# Chapter 5: Linear Inequalities

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## Exercise 5.1 — Exercise 5.1

**Q1** Solve $24x < 100$, when (i) x is a natural number. (ii) x is an integer.

SOLUTION

We have $24x < 100$.

Dividing both sides by 24 (positive, so inequality sign unchanged):

$x < 100/24 = 25/6 \approx 4.16$

(i) When x is a natural number:

Natural numbers less than 25/6 are 1, 2, 3, 4.

Solution set = {1, 2, 3, 4}

(ii) When x is an integer:

Integers less than 25/6 are ..., −3, −2, −1, 0, 1, 2, 3, 4.

Solution set = {..., −3, −2, −1, 0, 1, 2, 3, 4}

Answer: (i) {1, 2, 3, 4}; (ii) {..., −3, −2, −1, 0, 1, 2, 3, 4}

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**Q2** Solve $-12x > 30$, when (i) x is a natural number. (ii) x is an integer.

SOLUTION

We have $-12x > 30$.

Dividing both sides by −12 (negative, so inequality sign reverses):

$x < 30/(-12) = -5/2 = -2.5$

(i) When x is a natural number:

There is no natural number less than −2.5 (all natural numbers are positive).

Solution set = {} (empty set — no solution)

(ii) When x is an integer:

Integers less than −2.5 are ..., −5, −4, −3.

Solution set = {..., −5, −4, −3}

Answer: (i) No solution (empty set); (ii) {..., −5, −4, −3}

**Q3** Solve $5x - 3 < 7$, when (i) x is an integer. (ii) x is a real number.

SOLUTION

We have $5x - 3 < 7$.
Adding 3 to both sides:
$5x < 10$
Dividing both sides by 5:
$x < 2$

(i) When x is an integer:
Integers less than 2 are ..., −2, −1, 0, 1.
Solution set = {..., −2, −1, 0, 1}

(ii) When x is a real number:
All real numbers less than 2 are solutions.
Solution set = $(-\infty, 2)$

Answer: (i) {..., −2, −1, 0, 1}; (ii) $x \in (-\infty, 2)$

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**Q4** Solve $3x + 8 > 2$, when (i) x is an integer. (ii) x is a real number.

SOLUTION

We have $3x + 8 > 2$.
Subtracting 8 from both sides:
$3x > -6$
Dividing both sides by 3:
$x > -2$

(i) When x is an integer:
Integers greater than −2 are −1, 0, 1, 2, ...
Solution set = {−1, 0, 1, 2, ...}

(ii) When x is a real number:
All real numbers greater than −2 are solutions.
Solution set = $(-2, \infty)$

Answer: (i) {−1, 0, 1, 2, ...}; (ii) $x \in (-2, \infty)$

## Q5 Solve the inequality for real x: $4x + 3 < 5x + 7$

SOLUTION

We have $4x + 3 < 5x + 7$.

Subtract $4x$ from both sides:

$3 < x + 7$

Subtract 7 from both sides:

$-4 < x$

i.e., $x > -4$

Solution set = $(-4, \infty)$

**Answer: $x \in (-4, \infty)$**

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## Q6 Solve the inequality for real x: $3x - 7 > 5x - 1$

SOLUTION

We have $3x - 7 > 5x - 1$.

Subtract $5x$ from both sides:

$-2x - 7 > -1$

Add 7 to both sides:

$-2x > 6$

Divide by $-2$ (reverse inequality sign):

$x < -3$

Solution set = $(-\infty, -3)$

**Answer: $x \in (-\infty, -3)$**

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## Q7 Solve the inequality for real x: $3(x - 1) \leq 2(x - 3)$

SOLUTION

We have $3(x - 1) \leq 2(x - 3)$.

Expand both sides:

$3x - 3 \leq 2x - 6$

Subtract $2x$ from both sides:

$x - 3 \leq -6$

Add 3 to both sides:

$x \leq -3$

Solution set = $(-\infty, -3]$

Answer: $x \in (-\infty, -3]$

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## Q8 Solve the inequality for real x: $3(2 - x) \geq 2(1 - x)$

SOLUTION

We have $3(2 - x) \geq 2(1 - x)$.

Expand both sides:

$6 - 3x \geq 2 - 2x$

Add $3x$ to both sides:

$6 \geq 2 + x$

Subtract 2 from both sides:

$4 \geq x$

i.e., $x \leq 4$

Solution set = $(-\infty, 4]$

Answer: $x \in (-\infty, 4]$

---

## Q9 Solve the inequality for real x: $x + x/2 + x/3 < 11$

SOLUTION

We have $x + x/2 + x/3 < 11$.

The LCM of 1, 2, 3 is 6. Multiply each term by 6 (or find a common denominator):

$6x/6 + 3x/6 + 2x/6 < 11$

$11x/6 < 11$

Multiply both sides by 6/11 (positive, sign unchanged):

$x < 6$

Solution set = $(-\infty, 6)$

Answer: $x \in (-\infty, 6)$

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## Q10 Solve the inequality for real x: $x/3 > x/2 + 1$

SOLUTION

We have $x/3 > x/2 + 1$.

Multiply both sides by 6 (LCM of 3 and 2):

$2x > 3x + 6$

Subtract $3x$ from both sides:

$-x > 6$

Multiply both sides by −1 (reverse inequality sign):
$x < -6$
Solution set = $(-\infty, -6)$

Answer: $x \in (-\infty, -6)$

---

Q11 Solve the inequality for real x: $3(x - 2)/5 \leq 5(2 - x)/3$

SOLUTION

We have $3(x - 2)/5 \leq 5(2 - x)/3$.
Multiply both sides by 15 (LCM of 5 and 3):
$3 \times 3(x - 2) \leq 5 \times 5(2 - x)$
$9(x - 2) \leq 25(2 - x)$
$9x - 18 \leq 50 - 25x$
Add 25x to both sides:
$34x - 18 \leq 50$
Add 18 to both sides:
$34x \leq 68$
Divide by 34:
$x \leq 2$
Solution set = $(-\infty, 2]$

Answer: $x \in (-\infty, 2]$

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Q12 Solve the inequality for real x: $(1/2)(3x/5 + 4) \geq (1/3)(x - 6)$

SOLUTION

We have $(1/2)(3x/5 + 4) \geq (1/3)(x - 6)$.
Expand both sides:
$3x/10 + 2 \geq x/3 - 2$
Subtract x/3 from both sides and subtract 2 from both sides:
$3x/10 - x/3 \geq -4$
Find common denominator (LCM of 10 and 3 is 30):
$9x/30 - 10x/30 \geq -4$
$-x/30 \geq -4$
Multiply both sides by −30 (reverse inequality sign):
$x \leq 120$
Solution set = $(-\infty, 120]$

Answer: $x \in (-\infty, 120]$

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Q13 Solve the inequality for real x: $2(2x + 3) - 10 < 6(x - 2)$

SOLUTION

We have $2(2x + 3) - 10 < 6(x - 2)$.

Expand both sides:

$4x + 6 - 10 < 6x - 12$

$4x - 4 < 6x - 12$

Subtract 6x from both sides:

$-2x - 4 < -12$

Add 4 to both sides:

$-2x < -8$

Divide by −2 (reverse inequality sign):

$x > 4$

Solution set = $(4, \infty)$

Answer: $x \in (4, \infty)$

---

Q14 Solve the inequality for real x: $37 - (3x + 5) > 9x - 8(x - 3)$

SOLUTION

We have $37 - (3x + 5) > 9x - 8(x - 3)$.

Expand both sides:

$37 - 3x - 5 > 9x - 8x + 24$

$32 - 3x > x + 24$

Subtract x from both sides:

$32 - 4x > 24$

Subtract 32 from both sides:

$-4x > -8$

Divide by −4 (reverse inequality sign):

$x < 2$

Solution set = $(-\infty, 2)$

Answer: $x \in (-\infty, 2)$

## Q15 Solve the inequality for real x: $x/4 < (5x - 2)/3 - (7x - 3)/5$

SOLUTION

We have $x/4 < (5x - 2)/3 - (7x - 3)/5$.

Simplify the right-hand side using LCM of 3 and 5 = 15:

$(5x - 2)/3 - (7x - 3)/5 = [5(5x - 2) - 3(7x - 3)] / 15$

$= [25x - 10 - 21x + 9] / 15$

$= (4x - 1)/15$

So the inequality becomes: $x/4 < (4x - 1)/15$

Multiply both sides by 60 (LCM of 4 and 15):

$15x < 4(4x - 1)$

$15x < 16x - 4$

Subtract 16x from both sides:

$-x < -4$

Multiply by −1 (reverse inequality sign):

$x > 4$

Solution set = $(4, \infty)$

Answer: $x \in (4, \infty)$

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## Q16 Solve the inequality for real x: $(2x - 1)/3 \geq (3x - 2)/4 - (2 - x)/5$

SOLUTION

We have $(2x - 1)/3 \geq (3x - 2)/4 - (2 - x)/5$.

Simplify the right-hand side using LCM of 4 and 5 = 20:

$(3x - 2)/4 - (2 - x)/5 = [5(3x - 2) - 4(2 - x)] / 20$

$= [15x - 10 - 8 + 4x] / 20$

$= (19x - 18)/20$

So the inequality becomes: $(2x - 1)/3 \geq (19x - 18)/20$

Multiply both sides by 60 (LCM of 3 and 20):

$20(2x - 1) \geq 3(19x - 18)$

$40x - 20 \geq 57x - 54$

Subtract 57x from both sides:

$-17x - 20 \geq -54$

Add 20 to both sides:

$-17x \geq -34$

Divide by −17 (reverse inequality sign):

$x \leq 2$

Solution set = $(-\infty, 2]$

Answer: $x \in (-\infty, 2]$

---

Q17 Solve the inequality $3x - 2 < 2x + 1$ and show the graph of the solution on a number line.

SOLUTION

We have $3x - 2 < 2x + 1$.

Subtract $2x$ from both sides:

$x - 2 < 1$

Add 2 to both sides:

$x < 3$

Solution set = $(-\infty, 3)$

Graph: On the number line, place an open circle at 3 and shade all values to the left of 3.

Answer: $x \in (-\infty, 3)$; on the number line, open circle at 3, shade left

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Q18 Solve the inequality $5x - 3 > 3x - 5$ and show the graph of the solution on a number line.

SOLUTION

We have $5x - 3 > 3x - 5$.

Subtract $3x$ from both sides:

$2x - 3 > -5$

Add 3 to both sides:

$2x > -2$

Divide by 2:

$x > -1$

Solution set = $(-1, \infty)$

Graph: On the number line, place an open circle at $-1$ and shade all values to the right of $-1$.

Answer: $x \in (-1, \infty)$; on the number line, open circle at $-1$, shade right

Q19 Solve the inequality $3(1 - x) < 2(x + 4)$ and show the graph of the solution on a number line.

SOLUTION

We have $3(1 - x) < 2(x + 4)$.
Expand both sides:
$3 - 3x < 2x + 8$
Subtract $2x$ from both sides:
$3 - 5x < 8$
Subtract 3 from both sides:
$-5x < 5$
Divide by $-5$ (reverse inequality sign):
$x > -1$
Solution set = $(-1, \infty)$

Graph: On the number line, place an open circle at $-1$ and shade all values to the right of $-1$.

Answer: $x \in (-1, \infty)$; on the number line, open circle at $-1$, shade right

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Q20 Solve the inequality $x/2 \geq (5x - 2)/3 - (7x - 3)/5$ and show the graph of the solution on a number line.

SOLUTION

We have $x/2 \geq (5x - 2)/3 - (7x - 3)/5$.
Simplify the right-hand side (LCM of 3 and 5 = 15):
$(5x - 2)/3 - (7x - 3)/5 = [5(5x - 2) - 3(7x - 3)] / 15$
$= [25x - 10 - 21x + 9] / 15$
$= (4x - 1)/15$
So the inequality becomes: $x/2 \geq (4x - 1)/15$
Multiply both sides by 30 (LCM of 2 and 15):
$15x \geq 2(4x - 1)$
$15x \geq 8x - 2$
Subtract $8x$ from both sides:
$7x \geq -2$
Divide by 7:
$x \geq -2/7$
Solution set = $[-2/7, \infty)$

Graph: On the number line, place a filled (closed) circle at −2/7 and shade all values to the right.

Answer: $x \in [-2/7, \infty)$; on the number line, closed circle at −2/7, shade right

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Q21 Ravi obtained 70 and 75 marks in first two unit tests. Find the minimum marks he should get in the third test to have an average of at least 60 marks.

SOLUTION

Let x be the marks obtained in the third test.
For an average of at least 60 marks over three tests:
$(70 + 75 + x)/3 \geq 60$
$145 + x \geq 180$
$x \geq 35$
Thus, Ravi must obtain a minimum of 35 marks in the third test.

Answer: Minimum marks required in the third test = 35

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Q22 To receive Grade 'A' in a course, one must obtain an average of 90 marks or more in five examinations (each of 100 marks). If Sunita's marks in first four examinations are 87, 92, 94 and 95, find minimum marks that Sunita must obtain in the fifth examination to get grade 'A' in the course.

SOLUTION

Let x be Sunita's marks in the fifth examination.
Sum of marks in first four examinations = 87 + 92 + 94 + 95 = 368.
For grade 'A', average ≥ 90:
$(368 + x)/5 \geq 90$
$368 + x \geq 450$
$x \geq 82$
Also, maximum marks in any exam = 100, so $x \leq 100$.
Therefore, Sunita must score a minimum of 82 marks in the fifth examination.

Answer: Minimum marks required in the fifth examination = 82

Q23 Find all pairs of consecutive odd positive integers both of which are smaller than 10 such that their sum is more than 11.

SOLUTION

Let x be the smaller odd positive integer, so the other is x + 2.

Given conditions:

(i) Both are smaller than 10: $x + 2 < 10 \Rightarrow x < 8$

(ii) Sum is more than 11: $x + (x + 2) > 11 \Rightarrow 2x + 2 > 11 \Rightarrow 2x > 9 \Rightarrow x > 4.5$

Since x is an odd integer: $x > 4.5$ means $x \geq 5$ (odd).

Combining with $x < 8$, x is odd: x can be 5 or 7.

Pairs: (5, 7) and (7, 9).

Verify: both 5, 7 < 10; 5 + 7 = 12 > 11 ✓; both 7, 9 < 10; 7 + 9 = 16 > 11 ✓

Answer: The pairs are (5, 7) and (7, 9)

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Q24 Find all pairs of consecutive even positive integers, both of which are larger than 5 such that their sum is less than 23.

SOLUTION

Let x be the smaller even positive integer, so the other is x + 2.

Given conditions:

(i) Both are larger than 5: $x > 5$. Since x is even, $x \geq 6$.

(ii) Sum is less than 23: $x + (x + 2) < 23 \Rightarrow 2x + 2 < 23 \Rightarrow 2x < 21 \Rightarrow x < 10.5$

Since x is an even integer: $6 \leq x \leq 10$ ($x < 10.5$ means $x \leq 10$).

Even values: x = 6, 8, 10.

Pairs: (6, 8), (8, 10), (10, 12).

Verify: 6+8=14<23 ✓; 8+10=18<23 ✓; 10+12=22<23 ✓; all first elements > 5 ✓

Answer: The pairs are (6, 8), (8, 10), and (10, 12)

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Q25 The longest side of a triangle is 3 times the shortest side and the third side is 2 cm shorter than the longest side. If the perimeter of the triangle is at least 61 cm, find the minimum length of the shortest side.

SOLUTION

Let the shortest side = x cm.

Then: longest side = 3x cm, and third side = 3x − 2 cm.

Perimeter ≥ 61:

$x + 3x + (3x - 2) \geq 61$

$7x - 2 \geq 61$

$7x \geq 63$

$x \geq 9$

Therefore, the minimum length of the shortest side is 9 cm.

Answer: Minimum length of the shortest side = 9 cm

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Q26 A man wants to cut three lengths from a single piece of board of length 91 cm. The second length is to be 3 cm longer than the shortest and the third length is to be twice as long as the shortest. What are the possible lengths of the shortest board if the third piece is to be at least 5 cm longer than the second? [Hint: If x is the length of the shortest board, then x, (x + 3) and 2x are the lengths of the second and third piece, respectively. Thus, $x + (x + 3) + 2x \leq 91$ and $2x \geq (x + 3) + 5$].

SOLUTION

Let x cm be the length of the shortest piece.

Then: second piece = (x + 3) cm, third piece = 2x cm.

Condition 1 — total length ≤ 91 cm:

$x + (x + 3) + 2x \leq 91$

$4x + 3 \leq 91$

$4x \leq 88$

$x \leq 22$ ... (i)

Condition 2 — third piece is at least 5 cm longer than second:

$2x \geq (x + 3) + 5$

$2x \geq x + 8$

$x \geq 8$ ... (ii)

From (i) and (ii): $8 \leq x \leq 22$.

Therefore, the length of the shortest board can be any value from 8 cm to 22 cm.

Answer: The shortest piece can be between 8 cm and 22 cm (inclusive), i.e., $8 \leq x \leq 22$

## Misc — Miscellaneous Exercise

### Q1 Solve the inequality: $2 \le 3x - 4 \le 5$

SOLUTION

We have $2 \le 3x - 4 \le 5$.

Add 4 throughout:

$2 + 4 \le 3x \le 5 + 4$

$6 \le 3x \le 9$

Divide throughout by 3:

$2 \le x \le 3$

Solution set = [2, 3]

Answer: $x \in [2, 3]$

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### Q2 Solve the inequality: $6 \le -3(2x - 4) < 12$

SOLUTION

We have $6 \le -3(2x - 4) < 12$.

Divide throughout by −3 (negative, so reverse both inequality signs):

$-2 \ge 2x - 4 > -4$

Add 4 throughout:

$2 \ge 2x > 0$

Divide throughout by 2:

$1 \ge x > 0$

i.e., $0 < x \le 1$

Solution set = (0, 1]

Answer: $x \in (0, 1]$

---

### Q3 Solve the inequality: $-3 \le 4 - 7x/2 \le 18$

SOLUTION

We have $-3 \le 4 - 7x/2 \le 18$.

Subtract 4 throughout:

$-3 - 4 \le -7x/2 \le 18 - 4$

$-7 \le -7x/2 \le 14$

Multiply throughout by −2/7 (negative, so reverse both inequality signs):

$(-7)(-2/7) \ge x \ge (14)(-2/7)$

$2 \geq x \geq -4$

i.e., $-4 \leq x \leq 2$

Solution set = $[-4, 2]$

Answer: $x \in [-4, 2]$

---

Q4 Solve the inequality: $-15 < 3(x - 2)/5 \leq 0$

SOLUTION

We have $-15 < 3(x - 2)/5 \leq 0$.

Multiply throughout by 5/3 (positive, sign unchanged):

$-15 \times (5/3) < (x - 2) \leq 0 \times (5/3)$

$-25 < x - 2 \leq 0$

Add 2 throughout:

$-23 < x \leq 2$

Solution set = $(-23, 2]$

Answer: $x \in (-23, 2]$

---

Q5 Solve the inequality: $-12 < 4 - 3x/(-5) \leq 2$

SOLUTION

We have $-12 < 4 - 3x/(-5) \leq 2$.

Note: $-3x/(-5) = 3x/5$, so the inequality is $-12 < 4 + 3x/5 \leq 2$.

Subtract 4 throughout:

$-16 < 3x/5 \leq -2$

Multiply throughout by 5/3 (positive, sign unchanged):

$-16 \times (5/3) < x \leq -2 \times (5/3)$

$-80/3 < x \leq -10/3$

Solution set = $(-80/3, -10/3]$

Answer: $x \in (-80/3, -10/3]$

Q6 Solve the inequality: $7 \le (3x + 11)/2 \le 11$

SOLUTION

We have $7 \le (3x + 11)/2 \le 11$.
Multiply throughout by 2:
$14 \le 3x + 11 \le 22$
Subtract 11 throughout:
$3 \le 3x \le 11$
Divide throughout by 3:
$1 \le x \le 11/3$
Solution set = $[1, 11/3]$

Answer: $x \in [1, 11/3]$

---

Q7 Solve the inequalities and represent the solution graphically on a number line: $5x + 1 > -24$, $5x - 1 < 24$

SOLUTION

Inequality 1: $5x + 1 > -24$
$5x > -25$
$x > -5$ ... (i)

Inequality 2: $5x - 1 < 24$
$5x < 25$
$x < 5$ ... (ii)

The solution satisfying both (i) and (ii) is $-5 < x < 5$.
Solution set = $(-5, 5)$

Graph: On the number line, place open circles at $-5$ and 5, and shade the region between them.

Answer: $x \in (-5, 5)$; on the number line, open circles at $-5$ and 5, shade between

---

Q8 Solve the inequalities and represent the solution graphically on a number line: $2(x - 1) < x + 5$, $3(x + 2) > 2 - x$

SOLUTION

Inequality 1: $2(x - 1) < x + 5$
$2x - 2 < x + 5$
$x < 7$ ... (i)

Inequality 2: $3(x + 2) > 2 - x$
$3x + 6 > 2 - x$
$4x > -4$
$x > -1$ ... (ii)

The solution satisfying both (i) and (ii) is $-1 < x < 7$.
Solution set = $(-1, 7)$

Graph: On the number line, place open circles at $-1$ and $7$, and shade the region between them.

Answer: $x \in (-1, 7)$; on the number line, open circles at $-1$ and $7$, shade between

---

Q9 Solve the inequalities and represent the solution graphically on a number line: $3x - 7 > 2(x - 6)$, $6 - x > 11 - 2x$

SOLUTION

Inequality 1: $3x - 7 > 2(x - 6)$
$3x - 7 > 2x - 12$
$x > -5$ ... (i)

Inequality 2: $6 - x > 11 - 2x$
$6 - x + 2x > 11$
$x > 5$ ... (ii)

The solution satisfying both (i) and (ii) is $x > 5$ (since $x > 5$ is the stronger condition).
Solution set = $(5, \infty)$

Graph: On the number line, place an open circle at 5 and shade all values to the right.

Answer: $x \in (5, \infty)$; on the number line, open circle at 5, shade right

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Q10 Solve the inequalities and represent the solution graphically on a number line: $5(2x - 7) - 3(2x + 3) \leq 0$, $2x + 19 \leq 6x + 47$

SOLUTION

Inequality 1: $5(2x - 7) - 3(2x + 3) \leq 0$
$10x - 35 - 6x - 9 \leq 0$
$4x - 44 \leq 0$

$4x \le 44$

$x \le 11$ ... (i)

Inequality 2: $2x + 19 \le 6x + 47$

$19 - 47 \le 6x - 2x$

$-28 \le 4x$

$x \ge -7$ ... (ii)

The solution satisfying both (i) and (ii) is $-7 \le x \le 11$.

Solution set = $[-7, 11]$

Graph: On the number line, place closed circles at $-7$ and 11, and shade the region between them.

Answer: $x \in [-7, 11]$; on the number line, closed circles at $-7$ and 11, shade between

---

Q11 A solution is to be kept between 68°F and 77°F. What is the range in temperature in degree Celsius (C) if the Celsius/Fahrenheit (F) conversion formula is given by $F = 9C/5 + 32$?

SOLUTION

It is given that $68 < F < 77$.

Substituting $F = 9C/5 + 32$:

$68 < 9C/5 + 32 < 77$

Subtract 32 throughout:

$36 < 9C/5 < 45$

Multiply throughout by 5/9:

$36 \times (5/9) < C < 45 \times (5/9)$

$20 < C < 25$

Therefore, the range in temperature in Celsius is between 20°C and 25°C.

Answer: The temperature range in Celsius is $20°C < C < 25°C$

Q12 A solution of 8% boric acid is to be diluted by adding a 2% boric acid solution to it. The resulting mixture is to be more than 4% but less than 6% boric acid. If we have 640 litres of the 8% solution, how many litres of the 2% solution will have to be added?

SOLUTION

Let x litres of 2% boric acid solution be added.
Total mixture = (640 + x) litres.
Boric acid in mixture = 8% of 640 + 2% of x = 0.08 × 640 + 0.02x = 51.2 + 0.02x litres.

Condition: mixture is more than 4% boric acid:
$(51.2 + 0.02x)/(640 + x) > 0.04$
$51.2 + 0.02x > 0.04(640 + x)$
$51.2 + 0.02x > 25.6 + 0.04x$
$25.6 > 0.02x$
$x < 1280$ ... (i)

Condition: mixture is less than 6% boric acid:
$(51.2 + 0.02x)/(640 + x) < 0.06$
$51.2 + 0.02x < 0.06(640 + x)$
$51.2 + 0.02x < 38.4 + 0.06x$
$12.8 < 0.04x$
$x > 320$ ... (ii)

From (i) and (ii): $320 < x < 1280$.
Therefore, more than 320 litres but less than 1280 litres of the 2% solution must be added.

Answer: $320 < x < 1280$ litres of 2% solution must be added

Q13 How many litres of water will have to be added to 1125 litres of the 45% solution of acid so that the resulting mixture will contain more than 25% but less than 30% acid content?

SOLUTION

Let x litres of water be added.
Total mixture = (1125 + x) litres.
Amount of acid = 45% of 1125 = 506.25 litres (unchanged, since we add water).

Condition: mixture contains more than 25% acid:

506.25/(1125 + x) > 0.25
506.25 > 0.25(1125 + x)
506.25 > 281.25 + 0.25x
225 > 0.25x
x < 900 ... (i)

Condition: mixture contains less than 30% acid:
506.25/(1125 + x) < 0.30
506.25 < 0.30(1125 + x)
506.25 < 337.5 + 0.30x
168.75 < 0.30x
x > 562.5 ... (ii)

From (i) and (ii): 562.5 < x < 900.
Therefore, more than 562.5 litres but less than 900 litres of water must be added.

Answer: 562.5 < x < 900 litres of water must be added

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Q14 IQ of a person is given by the formula IQ = (MA/CA) × 100, where MA is mental age and CA is chronological age. If 80 ≤ IQ ≤ 140 for a group of 12 years old children, find the range of their mental age.

SOLUTION

Given: IQ = (MA/CA) × 100, CA = 12 years, and 80 ≤ IQ ≤ 140.
Substituting CA = 12:
80 ≤ (MA/12) × 100 ≤ 140
Divide throughout by 100:
80/100 ≤ MA/12 ≤ 140/100
0.8 ≤ MA/12 ≤ 1.4
Multiply throughout by 12:
9.6 ≤ MA ≤ 16.8
Therefore, the range of mental age is 9.6 ≤ MA ≤ 16.8 years.

Answer: The range of mental age is 9.6 ≤ MA ≤ 16.8 years