Class 11 Mathematics · Chapter 5: Linear Inequalities

Answer key and marking scheme · 20 marks · about 40 minutes · based on NCERT

Scan for the free Class 11 Mathematics test

1. If $p < q$, which of the following is true? [1]

(a) $-4p < -4q$ (b) $-4p > -4q$

(c) $p - 4 > q - 4$ (d) $\frac{p}{4} > \frac{q}{4}$

Answer: (b) Multiplying both sides by the negative number -4 reverses the sign: $-4p > -4q$. Subtracting 4, or dividing by the positive number 4, keeps the sign, so (c) and (d) are false.

2. On a number line, the solution of $x > -2$ is shown by [1]

(a) a dark circle at -2 and the line darkened to the right

(b) an open circle at -2 and the line darkened to the right

(c) an open circle at -2 and the line darkened to the left

(d) a dark circle at -2 and the line darkened to the left

Answer: (b) The sign is strict, so -2 is not a solution: an open circle at -2. The solutions are greater than -2, so the line is darkened to the right.

3. Which of the following is a linear inequality in one variable? [1]

(a) $x^2 - 4 < 0$ (b) $3x + 2y \geq 7$

(c) $5 - 2x > 0$ (d) $4x - 7 = 9$

Answer: (c) $5 - 2x > 0$ is of the form $ax + b > 0$ with $a = -2 \neq 0$. $x^2 - 4 < 0$ is quadratic, $3x + 2y \geq 7$ has two variables, and $4x - 7 = 9$ is an equation, not an inequality.

4. A goods lift in a Surat warehouse can carry at most 500 kg. The operator weighs 68 kg and each carton weighs 24 kg. The greatest number of cartons the operator can take up with him in one trip is [1]

(a) 17 (b) 18

(c) 20 (d) 19

Answer: (b) $68 + 24x \leq 500$ gives $24x \leq 432$, $x \leq 18$. The sign is $\leq$, so exactly 500 kg is allowed and $x = 18$ works; 19 cartons make 524 kg. 17 comes from treating the limit as strict; 20 ignores the operator's weight.

5. Adding $x - 7$ to both sides of $3 - x > 7$ gives [1]

(a) $-4 > x$ (b) $-4 < x$

(c) $x > 4$ (d) $-4 > -x$

Answer: (a) By Rule 1 the sign is unchanged: $3 - x + x - 7 > 7 + x - 7$, that is, $-4 > x$.

6. Find how many integers satisfy both $3x - 2 < 10$ and $5x + 3 \geq 2x - 6$. [2]

$3x - 2 < 10$ gives $x < 4$. $5x + 3 \geq 2x - 6$ gives $3x \geq -9$, $x \geq -3$. Common values: $-3 \leq x < 4$, the integers -3, -2, -1, 0, 1, 2, 3: 7 integers.

- solves each: $x < 4$ and $x \geq -3$ (1)
- $-3 \leq x < 4$ gives 7 integers (1)

Every question original, written from NCERT, checked by a second reviewer · photocopy freely for your class

7. Find k if the solution set of $3 - 2x \le k$, for real x, is $[-3, \infty)$. How is this set shown on the number line? [2]

$3 - 2x \le k$ gives $-2x \le k - 3$, and dividing by -2 reverses the sign: $x \ge \frac{3 - k}{2}$. For the set $[-3, \infty)$, $\frac{3 - k}{2} = -3$, so $3 - k = -6$ and $k = 9$. On the number line: a dark circle at -3 (it is included) and the line darkened to the right.

- $x \ge (3 - k)/2$ with the sign reversed, and $k = 9$ (1)
- dark circle at -3, line darkened to the right (1)

8. Show that no real number x satisfies both $2x - 5 > 3$ and $3 - x \ge -1$. [2]

$2x - 5 > 3$ gives $2x > 8$, $x > 4$. $3 - x \ge -1$ gives $-x \ge -4$, and multiplying by -1 reverses the sign: $x \le 4$. A number cannot be both greater than 4 and at most 4, so the system has no solution; 4 itself fails the first, since $3 > 3$ is false.

- $x > 4$ and, with the sign reversed, $x \le 4$ (1)
- concludes there are no common values, noting that 4 fails the strict inequality (1)

9. Aman solved $\frac{x + 2}{3} - \frac{x - 1}{4} \ge \frac{x}{6}$ as follows. Step 1: $4(x + 2) - 3(x - 1) \ge 2x$. Step 2: $4x + 8 - 3x - 3 \ge 2x$. [3]
Step 3: $x + 5 \ge 2x$, so $x \le 5$. Find the step with the error and solve the inequality correctly.

Step 1 is correct (multiplying by 12, a positive number). The error is in Step 2: $-3(x - 1) = -3x + 3$, not $-3x - 3$. Correctly: $4x + 8 - 3x + 3 \ge 2x$, so $x + 11 \ge 2x$, $x \le 11$. Solution set $(-\infty, 11]$.

- identifies Step 2: $-3(x - 1) = -3x + 3$ (1)
- $x + 11 \ge 2x$ (1)
- $x \le 11$, i.e. $(-\infty, 11]$ (1)

10. A gym in Lucknow offers two plans. Plan A: ₹ 1500 to join and ₹ 600 a month. Plan B: no joining fee and ₹ 850 a month. Form an inequality and find the least number of whole months of membership for which Plan A costs less than Plan B. [3]

For m months, Plan A costs $1500 + 600m$ and Plan B costs $850m$. Plan A is cheaper when $1500 + 600m < 850m$, i.e. $250m > 1500$, $m > 6$. At $m = 6$ both cost ₹ 5100, so the least number of whole months is 7 (A: ₹ 5700, B: ₹ 5950).

- forms $1500 + 600m < 850m$ (1)
- $m > 6$ (1)
- least whole number 7, noting the plans are equal at 6 (1)

11. Find the least and the greatest integers satisfying $-4 \le \frac{3 - 2x}{5} < 1$, and the number of integers that satisfy it. [3]

Multiply by 5: $-20 \le 3 - 2x < 5$. Subtract 3: $-23 \le -2x < 2$. Divide by -2 and reverse the signs: $23/2 \ge x > -1$, that is, $-1 < x \le 23/2 = 11.5$. The integers are 0, 1, 2, ..., 11: least 0, greatest 11, and 12 of them.

- $-23 \le -2x < 2$ (1)
- reverses both signs: $-1 < x \le 23/2$ (1)
- least 0, greatest 11, 12 integers (1)

Every question original, written from NCERT, checked by a second reviewer · photocopy freely for your class