Pair of Linear Equations in Two Variables

MATHEMATICAL REASONING

1. The sum of two numbers is 8 and the sum 8 of their reciprocals is $\frac{8}{15}$. Find the numbers.

(a) 5, 3
(b) 7, 1
(c) 4, 4
(d) 2, 6

2. The sum of the digits of a two-digit number is 12. The number obtained by interchanging the two digits exceeds the given number by 18. Find the number.

(a) 57 (b) 75
(c) 85 (d) 58

3. The denominator of a rational number is greater than its numerator by 3. If 3 is subtracted from the numerator and 2 is added to the denominator, the new number becomes $\frac{1}{5}$. Then the original number was ____.

(a) $\frac{7}{11}$ (b) $\frac{3}{5}$
(c) $\frac{5}{8}$ (d) $\frac{4}{7}$

4. If $am = bl$ and $bn \neq cm$, then the system of equations

$$ax + by = c$$
$$lx + my = n$$

(a) Has a unique solution.
(b) Has no solution.
(c) Has infinitely many solutions.
(d) May or may not have a solution.

5. The value of k, for which the system of equations $kx - 3y + 6 = 0,\ 4x - 6y + 15 = 0$ represent parallel lines, is ____.

(a) 1 (b) 2
(c) 3 (d) 4

6. If the system of equations

$$2x + 3y = 7$$
$$2ax + (a+b)y = 28$$

has infinitely many solutions, then the values of a and b respectively are ____.

(a) 2. 5 (b) 5, 8
(c) 4, 8 (d) 3, 6

7. In a ΔABC, $\angle C = 3\angle B = 2(\angle A + \angle B)$. . The three angles will be ____.

(a) $20^o, 40^o, 120^o$ (b) $30^o, 60^o, 90^o$
(c) $45^o, 45^o, 90^o$ (d) $90^o, 40^o, 50^o$

8. $ax + by + c = 0$ does not represent an equation of line when ____.

(a) $a = c = 0,\ b \neq 0$
(b) $b = c = 0,\ a \neq 0$
(c) $a = b = 0$
(d) $a = b \neq 0$

9. The ratio of a 2-digit number to the sum of digits of that number is $4:1$. If the digit in the unit place is 3 more than the digit in the tens place, what is the number?

(a) 63 (b) 36
(c) 24 (d) 40

10. How many values of c, for which the system of equations $6x + 3y = c - 3,\ 12x + cy = c$ has infinitely many solutions?

(a) 1 (b) 2
(c) 3 (d) Infinite

11. Sum of two numbers is 64 and their difference is 22. Find the numbers.

(a) 42, 22 (b) 43, 21
(c) 40, 24 (d) 50, 28

12. if a pair of linear equations in two variables is consistent, then the lines represented by two equations are

(a) Always intersecting
(b) Parallel
(c) Always coincident
(d) Intersecting or coincident

13. The solution of the system of equations $\frac{2x+5y}{xy}=6$ and $\frac{4x-5y}{xy}+3=0$ (where $x \neq 0,\ y \neq 0$), is ____.

(a) 1.2 (b) 0,0

(c) $-1,\ 2$ (d) $1,-2$

14. Value of x in pair of linear equations $36x+24y=702$ and $24x+36y=558$ is

(a) $\frac{33}{2}$ (b) $\frac{145}{7}$

(c) 16 (d) 17

15. Which of the following linear equation coincide with the line $4x+5y=15$?

(a) $8x+10y=25$

(b) $2x+3y=7$

(c) $7x+14y=17$

(d) $12x+15y=45$

EVERYDAY MATHEMATICS

16. Arun and Prabhat have some books with them. Once Prabhat said to Arun that, if Arun gives 3 books to Prabhat then Arun will have only - of the books that Prabhat ; will have with him. Then Arun asked frankly that if Prabhat gives him only two books (to Arun), then Prabhat will have as many books as Arun will have. The total number of books that Arun and Prabhat have with them is ____.

(a) 25

(b) 56

(c) 30

(d) Can't be determined

17. Places M and N are 90 km apart from each other on a national highway. A truck starts from M and another from N at the same time. If they go in the same direction, then they meet in 9 hours and if they go in opposite directions they meet in - hours.

The speed of the trucks are ____.

(a) 90 km/hr, 40 km/hr

(b) 40 km/hr, 30 km/hr

(c) 20 km/hr, 60 km/hr

(d) 50 km/hr, 12 km/hr

18. A boat goes 32 km upstream and 36 km downstream in 7 hours. In 9 hours, it can go 40 km upstream and 48 km downstream. If x represents the speed of the boat in still water in km/hr and y represents the speed of the stream in km/hr, then____.

(a) $x+y=12,\ x-y=8$

(b) $x+y=5,\ x-y=11$

(c) $x+y=6,\ x-y=10$

(d) $x+y=10,\ x-y=6$

19. At the end of the year 2002, Ram was half as old as his grandpa. The sum of the years in which they were born is 3854. Age of Ram at the end of year 2003 is ____.

(a) 50 years

(b) 35 years

(c) 51 years

(d) 36 years

20. On selling a tea-set at 5% loss and lemon- set at 15% gain, a crockery seller gains Rs. 7. If he sells the tea-set at 5% gain and the lemon-set at 10% gain, he gains Rs. 13. Find the actual prices of the tea-set and the lemon-set.

(a) Rs.100, Rs.80

(b) Rs. 90, Rs. 100

(c) Rs.120, Rs. 60

(d) Rs.150, Rs. 80

ACHIEVERS SECTION (HOTS)

21. Solve for x and y in the following question.

$\frac{2}{x+2y}+\frac{1}{2x-y}+\frac{5}{9}=0,\ \frac{9}{x+2y}+\frac{6}{2x-y}+4=0$

(a) $x=1,\ y=2$

(b) $x=2,\ y=1$

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

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

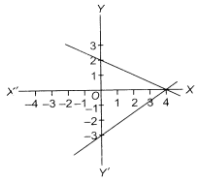
22. Match the following.

System of equations	Solutions
(P) $2x-3y+15=0$ $3x-5=0$	(i) $x=3,\ y=5$
(Q) $2x-y=1$ $4x+3y=27$	(ii) $x=1, y=4$
(R) $x+2y-3=0$ $3x-2y+7=0$	(iii) $x=\frac{5}{3}, y=\frac{55}{9}$
(S) $4x+\frac{y}{3}=\frac{16}{3}$ $\frac{x}{2}+\frac{2y}{4}=\frac{5}{2}$	(iv) $x=-1, y=2$

(a) (P) $\rightarrow$ (iii); (Q) $\rightarrow$ (iv); (R) $\rightarrow$ (i); (S) $\rightarrow$ (ii)
(b) (P) $\rightarrow$ (iii); (Q) $\rightarrow$ (i); (R) $\rightarrow$ (iv); (S) $\rightarrow$ (ii)
(c) (P) $\rightarrow$ (iii); (Q) $\rightarrow$ (ii); (R) $\rightarrow$ (iv); (S) $\rightarrow$ (i)
(d) (P) $\rightarrow$ (ii); (Q) $\rightarrow$ (i); (R) $\rightarrow$ (iv); (S) $\rightarrow$ (iii)

23. Which of the following graphs represent the lines $2x+4y=8$ and $3x-4y=12$?

(a)



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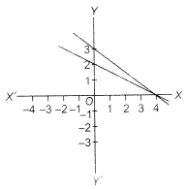

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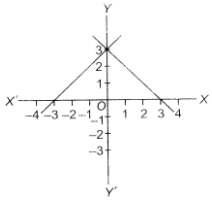
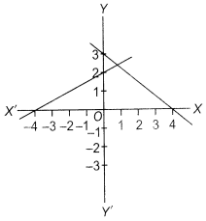


(d)



24. Fill in the blanks.
(i) If pair of linear equations Js consistent, then it has either **P** or **Q** solution (s).
(ii) If the pair of linear equation is inconsistent, then it has **R** solution (s).
(iii) If the graph of two linear equations coincide, then they have **S** solution (s).

	P	Q	R	S
(a)	no	infinite	unique	infinite
(b)	unique	infinite	no	infinite
(c)	no	infinite	unique	unique
(d)	unique	no	infinite	no

25. Read the statements carefully and state 'T' for true and 'F' for false.
(i) The pair of linear equations $x+2y=5$ and $7x+3y=13$ has unique solution $x=2.\ y=1$.
(ii) $\sqrt{2}x+\sqrt{3}y=0,\ \sqrt{3}x-\sqrt{8}y=0$ has no solution.
(iii) The values of p and q for which the following system of equations $2x-y=5$, $(p+q)x+(2p-q)y=15$ has infinite number of solutions, is $p=1$ and $q=5$.

	(i)	(ii)	(iii)
(a)	T	F	T
(b)	T	T	F
(c)	F	T	T
(d)	F	F	T

ANSWER KEY

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

HINTS AND SOLUTION

1. (a): Let the two numbers be x and y.
According to the given conditions,

$$x+y=8 \quad \ldots(1)$$

and $\frac{1}{x}+\frac{1}{y}=\frac{8}{15}$ $\ldots(2)$

Putting value of $x=8-y$ in (2), we get

$$\frac{1}{8-y}+\frac{1}{y}=\frac{8}{15} \Rightarrow \frac{y+8-y}{y(8-y)}=\frac{8}{15}$$

$\Rightarrow y^2-8y+15=0 \Rightarrow y^2-5y-3y+15=0$

$\Rightarrow (y-5)(y-3)=0 \Rightarrow y=5$ or $y=3$

From (1), $x=3$ or $x=5$

Thus, the numbers are 5 and 3.

2. (a): Let the unit's and ten's digits in the number be y and x respectively.

So, the number be $10x+y$.

According to the question,

$x+y=12$ .....(1)

Also, $10x+y+18=10y+x$

$\Rightarrow 9x-9y=-18 \Rightarrow x-y=-2$ .....(2)

Solving (1) and (2), we get $x=5$ and $y=7$

$\therefore$ Required number is 57.

3. (c): Let the number be $\frac{x}{y}$

According to the question,

$y=x+3 \Rightarrow x=y-3$ .....(1)

Also, $\frac{x-3}{y+2}=\frac{1}{5} \Rightarrow 5x-15=y+2$

$\Rightarrow 5x=y+17$ ……(2)

Solving (1) and (2), we get $x=5$ and $y=8$

$\therefore$ Required number $=\frac{x}{y}=\frac{5}{8}$

4. (b): We have, $ax+by=c$ and $lx+my=n$

Now, $\frac{a}{l}=\frac{b}{mn}\neq\frac{c}{n}$ (given)

$\therefore$ The given system of equations has no solution.

5. (b): It is given that, $kx-3y+6=0$ and $4x-6y+15=0$ are two parallel lines,

i.e., The given lines has no solution or

$\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$

$\Rightarrow \frac{k}{4}=\frac{-3}{-6}\neq\frac{6}{15} \Rightarrow \frac{k}{4}=\frac{3}{6} \Rightarrow k=2$

6. (c): Given equations are

$2x+3y=7$ and $2ax+(a+b)y=28$

For infinitely many solutions, we have

$$\frac{2}{2a}=\frac{3}{a+b}=\frac{7}{28}$$

Taking first two members, we get

$2a+2b=6a;$

$\Rightarrow 4a=2b \Rightarrow 2a=b$ .....(1)

Also, $\frac{2}{2a}=\frac{7}{28} \Rightarrow a=4$

From (1) and (2), we have

$2(4)=b \Rightarrow b=8$

7. (a): In a triangle, sum of angles is 180^o

$\therefore \angle A+\angle B+\angle C=180^o$ .....(1)

$\angle C=3\angle B$ ……(2)

and $3\angle B=2\angle A+2\angle B$

$\therefore \angle A=\frac{\angle B}{2}$ ……(3)

From (1), (2) and (3), we get

$\frac{\angle B}{2}+\angle B+3\angle B=180^o$

$\Rightarrow \left(\frac{9}{2}\right)\angle B=180^o \Rightarrow \angle A=20^o$

8. (c): $ax+by+c=0$

When a and b are equal to zero, then the above linear equation does not represent an equation of line.

9. (b): Let the digit at unit place be x and the digit at tens place be y, then the number $=10y+x$

Now, according to the question,

$\frac{10y+x}{y+x}=\frac{4}{1}$

$\Rightarrow 10y+x=4y+4x$

$\Rightarrow 6y=3x \Rightarrow x=2y$ .....(1)

Also, $x=3+y \Rightarrow 2y=3+y$ [From (1)]

$\Rightarrow y=3$ and $x=6$ $\therefore$ Number = 36

10. (a): Given equations are

$6x+3y=c-3$ and $12x+cy=c$

For infinitely many solutions,

$$\frac{6}{12}=\frac{3}{c}=\frac{c-3}{c}$$

Taking first two members, we have

$\frac{1}{2}=\frac{3}{c}\Rightarrow c=6$

Thus, only one value of c exists.

11. (B): Let the two numbers be x and y.

Then, $x+y=64$ ……(1)

Also, $x-y=22$ ……(2)

or $y-x=22$ ….(3)

(I) If $x-y=22,$ from (1) and (2), we have $2x=86$

$\Rightarrow$ x = 43 and y = 21

(ii) If $y-x=22,$ from (1) and (3), we have $2y=86\Rightarrow y=43$ and $x=21$

$\therefore$ Numbers are 43 and 21.

12. (d):

13. (a): We have, $\frac{2x+5y}{xy}=6$ or $\frac{2}{y}+\frac{5}{x}=6$ ….(1)

Also, $\frac{4x-5y}{xy}=-3$ or $\frac{4}{y}-\frac{5}{x}=-3$ ....(2)

Let $\frac{1}{y}=a$ and $\frac{1}{x}=b$

So, (1) and (2) become

$2a+5b=6$ ...(3)

and, $4a-5b=-3$ ...(4)

Adding (3) and (4), we get

$a=\frac{1}{2}$ and $b=1$ [From (3)]

$\therefore \quad x=1$ and $y=2$

14. (a): We have, $36x+24y=702$

and $24x+36y=558$

Simplifying above equations, we get

$6x+4y=117$ ……(1)

and

$4x+6y=93$ ……(2)

Multiplying eq. (1) by 3, eq. (2) by -2 and then; adding, we get

$$18x+12y-8x-12y=351-186$$

$$\Rightarrow \quad 10x=165\Rightarrow x=\frac{165}{10}=\frac{33}{2}$$

15. (d): For coincident lines, $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$

i.e., $\frac{4}{12}=\frac{5}{15}=\frac{15}{45}$ or $\frac{1}{3}=\frac{1}{3}=\frac{1}{3}$

16. (c): Let Arun has x books and Prabhat has y books.

According to the question,

$x-3=\frac{1}{2}(y+3)\Rightarrow 2x=y+9$ ... (1)

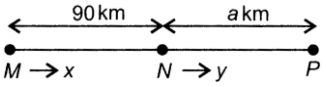
Also, $x+2=y-2\Rightarrow x+4=y$ ….(2)

Solving (1) and (2), we get

$x=13$ and $y=17\Rightarrow x+y=30$

17. (b): Let x km/hr be the speed of truck starting from M and y km/hr be the speed of truck starting from N.

Case I: If they meet at P.



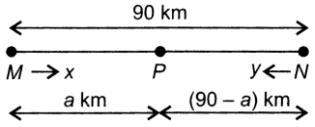
$\text{Speed}=\frac{Distance}{Time}$

For M, $x=\frac{90+a}{9}$ or $9x=90+a$

For N, $y=\frac{a}{9}$ or $9y=a$

$\Rightarrow \quad 10+y=x$ ...(1)

Case II: If they meet at P.



For M, $x=\frac{a}{9/7}$ and For N, $y=\frac{9-a}{9/7}$

$\Rightarrow \quad 70=x+y$ ...(2)

Solving (1) and (2), we get

$y=30\ km/hr$ and $x=40\ km/hr$

18. (a):

19. (c): Let the year in which Ram was born be x and the year in which Ram's grandpa was born be y.

Then, according to question,

$$2002-x=\frac{2002-y}{2}$$

$\Rightarrow \quad 2x - y = 2002 \quad$ .....(1)

and $\quad x + y = 3854 \quad$ .....(2)

Solving (1) and (2), we get $\Rightarrow \; x = 1952$

Thus 2003, Ram's age would be

$2003 - 1952 = 51\ yrs$

20. (a): Let cost price of tea-set = Rs. x

and cost price of lemon-set = Rs. y

(i) Loss on tea-set $= Rs.\frac{5x}{100} = Rs.\frac{x}{20}$

Gain on lemon-set $= Rs.\frac{15y}{100} = Rs.\frac{3y}{20}$

Also, $\frac{3}{20}y - \frac{x}{20} = 7 \Rightarrow 3y - x = 140 \quad ...(1)$

(ii) Gain on tea-set $= Rs.\frac{5x}{100} = Rs.\frac{x}{20}$

Gain on lemon-set $= Rs,\frac{10y}{100} = Rs.\frac{y}{10}$

Also, $\frac{x}{20} + \frac{y}{10} = 13 \Rightarrow x + 2y = 260 \quad ...(2)$

Solving (1) and (2), we get $\Rightarrow \; y = Rs.80$

and $x = Rs.100$

21. (d): We have, $\frac{2}{x+2y} + \frac{1}{2x-y} + \frac{5}{9} = 0$

and $\frac{9}{x+2y} + \frac{6}{2x-y} + 4 = 0$

Let $\frac{1}{x+2y} = a$ and $\frac{1}{2x-y} = b$

Thus equations would reduce to

$2a + b = -\frac{5}{9} \quad$ .....(1) and

$9a + 6b = -4 \quad$ .....(2)

Solving (1) and (2), we get $a = \frac{2}{9}$ and

$b = -1$

$\frac{2}{9} = \frac{1}{x+2y}$ and $-1 = \frac{1}{2x-y}$

$\Rightarrow \quad 2x + 4y = 9 \quad$ .....(3) and

$2x - y = -1 \quad$ .....(4)

Solving (3) and (4), we get $y = 2$ and $x = \frac{1}{2}$

22. (b): (P) We have, $\quad 2x - 3y = -15 \quad$ .....(1)

and $\quad 3x - 5 = 0 \;\Rightarrow\; x = \frac{5}{3}$

From (1), $\quad 2\left(\frac{5}{3}\right) - 3y = -15$

$\Rightarrow \quad 3y = \frac{10}{3} + 15 \Rightarrow y = \frac{55}{9}$

(Q) We have, $\quad 2x - y = 1 \quad$ ....(1)

and $\quad 4x + 3y = 27 \quad$ ....(2)

Multiplying (1) by 2 and then subtracting from (2), we get, $y = 5$ and $x = 3$

(R) We have, $\quad x + 2y = 3 \quad$ ....(1)

and $\quad 3x - 2y = -7 \quad$ ...(2)

Multiplying (1) by 3 and then subtracting from (2), we get $y = 2$ and $x = -1$

(S) We have, $4x + \frac{y}{3} = \frac{16}{3} \Rightarrow 12x + y = 16$

...(1)

and $\quad \frac{x}{2} + \frac{y}{2} = \frac{5}{2} \Rightarrow x + y = 5 \quad$ ...(2)

Subtracting (2) from (1), we get x= 1 and y = 4

23. (a)

24. (b)

25. (d): (i) Given equations are

$x + 2y = 5 \quad ...(1)$ and $7x + 3y = 13 \quad ...(2)$

Multiplying (1) by 7 and then subtracting from (2),

we get $7x + 3y - 7x - 14y = 13 - 35$

$x = 1$ and $y = 2$

Here, $\frac{1}{7} \neq \frac{2}{3} \neq \frac{5}{13}$, a unique solution exist.

(ii) Given equations are

$\sqrt{2}x + \sqrt{3}y = 0$ and $\sqrt{3}x - \sqrt{8}y = 0$

$\frac{\sqrt{2}}{\sqrt{3}} \neq \frac{\sqrt{3}}{-2\sqrt{2}}$

$\therefore$ Given equations have a unique solution

(iii) Given equations are $2x - y = 5 \quad$ .....(1)

and $(p+q)x + (2p-q)y = 15 \quad$ .....(2)

Putting $p = 1$ and $q = 5$ in (2), we get

$6x - 3y = 15$ or $2x - y = 5 \quad$ .....(3)

From (1) and (3), we have

$$\frac{2}{2} = \frac{-1}{-1} = \frac{5}{5}$$

Hence, infinitely many solutions exist.