Linear Inequalities

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. The solution of $-6x - 2 < 1$ is:

(a) $x > -1/2$ **(b)** $x > 1/2$ **(c)** $x > 1/6$ **(d)** $x < -1/2$

2. The solution of $0 \le 6x + 8 < 17$ is:

(a) $-8 \le x < 9$ **(b)** $4/3 \le x < 25/6$ **(c)** $-4/3 \le x < 3/2$ **(d)** $-4/3 < x \le 3/2$

3. How many integers x satisfy $-12 \le 2x + 2 < 2$?

(a) 9 **(b)** 8 **(c)** 6 **(d)** 7

4. In interval notation, the solution of $6x \ge -9$ ($x \in R$) is:

(a) $[-3/2, \infty)$ **(b)** $[3/2, \infty)$ **(c)** $(-\infty, -3/2]$ **(d)** $(-3/2, \infty)$

5. When both sides of an inequality are multiplied by a negative number, the sign of the inequality:

(a) stays the same **(b)** is reversed **(c)** becomes = **(d)** disappears

6. The solution set of $7x + 1 < 14$, when x is a natural number, is:

(a) {1} **(b)** {2} **(c)** φ **(d)** {1, 2}

7. A student scored 79, 61 in 2 tests. Can the student reach an average of at least 85 after one more test marked out of 100?

(a) No, it would need more than 100 **(b)** Only with a score of 0

(c) Yes, with 100 **(d)** Yes, with exactly the average so far

8. Assertion (A): The solution of $-8x < -13$ is $x < 13/8$.
Reason (R): Multiplying or dividing both sides by a negative number reverses the inequality sign.

(a) Both A and R are true, and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true, but R is false.

(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. Solve: $x/6 - 5 \ge x/5 - 0$.

10. Solve $3 < 9 - 6x \le 12$.

11. Find all pairs of consecutive even positive integers, both greater than 11, whose sum is less than 43.

12. Solve the system: $5x + 4 > 3$ and $3x + 1 \le -2$.

13. A student's marks in two tests are 88 and 79, out of 100. What marks in the third test give an average between 65 and 80, inclusive?

14. The temperature of a solution is kept between 20 °C and 60 °C. What is the range in degrees Fahrenheit? ($F = 9C/5 + 32$)

15. Which of the points $(1, 3)$, $(5, -5)$, $(-1, 0)$ satisfy $3x + 3y \ge 4$?

16. List the integers x that satisfy $-14 \le 5x - 5 \le 27$.

Section C — Word problems — 4 × 4 = 16 marks

17. A solution of 2,970 litres contains 60% acid. How many litres of water must be added so that the acid content is between 30% and 45%?

18. Consider the system $2x + 4y \le 19$, $4x - 3y \ge -2$, $x \ge 0$, $y \ge 0$. Which of the points $(1, 3)$, $(1, 2)$, $(3, 3)$, $(5, 6)$ lie in the solution region? Explain how you would shade the region.

19. A company makes bags at a cost of Rs 1,000 plus Rs 100 per bag, and sells them at Rs 150 each. How many bags must it sell to make a profit of more than Rs 5,000?

20. Solve each inequality and find the values of x that satisfy both: (i) $(x - 3)/6 \leq (x + 6)/2$; (ii) $3x > -5$.

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Answer key

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Q	Answer	Working
1	**(a) x > −1/2**	−6x < 3; dividing by a negative number reverses the sign
2	**(c) −4/3 ≤ x < 3/2**	subtract 8, then divide by 6
3	**(d) 7**	−7 ≤ x < 0
4	**(a) [−3/2, ∞)**	x ≥ −3/2
5	**(b) is reversed**	—
6	**(a) {1}**	x < 13/7
7	**(a) No, it would need more than 100**	needs x ≥ 115
8	**(d) A is false, but R is true.**	A is false: divide by −8: x > 13/8. R is true.
9	**x ≤ −150**	multiply by 30: x(1/6 − 1/5) ≥ 5; the coefficient is negative, so the sign reverses
10	**−1/2 ≤ x < 1**	subtract 9, then divide by −6 and reverse both signs
11	**(12, 14), (14, 16), (16, 18), (18, 20), (20, 22)**	x > 11 and x + (x + 2) < 43, so x < 41/2
12	**no solution**	x > −1/5 and x ≤ −1
13	**From 28 to 73**	195 ≤ 167 + x ≤ 240, and 0 ≤ x ≤ 100
14	**Between 68 °F and 140 °F**	F = 9C/5 + 32 at C = 20 and at C = 60
15	**(1, 3)**	(1, 3): 12; (5, −5): 0; (−1, 0): −3
16	**{−1, 0, 1, 2, 3, 4, 5, 6}**	−9/5 ≤ x ≤ 32/5
17	**Between 990 and 2,970 litres**	30 ≤ 60 × 2970 ÷ (2970 + x) ≤ 45
18	**(1, 2), (3, 3). Draw each boundary line as a solid line (≤, ≥), shade the side that contains a point satisfying it (test the origin where it is not on the line), and take the common region in the first quadrant.**	(1, 3): 14, −5; (1, 2): 10, −2; (3, 3): 18, 3; (5, 6): 34, 2
19	**More than 120 bags, so at least 121 bags**	150x − (1000 + 100x) > 5000
20	**(i) x ≥ −21/2; (ii) x > −5/3; both: x > −5/3**	(i) multiply by 12: 2(x − 3) ≤ 6(x + 6)

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