EXAM PAPERS PRACTICE

Linear Inequalities

Model Answer

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Question 1

Find the integers which satisfy the inequality.

$$-5 < 2n - 1 \leq 5$$ [3]

$-5 < 2n - 1 \leq 5$
First, we isolate the variable n by adding 1 to all expressions:
$-5 + 1 < 2n - 1 + 1 \leq 5 + 1$
This gives us:
$-4 < 2n \leq 6$
Next, we divide all expressions by 2 :
$-2 < 2 \cdot n \leq \frac{6}{2}$
This simplifies to:
$-2 < n \leq 3$
Finally, we check the integers which satisfy the inequality. n can be $-2, -1, 0, 1, 2$, or 3 .
Therefore, the integers that satisfy the inequality are $-2, -1, 0, 1, 2$, and 3 .

Question 2

Solve $6x + 3 < x < 3x + 9$ for **integer** values of x. [4]

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Steps to solve:
1. Simplify the inequality:
$5x + 2 < x - 1 < 3x + 8$
2. Isolate x in the first inequality:
$5x < x - 3$
$4x < -3$
$x < -\frac{3}{4}$
$x \leq -1$
3. Isolate x in the second inequality:
$x > x - 1$
$0 > -1$
4. Combine the inequalities:
$x \leq -1$ and $0 > -1$
5. Check the integer values of x :
The only integer value of x that satisfies both inequalities is -1 .
Answer:
$x = -1$

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Question 3

(a) Solve $3n + 23 < n + 41$. [2]

Steps to solve:
1. Add/subtract terms from both sides:
$3n + 23 - 23 < n + 41 - 23$
2. Simplify the expression:
$3n < n + 18$
3. Add/subtract terms from both sides:
$3n - n < n + 18 - n$
4. Simplify the expression:
$2n < 18$
5. Divide both sides by the same factor:
$\frac{2n}{2} < \frac{18}{2}$
6. Simplify the expression:
$n < 9$
Answer:
$n < 9$

(b) Factorise completely $ab + bc + ad + cd$. [2]

To factorize the expression, we can group the terms:
$ab + bc + ad + cd =$
$(ab + bc) + (ad + cd) =$
$b(a + c) + d(a + c)$
Now we can factor out $(a + c)$:
$b(a + c) + d(a + c) =$
$(a + c)(b + d)$
Therefore, the completely factored expression is $(a + c)(b + d)$.

Question 4

List all the prime numbers which satisfy this inequality.

$$16 < 2x - 5 < 48$$ [3]

Since the inequality $16 < 2x - 5 < 48$ involves a variable, we need to solve for x in order to find the prime numbers that satisfy the inequality.
Adding 5 to all three parts of the inequality, we get $21 < 2x < 53$.
Dividing all three parts of the inequality by 2 , we get $\frac{21}{2} < x < \frac{53}{2}$.
The integer values of x that satisfy the inequality are 11, 12, 13, 14, 25, 26.
Out of these integer values, only 11, 13, 17, 19, 23, and 29 are prime numbers.
Therefore, the prime numbers which satisfy the inequality $16 < 2x - 5 < 48$ are 11, 13, 17, 19, 23, and 29.

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Question 5

Solve the inequality

$$\frac{2x-5}{8} > \frac{x+4}{3}.$$ [3]

1. Clear the fractions by multiplying both sides of the inequality by the least common denominator (LCD), which is 24 in this case.
$24 \cdot \frac{2x-5}{8} > 24 \cdot \frac{x+4}{3}$.
Simplify both sides:
$3(2x-5) > 8(x+4)$.
2. Distribute on both sides of the inequality:
$6x - 15 > 8x + 32$.
3. Move $6x$ to one side and 32 to the other by subtracting $6x$ from both sides and subtracting 32 from both sides:
$-15 - 32 > 8x - 6x$.
Simplify both sides:
$-47 > 2x$.
4. Divide both sides by 2 (note that since we're dividing by a negative number, the inequality sign will flip):
$x < -\frac{47}{2}$.
So, the solution to the inequality is x belonging to the set of all real numbers less than $-\frac{47}{2}$. In interval notation, this is $\left(-\infty, -\frac{47}{2}\right)$.

Question 6

Solve the inequality $3 < 2x - 5 < 7$. [2]

We can solve the inequality by adding/subtracting terms from both sides and multiplying both sides by the same factor.
Steps to solve:
1. Add 5 to all three parts of the inequality:
$8 < 2x < 12$
2. Divide all three parts of the inequality by 2 :
$4 < x < 6$
Answer:
$4 < x < 6$

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Question 7

Solve the inequality.

$$\frac{2x-3}{5} - \frac{x}{3} \leqslant 2$$ [3]

We can solve the inequality by simplifying the expression, adding/subtracting terms from both sides, and combining like terms.
Steps to solve:
1. Simplify the expression:
$\frac{2x-3}{5} - \frac{x}{3} \leq 2$
$6x - 9 - 5x \leq 30$
$x - 9 \leq 30$
2. Add/subtract terms from both sides:
$x - 9 + 9 \leq 30 + 9$
$x \leq 39$
Answer:
$x \leq 39$

Question 8

x is a positive integer and $15x - 43 < 5x + 2$.

Work out the possible values of x. [3]

First, we need to isolate x in the inequality. To do this, we can add 43 to both sides:
$15x - 43 + 43 < 5x + 2 + 43$
This simplifies to:
$15x < 5x + 46$
Now, we can subtract $5x$ from both sides:
$15x - 5x < 5x + 46 - 5x$
This simplifies to:
$10x < 46$
Finally, we can divide both sides by 10 :
$x < \frac{46}{10}$
Since x is a positive integer, we round up to the nearest integer. Therefore, the possible values of$x$ are $1, 2, 3, 4$.

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Question 9

Solve the inequality.

$3y + 7 \leqslant 2 - y$ [2]

Steps to solve:

1. Rearrange terms:

$3y + 7 \leq -y + 2$

2. Add/subtract terms from both sides:

$3y + 7 - 7 \leq -y + 2 - 7$

$3y \leq -y - 5$

3. Add/subtract terms from both sides:

$3y + y \leq -y - 5 + y$

$4y \leq -5$

4. Divide both sides by the same factor:

$\frac{4y}{4} \leq \frac{-5}{4}$

$y \leq -\frac{5}{4}$

Answer:

$y \leq -\frac{5}{4}$

[3]

Question 10

Solve the inequality. $2x + 5 < \frac{x-1}{4}$

Steps to solve:

1. Add/subtract terms from both sides:

$2x + 5 - 5 < \frac{x-1}{4} - 5$

$2x < \frac{x-1}{4} - 5$

2. Simplify the expression:

$8x < x - 21$

3. Add/subtract terms from both sides:

$8x - x < x - 21 - x$

$7x < -21$

4. Divide both sides of the equation by the same factor:

$\frac{7x}{7} < \frac{-21}{7}$

5. Simplify the expression:

$x < -3$

Answer:

$x < -3$

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Question 11

Solve the inequality $6(2 - 3x) - 4(1 - 2x) \leqslant 0.$ [3]

Steps to solve:

1. Simplify the expression:

$6(2-3x)-4(1-2x) \leq 0$

$-10x+8 \leq 0$

2. Add/subtract terms from both sides:

$-10x+8-8 \leq 0-8$

$-10x \leq -8$

3. Divide both sides by the same factor:

$\frac{-10x}{-10} \geq \frac{-8}{-10}$

$x \geq \frac{4}{5}$

Answer:

$x \geq \frac{4}{5}$

Question 12

Solve the inequality $\frac{2-5x}{7} < \frac{2}{5}.$ [3]

Steps to solve:

1. Simplify the expression:

$\frac{2-5x}{7} < \frac{2}{5}$

$-25x+10 < 14$

2. Add/subtract terms from both sides:

$-25x+10-10 < 14-10$

$-25x < 4$

3. Divide both sides by the same factor:

$\frac{-25x}{-25} > \frac{4}{-25}$

$x > -\frac{4}{25}$

Answer:

$x > -\frac{4}{25}$

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Question 13

Solve the inequality $4 - 5x < 2(x + 4)$. [3]

Steps to solve:

1. Simplify the expression:

$4 - 5x < 2x + 8$

$-5x + 4 < 2x + 8$

2. Add/subtract terms from both sides:

$-5x + 4 - 4 < 2x + 8 - 4$

$-5x < 2x + 4$

3. Add/subtract terms from both sides:

$-5x - 2x < 2x + 4 - 2x$

$-7x < 4$

4. Divide both sides by the same factor:

$\frac{-7x}{-7} > \frac{4}{-7}$

$x > -\frac{4}{7}$

Answer:

$x > -\frac{4}{7}$

Question 14

Solve the inequality $5 - 3x < 17$. [2]

Steps to solve:

1. Rearrange terms:

$-3x + 5 < 17$

2. Add/subtract terms from both sides:

$-3x + 5 - 5 < 17 - 5$

$-3x < 12$

3. Simplify the expression:

$x > -4$

Answer:

$x > -4$

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Question 15

(a) Solve the inequality $5 - \frac{2x}{3} > \frac{1}{2} + \frac{x}{4}$ [3]

Steps to solve:

1. Simplify the expression:

$5 - \frac{2x}{3} > \frac{1}{2} + \frac{x}{4}$

$-8x + 60 > 3x + 6$

2. Add/subtract to both sides:

$-8x + 60 - 60 > 3x + 6 - 60$

$-8x > 3x - 54$

3. Add/subtract to both sides:

$-8x - 3x > 3x - 54 - 3x$

$-11x < -54$

4. Divide both sides by the same factor:

$\frac{-11x}{-11} < \frac{-54}{-11}$

$x > \frac{54}{11}$

Answer:

$x > \frac{54}{11}$

(b) List the positive integers which satisfy the inequality

$5 - \frac{2x}{3} > \frac{1}{2} + \frac{x}{4}$ [1]

Steps to solve:

1. Simplify the expression:

$5 - \frac{2x}{3} > \frac{1}{2} + \frac{x}{4}$

$-8x + 60 > 3x + 6$

2. Add/subtract to both sides:

$-8x + 60 - 60 > 3x + 6 - 60$

$-8x > 3x - 54$

3. Add/subtract to both sides:

$-8x - 3x > 3x - 54 - 3x$

$-11x < -54$

4. Divide both sides by the same factor:

$\frac{-11x}{-11} < \frac{-54}{-11}$

$x > \frac{54}{11}$

Answer:

$x > \frac{54}{11}$

The positive integers which satisfy the inequality are:

$x \in \{\frac{55}{11}, \frac{56}{11}, \frac{57}{11}, \frac{58}{11}, \frac{59}{11}, \frac{60}{11}, \frac{61}{11}, \frac{62}{11}, \frac{63}{11}, \frac{64}{11}, \frac{65}{11}, \frac{66}{11}, \frac{67}{11}, \frac{68}{11}, \frac{69}{11}, \frac{70}{11}\}$

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