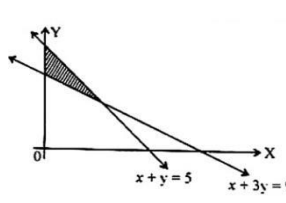





<b>GRADE: XII</b> <b>Date:</b>	<b>MONTHLY TEST -02 (2023-24)</b> <b>APPLIED MATHEMATICS(241)</b>	<b>Marks: 20</b> <b>Time: 50 minutes</b>
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**Name:**

**Class & Section:**

Q.No.	Questions	Mark
<b>SECTION A</b>		
1	What is the least value of $x$ that satisfies $x \equiv 27(\text{mod } 4)$ , when $27 < x \leq 36$ ? (a) 27 (b) 30 (c) 31 (d) 35	<b>1</b>
2	The solution set of the inequalities $6 \leq -3(2x - 4) < 12$ is (a) $(-\infty, 1]$ (b) $[0, 1]$ (c) $(0, 1] \cup [1, \infty)$ (d) $[1, \infty)$	<b>1</b>
3	A pipe A can fill a tank in 3 hours. There are two outlet pipes B and C from the tank which can empty it in 7 and 10 hours respectively. If all the three pipes are opened simultaneously, how long will it take to fill the tank?  (a) $11\frac{2}{19}$ hrs (b) $13\frac{1}{19}$ hrs (c) $13\frac{2}{19}$ hrs (d) $11\frac{1}{19}$ hrs	<b>1</b>
4	In the given figure (I), what is the LPP shaded region known as?   <p style="text-align: center;">Figure (I)</p> (a) Feasible region (b) Feasible solution (c) Optimal region (d) Objective region	<b>1</b>
5	The last two digits of the product $4321 \times 3215$ are (a) 15 (b) 25 (c) 35 (d) 45	<b>1</b>

<b>SECTION B</b>		
6	In a one-kilometre race, A beats B by 30 seconds and B beats C by 15 seconds. If A beats C by 180 metres, then find the time taken by A to run 1 kilometre.	<b>2</b>
7	Solve for x : $\frac{x+3}{x-2} \leq 2$	<b>2</b>
8	The cost price of type A apple is Rs 120 and that of type B apple is Rs 180per kg.If both type of Apples are mixed in the ratio 2:3 respectively then find the price per kg of mixed apples.	<b>2</b>
<b>SECTION C</b>		
9	Solve: Maximise $z = 100x + 120y$ subject to constraints : $2x + 3y \leq 30,$ $3x + y \leq 17,$ $x \geq 0, y \geq 0.$	<b>3</b>
10	(1) Find all pairs of consecutive odd positive integers , both of which are smaller than 10 such that their sum is more than 11. (2) Solve : $ 2x - 3  \geq 5$	<b>3</b>
11	<p><b><u>Case Study:</u></b></p> <p>Susy is rowing a boat. She takes 6 hours to row 48km upstream whereas she takes 3 hours to go the same distance downstream.</p>  <p>Based on the information, answer the following questions:  i. What is her speed in still water?  ii. What is the speed of the stream?  iii. What is her average speed?</p>	<b>3</b>

1) (c) 31

2)(b)[0,1].

3)(b)  $11\frac{2}{19}$  hrs

4) feasible region

5)15

6) A beats B by 30 seconds, B beats C by 15 seconds

∴ A beats C by (30+15) seconds = 45 seconds

⇒ Time taken by C to travel 180 m = 45 seconds

⇒ Time taken by C to cover the distance of

1km(1000m)= $180 \times \frac{45}{180} = 45$  seconds

∴ Required time taken by A to cover the distance of 1 km = (250-45)sec=205sec.

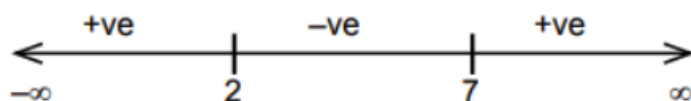
7)  $\frac{x+3}{x-2} \leq 2$

$$\frac{x+3}{x-2} \leq 2 \Rightarrow \frac{x+3}{x-2} - 2 \leq 0 \Rightarrow \frac{x+3-2x+4}{x-2} \leq 0$$

$$\Rightarrow \frac{7-x}{x-2} \leq 0 \Rightarrow \frac{x-7}{x-2} \geq 0 \text{ Here } x \neq 2$$

The critical points on putting  $(x - 7)$  and  $(x - 2)$  are obtained as equal to zero are 7 and 2.

The real number line is divided into 3 parts as shown below by these two critical points.



When  $x < 2$ , the expression  $\frac{x-7}{x-2} > 0$ .

When  $x$  lies between 2 and 7, the expression  $\frac{x-7}{x-2} < 0$ .

When  $x \geq 7$ , the expression  $\frac{x-7}{x-2} \geq 0$ .

∴ The inequality  $\frac{x+3}{x-2} \leq 2$  holds when  $x < 2$  or  $x \geq 7$ ,

i.e.,  $x \in (-\infty, 2) \cup [7, \infty)$ .

$$8) \frac{d-m}{m-c} = \frac{2}{3}$$

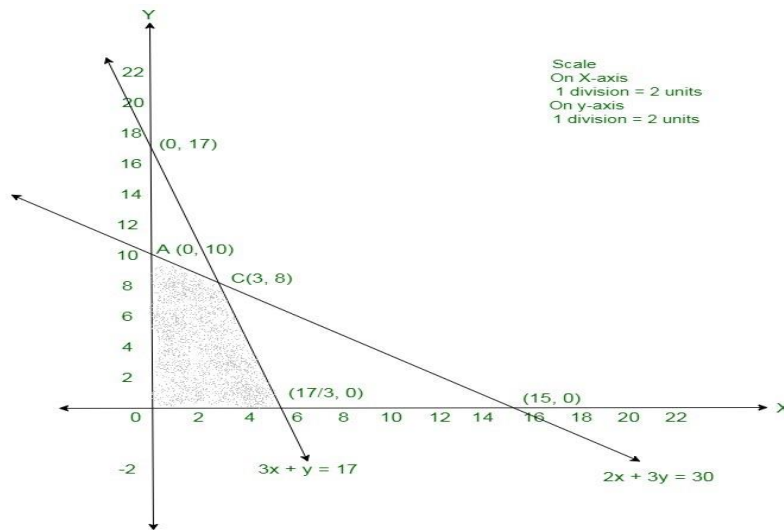
$$\frac{180 - m}{m - 120} = \frac{2}{3}$$

$$540 - 3m = 2m - 240$$

$$-5m = -780$$

$$M = \frac{780}{5} = 156$$

9)



The coordinates of the corner points of the feasible region are  $O(0, 0)$ ,  $A(0, 10)$ ,  $B(17/3, 0)$  and  $C(3, 8)$ . The value of the objective function at these points are showing the following table.

Corner Point	$Z = 100x + 120y$
0, 0	$100 \times 0 + 120 \times 0 = 0$
0, 10	$100 \times 0 + 120 \times 10 = 1200$
$(17/3, 0)$	$100 \times 17/3 + 120 \times 0 = 1700/3$
3, 8	$100 \times 3 + 120 \times 8 = 1260 \rightarrow \text{Maximum}$

The maximum value of  $Z$  is 1260 at  $x = 3$ ,  $y = 8$ .

10)(1) Let  $x$  be the smaller of the two consecutive odd positive integers. Then, the other integer is  $x+2$ . Since both the integers are smaller than 10.

$$x+2 < 10$$

$$\Rightarrow x < 10 - 2$$

$$\Rightarrow x < 8 \dots (i)$$

Also, the sum of the two integers is more than 11.

$$\therefore x + (x+2) > 11$$

$$\Rightarrow 2x + 2 > 11$$

$$\Rightarrow 2x > 11 - 2$$

$$\Rightarrow 2x > 9$$

$$\Rightarrow x > \frac{9}{2}$$

$$\Rightarrow x > 4.5 \dots (ii)$$

From (i) and (ii), we obtain

Since  $x$  is an odd number,  $x$  can take values, 5 and 7.

Thus, the required possible pairs are (5,7) and (7,9).

$$(2) |2x - 3| \geq 5$$

$$\Rightarrow 2x - 3 \geq 5 \text{ and } 2x - 3 \leq -5$$

$$\text{When, } \Rightarrow 2x - 3 \geq 5$$

$$\Rightarrow 2x \geq 8$$

$$\Rightarrow x \geq 4$$

$$\text{When, } \Rightarrow 2x - 3 \leq -5$$

$$\Rightarrow 2x \leq -2$$

$$\Rightarrow x \leq -1$$

Solution set is  $x \in (-\infty, -1] \cup [4, \infty)$

$$11)(a) x - y = 8 \dots \dots \dots (1)$$

$$x + y = 16 \dots \dots \dots (2)$$

From (1) and (2)

Speed of boat in still water = 12km/h

(b) speed of stream = 4km/h

(c) Average speed =  $\frac{96}{9} = 10\frac{2}{3}$  km/h