold at Rs. 7 profit and that

of B at a profit of Rs. 4. Find the production level per day for maximum profit graphically.

SECTION - E

20. A manufacturer produces three stationary products: Pencils, Erasers and Sharpeners which he sells in two markets. His annual sales are indicated below:

Market	Products (in numbers)		
	Pencil	Eraser	Sharpener
A	10,000	2000	18,000
B	6000	20,000	8,000

The unit sale price of Pencil, Eraser and Sharpener are Rs. 25, Rs. 15 and Rs. 10 respectively, and unit cost of the above three commodities are Rs. 20, Rs. 10 and Rs. 5 respectively.

Based on the above information answer the following, using matrices:

i. Find the total revenue of market A.

ii. Find the total revenue of market B.

iii. Find the cost incurred in markets A and B.

OR

Find the profits in markets A and B.

Class XII

Set A and B

Applied Mathematics

May Unit Test (2025-26)

Marking Scheme

Note :- Any relevant solution not mentioned here in but correct will be suitably awarded.

Q. No.	Value points / Key points	Value point	Total point
1	(b) 1	1	1
2	(b) $(-2, 3]$	1	1
3 2(B)	(d) 4	1	1
4	(b) $\frac{1}{19}$	1	1
5 4(B)	(c) 4 cm	1	1
6	(b) 76	1	1
7. 8(B)	(c) A function to be optimized	1	1
8 7(B)	(c) 172	1	1
9 7(B)	(c) Zero	1	1
10 11(B)	(d) A is False & R is true	1	1
11 10(B)	(a) Both A & R are true & R is the correct explanation of A.	1	1

12 13(B) A beats B by 35m or 7 seconds implies that B covers a distance of 35 metres in 7 seconds

Speed of $B = \frac{35}{7} = 5$ m/sec. — 1

Time taken by B to cover a distance of 200m $= \frac{200}{5} = 40$ sec. — 1/2

Now A beats B by 7 seconds

Time taken by A to complete the race $= (40 - 7) = 33$ seconds. — 1/2

2

13 12(B)

$$\frac{x-1}{x+3} - 2 > 0$$

$$\frac{x-1-2x-6}{x+3} > 0$$

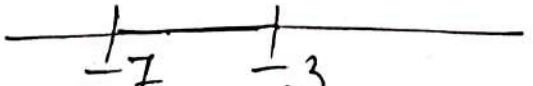
$$-\frac{x-7}{x+3} > 0$$

$$\frac{x+7}{x+3} < 0$$ — 1/2

02

$x+7 > 0$ and $x+3 < 0$

$x > -7$ & $x < -3$



$(-7, -3)$

$x+7 < 0$ and $x+3 > 0$

$x < -7$ & $x > -3$

No Sol^n — 1 1/2

$\therefore x \in (-7, -3)$

14

$2x+3y=1$

$5x+7y=2$

$D = \begin{vmatrix} 2 & 3 \\ 5 & 7 \end{vmatrix}$ ½

$14-15=-1$

$D_1 = \begin{vmatrix} 1 & 3 \\ 2 & 7 \end{vmatrix}$ ½

$7-6=1$

$D_2 = \begin{vmatrix} 2 & 1 \\ 5 & 2 \end{vmatrix}$ ½

$4-5=-1$

$x = \frac{D_1}{D} = \frac{1}{-1} = -1$ $y = \frac{D_2}{D} = \frac{-1}{-1}$ ½

$= 1$

2

15

$A = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$

$A^2 = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix} \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$

$= \begin{bmatrix} 9+20 & -15-10 \\ -12-8 & 20+4 \end{bmatrix}$

$= \begin{bmatrix} 29 & -25 \\ -20 & 24 \end{bmatrix}$ 1

$A^2 - 5A - 14I$

$$\begin{bmatrix} 29 & -25 \\ -20 & 24 \end{bmatrix} - \begin{bmatrix} 15 & -25 \\ -20 & 10 \end{bmatrix} - \begin{bmatrix} 14 & 0 \\ 0 & 14 \end{bmatrix}$$

$$\begin{bmatrix} 29-29 & -25+25 \\ -20+20 & 24-24 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$ 1/2

$A^2 - 5A - 14I = 0$

$A^2 = 5A + 14I$

Pre multiply by A^{-1}

$A^{-1}A^2 = 5A^{-1}A + 14A^{-1}I$

$A = 5I + 14A^{-1}$

$\frac{1}{14}[A - 5I] = A^{-1}$ 1

$A^{-1} = \frac{1}{14}\left\{\begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix} - \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}\right\}$

$A^{-1} = \frac{1}{14}\begin{bmatrix} -2 & -5 \\ -4 & -3 \end{bmatrix}$ — Ans 1/2

3

16 17(B) Let the Capacity of tank = x Litres

Part of tank filled by two pipes together in one minute = $\left(\frac{1}{16} + \frac{1}{18}\right)$

By third pipe

12 Litre emptied in 1 minute 1

$\therefore$ x litre emptied in $\frac{x}{12}$ minute

Part of tank emptied in 1 minute $= \frac{12}{x}$

if all the three pipes work together they can fill the tank in 20 minutes

$\therefore \frac{1}{16} + \frac{1}{18} + \left(-\frac{12}{x}\right) = \frac{1}{20}$ 1

$\frac{1}{16} + \frac{1}{18} - \frac{1}{20} = \frac{12}{x}$ 3

$\frac{45 + 40 - 36}{720} = \frac{12}{x}$

$\frac{49}{720} = \frac{12}{x}$

$x = \frac{12 \times 720}{49}$

$x = 176.3\ell$ 1

17 Let Speed of man in still water $= x$ k.m/h

18(B) Let " " Stream $= y$ k.m/h

i.e $y = 3$ k.m/h

Downstream speed $= (x+3)$ k.m/h

Upstream " $= (x-3)$ k.m/h 1

Total distance $= 12 + 12 = 24$ k.m.

Total time $= 3$ h.

Average speed of man $= \frac{24}{3} = 8$ k.m/h

Average speed $= \frac{(x+3)(x-3)}{x}$ 1

$\therefore \quad \frac{x^2-9}{x} = 8$

$x^2 - 9 = 8x$

$x^2 - 8x - 9 = 0$

$x^2 - 9x + x - 9 = 0$

$x(x-9) + 1(x-9) = 0$

$x = 9$ or $x = -1$

$x \neq -1$ [Speed can not be -ve]

$\therefore$ Speed of man in still water $= 9$ k.m/h

3

1

18

Sec D

$$A = \begin{bmatrix} 3 & 1 & 2 \\ 3 & 2 & -3 \\ 2 & 0 & -1 \end{bmatrix}$$

$|A| = 3(-2-0) - 1(-3+6) + 2(-4)$

$= -6 - 3 - 8 = -17$

1½

$$\text{adj } A = \begin{bmatrix} -2 & -3 & -4 \\ +1 & -7 & +2 \\ -7 & +15 & 3 \end{bmatrix}'$$

1

$$= \begin{bmatrix} -2 & 1 & -7 \\ -3 & -7 & 15 \\ -4 & 2 & 3 \end{bmatrix}$$

1½

$$A^{-1} = -\frac{1}{17}\begin{bmatrix} -2 & 1 & -7 \\ -3 & -7 & 15 \\ -4 & 2 & 3 \end{bmatrix}$$

1½

$3x + 3y + 2z = 1$

$x + 2y = 4$

$2x - 3y - z = 5$

$$\begin{bmatrix} 3 & 3 & 2 \\ 1 & 2 & 0 \\ 2 & -3 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 4 \\ 5 \end{bmatrix}$$ 1/2

$A' X = B$

$X = (A')^{-1} B$

$X = (A^{-1})' B$ 1

$$X = \frac{-1}{17} \begin{bmatrix} -2 & +3 & -4 \\ \text{h} & -7 & 2 \\ -7 & 15 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ 4 \\ 5 \end{bmatrix}$$ 1/2

5

$$X = \frac{-1}{17} \begin{bmatrix} -2-12-20 \\ 1-28+10 \\ -7+60+15 \end{bmatrix}$$

$$X = \frac{-1}{17} \begin{bmatrix} -34 \\ -17 \\ 68 \end{bmatrix}$$

$\Rightarrow x = 2, y = 1, z = -4$ 1/2

19

	x (units) A	y (units) B	
20(B) M_1	3	2	(12 h)
M_2	3	1	(9 h)

$3x + 2y \leq 12$ $\quad Z = 7x + 4y$ $\quad 1\frac{1}{2}$

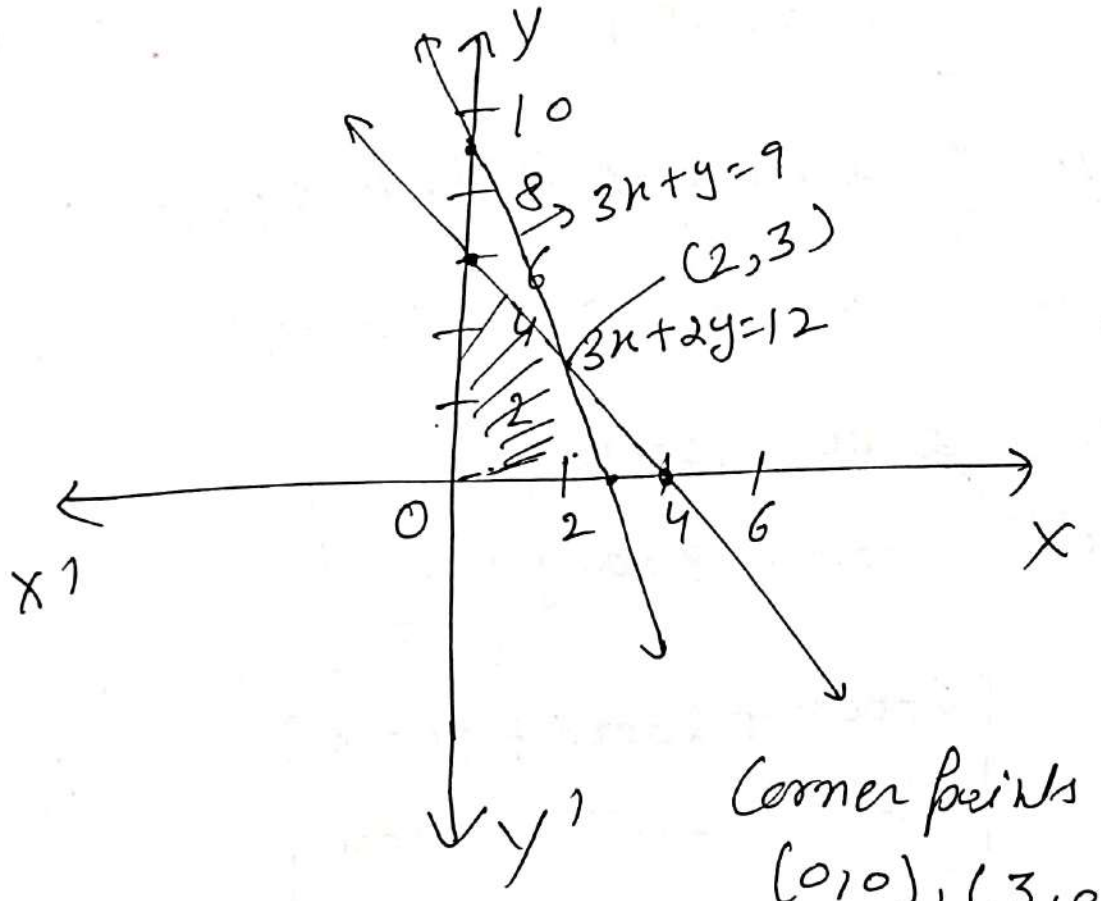
$3x + y \leq 9$

$x, y \geq 0$

x	0	4
y	6	0

x	0	3
y	9	0

$1\frac{1}{2}$



5

$1\frac{1}{2}$

Corner points $\quad (0,10), (3,0), (0,6), (2,3)$ $\quad \frac{1}{2}$

$Z_{(0,10)} = 0$

$Z_{(3,0)} = 21$

$Z_{(0,6)} = 24$

$Z_{(2,3)} = 14 + 12 = 26$

Maximum profit = ₹26 $\quad 1$

if A = 2 units B = 3 units

Section E

Q20

Q9(B)

$$\begin{matrix} A \\ B \end{matrix}\begin{bmatrix} 10000 & 2000 & 18000 \\ 6000 & 20000 & 8000 \end{bmatrix}_{2\times 3}\begin{bmatrix} 25 \\ 15 \\ 10 \end{bmatrix}_{3\times 1}$$

$$\begin{matrix} A \\ B \end{matrix}\begin{bmatrix} 250000 + 30000 + 180000 \\ 150000 + 300000 + 80000 \end{bmatrix}_{2\times 1}$$

$$\begin{bmatrix} 4,60,000 \\ 5,30,000 \end{bmatrix}$$ 1

(i) Total Revenue of Market A = ₹4,60,000 1/2

(ii) " " " " B = ₹5,30,000 1/2 4

(iii) $$\begin{bmatrix} 10000 & 2000 & 18000 \\ 6000 & 20000 & 8000 \end{bmatrix}\begin{bmatrix} 20 \\ 10 \\ 5 \end{bmatrix}$$

$$\begin{bmatrix} 200000 + 20000 + 90000 \\ 120000 + 200000 + 40000 \end{bmatrix}$$ 1

$$\begin{bmatrix} 31,0000 \\ 36,0000 \end{bmatrix}$$ Cost incurred in Market A & B 31,0000 & 360000 1/2 + 1/2

or

Profit of Market A = 1,5 0,000

" " " B = 1,7,0000 2

16. Different questions of Set B

1	(a.) 6	1	1
3	(b) $-9<x<9$	1	1
4	(d) does not exist	1	1
5	(b) 9	1	1

15.

$$5x+2y=3$$
$$3x+2y=5$$

$$D = \begin{vmatrix} 5 & 2 \\ 3 & 2 \end{vmatrix} \quad 1/2$$

$$10-6=4$$

$$D_1 = \begin{vmatrix} 3 & 2 \\ 5 & 2 \end{vmatrix} \quad 1/2$$

$$6-10=-4$$

$$D_2 = \begin{vmatrix} 5 & 3 \\ 3 & 5 \end{vmatrix} \quad 1/2$$

$$25-9=16$$

$$x = \frac{D_1}{D}, \quad y = \frac{D_2}{D}$$

$$x = \frac{-4}{4} = -1 \qquad y = \frac{16}{4} 4 \quad 1/2$$

$$x=-1, \quad y=4$$

2

14

$A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ $f(x) = x^2 - 2x - 3$

$f(A) = A^2 - 2A - 3I$

$A^2 = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} 5 & 4 \\ 4 & 5 \end{bmatrix}$ 1½

$A^2 - 2A - 3I$

$\begin{bmatrix} 5 & 4 \\ 4 & 5 \end{bmatrix} - \begin{bmatrix} 2 & 4 \\ 4 & 2 \end{bmatrix} - \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$ 1½

$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ 1½

$A^2 - 2A - 3I = 0$

Pre multiply by A^{-1} both sides 3

$A^{-1}A^2 - 2A^{-1}A - 3A^{-1}I = 0$ 1½

$A - 2I - 3A^{-1} = 0$

$A - 2I = 3A^{-1}$ 1½

$\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix} - \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix} = 3A^{-1}$

$A^{-1} = \frac{1}{3}\begin{bmatrix} -1 & 2 \\ 2 & -1 \end{bmatrix}$ 1½

(18) $AB = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$

$= \begin{bmatrix} 2+4+0 & 2-2-0 & -4+4+0 \\ 4-12+8 & 4+6-4 & -8-12+20 \\ 0-4+4 & 0+2-2 & 0-4+10 \end{bmatrix}$

$\begin{bmatrix} 6 & 0 & 0 \\ 0 & 6 & 0 \\ 0 & 0 & 6 \end{bmatrix} = 6I$ 1½

$AB = 6I$

$A^{-1}(AB) = 6A^{-1}I$

$B = 6A^{-1} \Rightarrow \frac{1}{6}B = A^{-1}$ 1

$x - y = 3$

$2x + 3y + 4z = 17$

$y + 2z = 7$

$\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix}$ 1½

$AX = B$

$X = A^{-1}B$ ½

$$X = \frac{1}{6}\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}\begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix} \quad 1/2$$

$$X = \frac{1}{6}\begin{bmatrix} 6+34-28 \\ -12+34-28 \\ 6-17+35 \end{bmatrix} \quad 1/2$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{6}\begin{bmatrix} 12 \\ -6 \\ 24 \end{bmatrix}$$

$$\Rightarrow x = 2,\ y = -1,\ z = 4 \quad 1/2$$

5