



Marathon 4

CA Nishant Kumar

NISH10

Schedule

Date (Day)	Topic
12-06-2023 (Monday)	Time Value of Money
13-06-2023 (Tuesday)	Logical Reasoning
14-06-2023 (Wednesday)	Measures of Central Tendency and Dispersion
15-06-2023 (Thursday)	Ratio, Proportion, Indices, Logarithms; Linear Inequalities
16-06-2023 (Friday)	Equations; Statistical Description of Data
17-06-2023 (Saturday)	Sequence and Series
18-06-2023 (Sunday)	Sets, Relations, and Functions
19-06-2023 (Monday)	Correlation and Regression
20-06-2023 (Tuesday)	Index Numbers
21-06-2023 (Wednesday)	Permutations and Combinations
22-06-2023 (Thursday)	Probability
23-06-2023 (Friday)	Theoretical Distributions

Highlights



Conceptual Revision



Question Based
Revision



Last Day Preparation
Tips



Questions to Revise on
the day before Exam

Chapter 1 – Ratio, Proportion, Indices, Logarithms

S. No.	Ratio	Proportion	Indices	Logarithms
1.	Ratio exists only between quantities of same kind.	Cross Product Rule If $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$.	$a^n = a \times a \times a \times a \times \dots \times a$ (n times)	$2^3 = 8$ is expressed in terms of Logarithms as $\log_2 8 = 3$. It is read as log 8 to the base 2 is 3.
2.	Quantities to be compared must be in the same units.	Invertendo If $\frac{a}{b} = \frac{c}{d}$, then $\frac{b}{a} = \frac{d}{c}$.	$a^{-n} = \frac{1}{a^n}$	$\log_a 1 = 0$
3.	To compare ratios, use calculator.	Alternendo	$a^0 = 1$	$\log_a a = 1$

		<p>If $\frac{a}{b} = \frac{c}{d}$, then</p> $\frac{a}{c} = \frac{b}{d}, \text{ or, } \frac{d}{b} = \frac{c}{a}$		
4.	<p>If a quantity increases or decreases in the ratio $a : b$, then new quantity = b of the original quantity/a. The fraction by which the original quantity is multiplied to get a</p>	<p>Componendo</p> <p>If $\frac{a}{b} = \frac{c}{d}$, then</p> $\frac{a+b}{b} = \frac{c+d}{d}.$	$a^m \times a^n = a^{m+n}$	$\log_a(mn) = \log_a m + \log_a n$

	new quantity is called the factor multiplying ratio. (This is basically unitary method.)			
5.	Inverse Ratio – The inverse ratio of a/b is b/a .	Dividendo If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a-b}{b} = \frac{c-d}{d}$	$\frac{a^m}{a^n} = a^{m-n}$	$\log_a \left(\frac{m}{n} \right) = \log_a m - \log_a n$
6.	Compound Ratio – The multiplication of two or more ratios	Componendo and Dividendo	$\begin{aligned} (a^m)^n &= a^{mn} \\ &= (a^n)^m \end{aligned}$	$\log_a (m^n) = n \log_a m$

	is called compound ratio. The compound ratio of $a : b$ and $c : d$ is $ac : bd$.	If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$		
7.	Duplicate Ratio – A ratio compounded of itself is called a Duplicate Ratio. The duplicate ratio of $a : b$ is $a^2 : b^2$.	Addendo If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \dots$, then each of these ratios is equal to $\frac{a+c+e+\dots}{b+d+f+\dots}$, i.e.,	$(ab)^n = a^n b^n$ $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$	$\log_a m = \frac{\log_b m}{\log_b a}$

		$\frac{a}{b} = \frac{a+c+e+\dots}{b+d+f+\dots};$ $\frac{c}{d} = \frac{a+c+e+\dots}{b+d+f+\dots};$ $\frac{e}{f} = \frac{a+c+e+\dots}{b+d+f+\dots}.$		
8.	Sub-Duplicate Ratio – The sub-duplicate ratio of $a : b$ is $\sqrt{a} : \sqrt{b}$.	Subtrahendo If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \dots$, then each of these ratios is equal to $\frac{a-c-e-\dots}{b-d-f-\dots}$, i.e.,	$a^{m/n} = (a^m)^{1/n},$ i.e., $a^{m/n} = \sqrt[n]{a^m}$ $= (\sqrt[n]{a})^m$	$\frac{1}{\log_a m} = \log_m a$

		$\frac{a}{b} = \frac{a-c-e-\dots}{b-d-f-\dots};$ $\frac{c}{d} = \frac{a-c-e-\dots}{b-d-f-\dots};$ $\frac{e}{f} = \frac{a-c-e-\dots}{b-d-f-\dots}$		
9.	Triplicate Ratio – The triplicate ratio of $a : b$ is $a^3 : b^3$.			$a^{\log_a n} = n$
10.	Sub-Triplicate Ratio – The sub-			$\log_{a^q} n^p = \frac{p}{q} \log_a n$

	triplicate ratio of a : b is $\sqrt[3]{a} : \sqrt[3]{b}$.			
--	---	--	--	--

Question 1

If $A : B = 3 : 5$, $B : C = 5 : 4$, $C : D = 2 : 3$, and D is 50% more than E, find the ratio between A and E.

(a) $2 : 3$

(b) $3 : 4$

(c) $3 : 5$

(d) $4 : 5$

Question 2

Find the value of $\sqrt{6561} + \sqrt[4]{6561} + \sqrt[8]{6561}$

(a) 81

(b) 93

(c) 121

(d) 243

Question 3

Find the value of $\log \frac{x^n}{y^n} + \log \frac{y^n}{z^n} + \log \frac{z^n}{x^n}$.

(a) -1

(b) 0

(c) 1

(d) 2

Question 4

If $\frac{8^n \times 2^3 \times 16^{-1}}{2^n \times 4^2} = \frac{1}{4}$, then the value of n

(a) 1

(b) 3

(c) $\frac{3}{2}$

(d) $\frac{2}{3}$

Question 5

If $\log_{10} 5 + \log_{10} (5x + 1) = \log_{10} (x + 5) + 1$, then x is equal to:

(a) 1

(b) 3

(c) 5

(d) 10

Question 6

If $xy + yz + zx = -1$, then the value of $\left(\frac{x+y}{1+xy} + \frac{z+y}{1+zy} + \frac{x+z}{1+zx} \right)$ is:

- (a) xyz (b) $-\frac{1}{yz}$ (c) $\frac{1}{xyz}$ (d) $\frac{1}{x+y+z}$

Question 7

The salaries of A , B and C are in the ratio $2 : 3 : 5$. If increments of 15%, 10% and 20% are allowed respectively to their salary, then what will be the new ratio of their salaries?

(a) $23 : 33 : 60$

(b) $33 : 23 : 60$

(c) $23 : 60 : 33$

(d) $33 : 60 : 23$

Question 8

If $A : B = 5 : 3$, $B : C = 6 : 7$, and $C : D = 14 : 9$, then the value of $A : B : C : D$ is:

- (a) $20 : 14 : 12 : 9$ (b) $20 : 9 : 12 : 14$ (c) $20 : 9 : 14 : 12$ (d) $20 : 12 : 14 : 9$

Question 9

X and Y have their present ages in the ratio $6 : 7$. 14 years ago, the ratio of the ages of the two was $4 : 5$. What will be the ratio of their ages 21 years from now?

(a) $7 : 11$

(b) $9 : 10$

(c) $8 : 11$

(d) $11 : 13$

Question 10

If $x = \sqrt{3} + \frac{1}{\sqrt{3}}$, then $\left(x - \frac{\sqrt{126}}{\sqrt{42}}\right) \left(x - \frac{1}{x - \frac{2\sqrt{3}}{3}}\right) = ?$

(a) $5/6$

(b) $6/5$

(c) $2/3$

(d) $-3/5$

Question 11

Find the value of a from the following: $(\sqrt{9})^{-5} \times (\sqrt{3})^{-7} = (\sqrt{3})^{-a}$

(a) 11

(b) 13

(c) 15

(d) 17

Question 12

If $\log_a(ab) = x$, then $\log_b(ab) = ?$

(a) $1/x$

(b) $\frac{x}{1+x}$

(c) $\frac{x}{x-1}$

(d) None

Question 13

A vessel contained a solution of acid and water in which water was 64%. Four litres of the solution were taken out of the vessel and the same quantity of water was added. If the resulting solution contains 30% acid, the quantity (in litres) of the solution, in the beginning in the vessel, was:

(a) 12

(b) 36

(c) 24

(d) 27

Question 14

If $\log_4 x + \log_{16} x + \log_{64} x + \log_{256} x = \frac{25}{6}$, then the value of x is:

(a) 64

(b) 4

(c) 16

(d) 2

Question 15

If $x^2 + y^2 = 7xy$, then $\log \frac{1}{3}(x + y) = ?$

- (a) $(\log x + \log y)$ (b) $\frac{1}{2}(\log x + \log y)$ (c) $\frac{1}{3}(\log x + \log y)$ (d) $3(\log / \log y)$

Question 16

Value of $\left[9^{n+\frac{1}{4}} \cdot \frac{\sqrt{3 \cdot 3^n}}{3 \cdot \sqrt{3^{-n}}} \right]^{\frac{1}{n}}$

(a) 9

(b) 27

(c) 81

(d) 3

Question 17

If $3^x = 5^y = 75^z$, then:

(a) $x + y - z = 0$

(b) $\frac{2}{x} + \frac{1}{y} = \frac{1}{z}$

(c) $\frac{1}{x} + \frac{2}{y} = \frac{1}{z}$

(d) $\frac{2}{x} + \frac{1}{z} = \frac{1}{y}$

Question 18

A bag contains ₹187 in the form 1 rupee, 50 paise and 10 paise coins in the ratio 3:4:5. Find the number of each type of coins.

(a) 102, 136, 170

(b) 136, 102, 170

(c) 170, 102, 136

(d) None

Question 19

$\log_e x + \log(1+x) = 0$ is equivalent to:

(a) $x^2 + x + e = 0$

(b) $x^2 + x - e = 0$

(c) $x^2 + x + 1 = 0$

(d) $x^2 + x - 1 = 0$

Question 20

If $x = 3^{1/4} + 3^{-1/4}$, and $y = 3^{1/4} - 3^{-1/4}$, then the value of $3(x^2 + y^2)^2$ will be:

(a) 12

(b) 18

(c) 46

(d) 64

Question 21

Find the value of $(x + y)$, if $\left(x + \frac{y^3}{x^2}\right)^{-1} - \left(\frac{x^2}{y} + \frac{y^2}{x}\right)^{-1} + \left(\frac{x^3}{y^2} + y\right)^{-1} = \frac{1}{3}$.

(a) $1/3$

(b) 3

(c) $1/2$

(d) 2

Question 22

If $pqr = a^x$, $qrs = a^y$, $rsp = a^z$, then find the value of $(pqrs)^{1/2}$.

(a) a^{x+y+z}

(b) $a^{\sqrt{x+y+z}}$

(c) $a^{\sqrt[4]{x+y+z}}$

(d) $(a^{x+y+z})^{1/4}$

Question 23

The ratio of the earnings of two persons 3:2. If each saves $\frac{1}{5}$ th of their earnings, the ratio of their savings is:

(a) 2 : 3

(b) 3 : 2

(c) 4 : 5

(d) 5 : 4

Question 24

If $x = 5^{1/3} + 5^{-1/3}$, then $5x^3 - 15x$ is given by:

(a) 25

(b) 26

(c) 27

(d) 30

Question 25

The value of $\log_5\left(1+\frac{1}{5}\right)+\log_5\left(1+\frac{1}{6}\right)+\dots+\log_5\left(1+\frac{1}{624}\right)$

- (a) 2
- (c) 5

- (b) 3
- (d) 0

Question 26

$$\log_{2\sqrt{2}}(512) : \log_{3\sqrt{2}} 324 =$$

(a) 128 : 81

(c) 3 : 2

(b) 2 : 3

(d) None

Question 27

$$\log_{0.01} 10,000$$

(a) 2

(b) -2

(c) 4

(d) -4

Question 28 – MTP June, 2023

The value of $\frac{64(b^4a^3)^6}{\left[4(a^3b)^2 \times (ab)^2\right]}$

(a) $16a^{10}b^{20}$

(b) $4a^{20}b^{10}$

(c) $8a^{10}b^{20}$

(d) $4a^{10}b^{20}$

Question 29 – December, 2022; MTP June, 2023

Four persons A, B, C, D wish to share a sum in the ratio of 5:2:4:3. If D gets ₹1,000 less than C, then the share of B?

(a) ₹2,000

(b) ₹1,200

(c) ₹2,400

(d) ₹3,000

Question 30 – MTP June, 2023

The mean proportional between $12x^2$ and $27y^2$ is:

(a) $18xy$

(b) $81xy$

(c) $8xy$

(d) $9xy$

Question 31 – MTP June, 2023

If thrice of A's age 6 years ago be subtracted from twice his present age, the result would be equal to his present age. Find A's present age.

(a) 7

(b) 8

(c) 9

(d) 6

Question 32 – MTP June, 2023

If $\log_3 4 \cdot \log_4 5 \cdot \log_5 6 \cdot \log_6 7 \cdot \log_7 8 \cdot \log_8 9 = x$, then find the value of x .

(a) 4

(b) 2

(c) 3

(d) 1

Question 33 – MTP June, 2023

If $\frac{1}{2}\log_{10} 4 = y$, and if $\frac{1}{2}\log_{10} 9 = x$, then find the value of $\log_{10} 15$.

(a) $x - y + 1$

(b) $x + y - 1$

(c) $x + y + 1$

(d) $y - x + 1$

Question 34 – December, 2022; MTP June, 2023

In a hostel, ration is stocked for 400 students upto 31 days. After 28 days 280 students were vacated the hostel. Find the number of days for which the remaining ration will be sufficient for the remaining students.

(a) 5

(b) 4

(c) 7

(d) 10

Question 35 – MTP June, 2023

Two vessels containing water and milk in the ratio 2 : 3 and 4 : 5 are mixed in the ratio 1 : 2. The ratio of milk and water in the resulting mixture is:

(a) 58 : 77

(b) 77 : 58

(c) 68 : 77

(d) None

Question 36 – MTP June, 2023

If $(x - 9) : (3x + 6)$ is the duplicate ratio of $4 : 9$, find the value of x .

(a) $x = 9$

(b) $x = 16$

(c) $x = 36$

(d) $x = 25$

Question 37 – MTP June, 2023

Value of $(a^{1/8} + a^{-1/8})(a^{1/8} - a^{-1/8})(a^{1/4} + a^{-1/4})(a^{1/2} + a^{-1/2})$ is:

(a) $a + \frac{1}{a}$

(b) $a - \frac{1}{a}$

(c) $a^2 + \frac{1}{a^2}$

(d) $a^2 - \frac{1}{a^2}$

Question 38 – MTP June, 2023

If $(25)^{150} = (25x)^{50}$, then the value of x will be:

(a) 5^3

(b) 5^4

(c) 5^2

(d) 5

Question 39 – MTP June, 2023

$7\log\left(\frac{16}{15}\right) + 5\log\left(\frac{25}{24}\right) + 3\log\left(\frac{81}{80}\right)$ is equal to:

(a) 0

(b) 1

(c) $\log 2$

(d) $\log 3$

Question 40 – MTP June, 2023

$$\log_4(x^2 + x) - \log_4(x + 1) = 2. \text{ Find } x.$$

(a) 16

(b) 0

(c) -1

(d) None

Chapter 3 – Linear Inequalities

Question 1

On the average, an experienced person does 7 units of work while a fresh one work 5 units of work daily but the employer has to maintain an output of at least 35 units of work per day. The situation can be expressed as:

(a) $7x + 5y < 35$

(b) $7x + 5y \leq 35$

(c) $7x + 5y > 35$

(d) $7x + 5y \geq 35$

Question 2

The solution space of the inequalities $2x + y \leq 10$ and $x - y \leq 5$:

1. Includes origin
2. Includes the point (4, 3)

Which one is correct:

- (a) Only 1 (b) Only 2 (c) Both 1 and 2 (d) None

Question 3

The solution of the inequality $\frac{(5-2x)}{3} \leq \frac{x}{6} - 5$ is:

(a) $x \geq 8$

(b) $x \leq 8$

(c) $x = 8$

(d) None

Question 4

On the average, an experienced person does 5 units of work while a fresh one work 3 units of work daily but the employer has to maintain an output of at least 30 units of work per day. The situation can be expressed as:

(a) $5x + 3y \leq 30$

(b) $5x + 3y \geq 30$

(c) $5x + 3y = 30$

(d) None

Question 5

The solution set of the inequation $x + 2 > 0$ and $2x - 6 > 0$ is:

(a) $(-2, \infty)$

(b) $(3, \infty)$

(c) $(-\infty, -2)$

(d) $(-\infty, -3)$

Question 6

A company produces two products A and B, each of which requires processing in two machines. The first machine can be used at most for 60 hours, the second machine can be used at most for 40 hours. The product A requires 2 hours on machine one and one hour on machine two. The product B requires one hour on machine one and two hours on machine two. Express above situation using linear inequalities.

(a) $2x + y \leq 60$ and $x + 2y \geq 40$

(b) $2x + y \geq 60$ and $x + 2y \geq 40$

(c) $2x + y \leq 60$ and $x + 2y \leq 40$

(d) $2x + y \geq 60$ and $x + 2y \leq 40$

Question 7

Mr. A plans to invest up to ₹30,000 in two stocks X and Y . Stock X (x) is priced at ₹175 and Stock Y (y) at ₹95 per share. This can be shown by:

- (a) $175x + 95y < 30,000$ (b) $175x + 95y > 30,000$ (c) $175x + 95y = 30,000$ (d) None

Question 8

The solution of the inequality $8x + 6 < 12x + 14$ is:

(a) $(-2, 2)$

(b) $(0, -2)$

(c) $(2, \infty)$

(d) $(-2, \infty)$

Question 9

The rules and representations demand that employer should employ not more than 8 experienced leads to 1 fresh one and this fact can be expressed as:

(a) $y \geq x/8$

(b) $8y \leq x$

(c) $8y = x$

(d) $y = 8x$

Question 10

A manufacturer produces two items A and B. He has ₹10,000 to invest and a space to store 100 items. A table costs him ₹400 and a chair ₹100. Express this in the form of linear inequalities.

- (a) $x + y \leq 100, 4x + y \leq 100, x \geq 0, y \geq 0$
- (b) $x + y \leq 1000, 2x + 5y < 1000, x \geq 0, y \geq 0$
- (c) $x + y > 100, 4x + y \geq 100, x \geq 0, y \geq 0$
- (d) None

Question 11

The common region in the graph of the inequalities $x + y \leq 4$, $x - y \leq 4$, $x \geq 2$ is

- (a) Equilateral triangle
- (b) Isosceles triangle
- (c) Quadrilateral
- (d) Square

Question 12

Solve for x of the Inequalities

$$2 \leq \frac{3x-2}{5} \leq 4 \text{ where } x \rightarrow N$$

(a) $\{5, 6, 7\}$

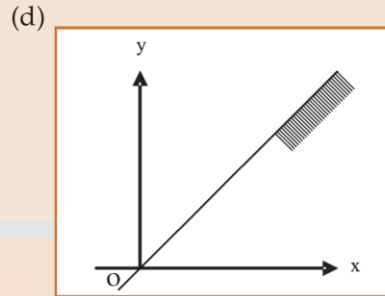
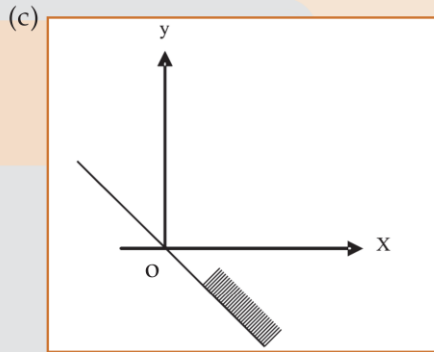
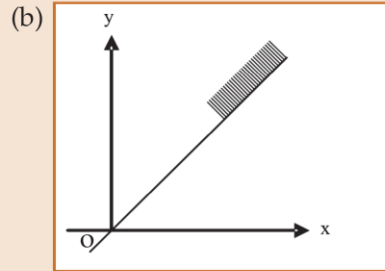
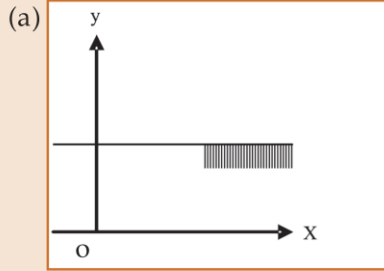
(c) $\{4, 5, 6\}$

(b) $\{3, 4, 5, 6\}$

(d) None

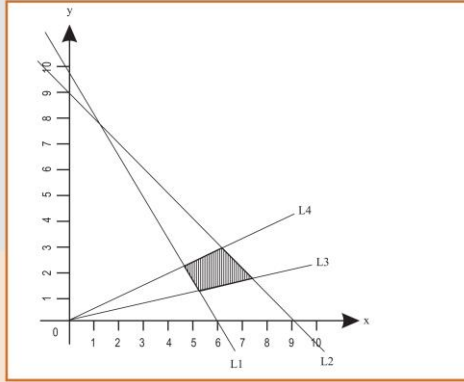
Question 13

(vii) The graph to express the inequality $y \leq \left(\frac{1}{2}\right) x$ is indicated by



Question 14

(viii)



$L1 : 5x + 3y = 30$ $L2 : x + y = 9$ $L3 : y = x/3$ $L4 : y = x/2$

The common region (shaded part) shown in the diagram refers to

(a) $5x + 3y \leq 30$ (b) $5x + 3y \geq 30$ (c) $5x + 3y \geq 30$ (d) $5x + 3y > 30$ (e) None of these

$x + y \leq 9$

$x + y \leq 9$

$x + y \geq 9$

$x + y < 9$

$y \leq 1/5 x$

$y \geq x/3$

$y \leq x/3$

$y \geq 9$

$y \leq x/2$

$y \leq x/2$

$y \geq x/2$

$y \leq x/2$

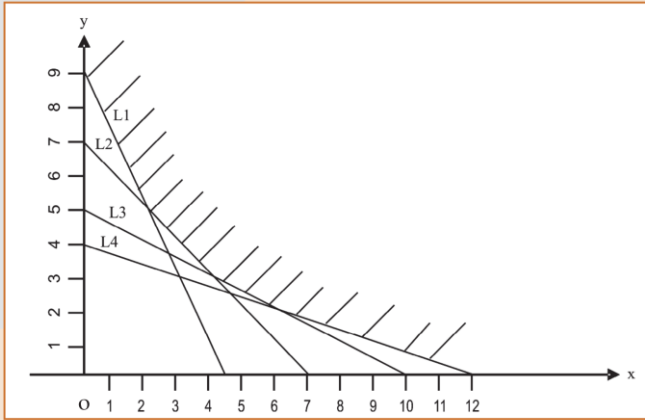
$x \geq 0, y \geq 0$

$x \geq 0, y \geq 0$

$x \geq 0, y \geq 0$

Question 15

3. Graphs of the inequations are drawn below :



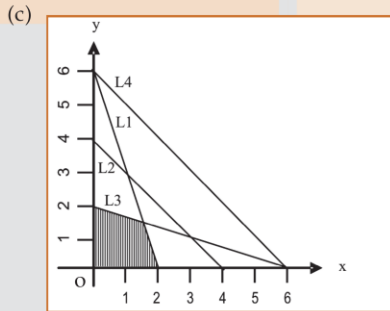
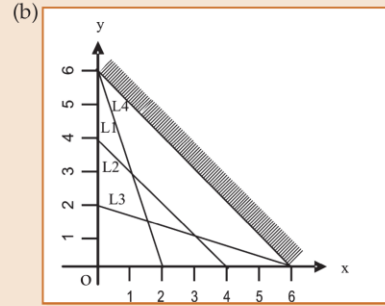
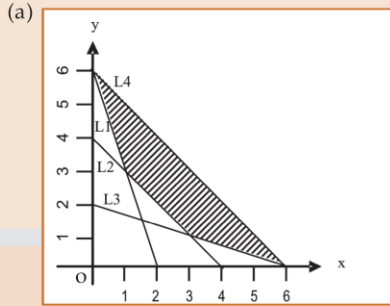
L1 : $2x + y = 9$ L2 : $x + y = 7$ L3 : $x + 2y = 10$ L4 : $x + 3y = 12$

The common region (shaded part) indicated on the diagram is expressed by the set of inequities

- (a) $2x + y \leq 9$ (b) $2x + y \geq 9$ (c) $2x + y \geq 9$ (d) none of these
 $x + y \geq 7$ $x + y \leq 7$ $x + y \geq 7$
 $x + 2y \geq 10$ $x + 2y \geq 10$ $x + 2y \geq 10$
 $x + 3y \geq 12$ $x + 3y \geq 12$ $x + 3y \geq 12$
 $x \geq 0, y \geq 0$

Question 16

4. The common region satisfied by the inequalities L1: $3x + y \geq 6$, L2: $x + y \geq 4$, L3: $x + 3y \geq 6$, and L4: $x + y \leq 6$ is indicated by



(d) none of these

Question 17 – MTP June, 2023

If $3x + 2 < 2x + 5$ and $4x - 5 \geq 2x - 3$, then x can take from the following values:

(a) 3

(b) -1

(c) 2

(d) -3