Unit – 7

Linear Equations and Inequalities

Q.1 **Choose the correct answer**

(i) Which of the following is the solution of the inequality $3-4x \leq 11$? **(A.B)**

(a) –8   (b) –2

(c) $-\dfrac{14}{4}$ (d) None of these

(ii) A statement involving any of the symbols <, >, ≤or >, is called------------ **(K.B)**

(a) Equation   (b) Identity

(c) Inequality   (d) Linear equation

(iii) $x =$ ------- is a solution of the inequality $-z < x > \dfrac{3}{2}$ **(U.B)**

(a) -5 (b) 3

(c) 0   (d) $\dfrac{3}{2}$

(iv) If x is no larger than 10, then ---------- **(U.B)**
(FSD 2014, 15, SWL 2017, RWP 2014, SGD 2014, D.G.K 2013)

(a) $x \leq 8$ (b) $x \geq 10$

(c) $x < 10$ (d) $x > 10$

(v) If the capacity of an elevator is at most 1600 pounds then ---------- **(K.B)**
(LHR 2013, GRW 2014, FSD 2014, 17, SWL 2014, 16)

(a) $c < 1600$ (b) $c \geq 1600$

(c) $c \leq 1600$ (d) $c > 1600$

(vi) x = 0 is a solution of the inequality ----------- **(A.B)**

(a) $x > 0$ (b) $3x+5 < 0$

(c) $x + \dfrac{z}{2} < 0$ (d) $x-2 < 0$

ANSWER KEY

i	ii	iii	iv	V	vi
b	c	c	b	C	d

Q.2 **Identify the following statement as true or false** **(U.B)**

(i) The equation $3x-5 = 7-x$ is a linear equation. **(True)**

(ii) The equation $x-0.3x = 0.7x$ is an identity **(True)**

(iii) The equation $-2x+3 = 8$ is equivalent to $-2x = 11$ **(False)**

(iv) To eliminate fractions we multiply each side of an equation by the L.C.M of denominators **(True)**

(v) $4(x+3) = x+3$ is a conditional equations **(True)**

(vi) The equation $2(3x+5) = 6x+12$ is an in consistent equation **(True)**

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(vii) To solve $\dfrac{2}{3}x = 12$, we should multiply each side by $\dfrac{2}{3}$ **(False)**

(viii) Equations having exactly the same solution are called equivalent equations. **(True)**

(ix) A solution that does not satisfy the original equation is called extra solution **(True)**

Q.3 Answer the following short question.

(i) Define a linear inequality in one variable **(K.B)**

Ans A linear inequality in one variable x is an inequality in which the variable x occurs only to the first power and has the standard form $ax + b < 0, a \neq 0$

(ii) State the Trichotomy and transitive properties of in equalities **(K.B)**

Ans **Trichotomy Property** **(K.B)**

For any $a, b \in R$ one and only one of the following statements in true. $a < b$ or $a = b,$ or $a > b$

Transitive Property

Let $a, b, c \in R$.

(a) If $a > b$ and $b > c$, then $a > c$

(b) If $a < b$ and $b < c$, then $a < c$

(iii) The formula relating degree Fahrenheit to degree Celsius is F$= \dfrac{9}{5}c + 32$ for what value of c is F< O was **(K.B) + (A.B) + (U.B)**

Ans $F = \dfrac{9}{5}c + 32$

$\dfrac{9}{5}c + 32 = F$

Since $F < 0$

So $\dfrac{9}{5}c + 32 < 0$

$\dfrac{9c + 160}{5} < 0$

Or $9c + 160 < 0 \times 5$

Or $9c + 160 < 0$

Or $9c < -160$

Or $c < -\dfrac{160}{9}$

(iv) Seven times the sum of an integer and 12 is at least 50 and at most 60. Write and solve the inequality that expresses this relationship **(U.B)**

Solution: Let the integer $= y$

Sum of integer and $12 = y + 12$

Seven times sum of integer and $12 = 7(y + 12)$

According to condition

$50 \leq 7(y + 12) \leq 60$

$\dfrac{50}{7} \leq 7\dfrac{(y + 12)}{7} \leq \dfrac{60}{7}$

$\dfrac{50}{7} \leq y + 12 \leq \dfrac{60}{7}$

$\dfrac{50}{7} - 12 \leq y + \cancel{12} - \cancel{12} \leq \dfrac{60}{7} - 12$

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$$\frac{50-84}{7} \le y \le \frac{60-84}{7}$$

$$\frac{-34}{7} \le y \le \frac{-24}{7} \qquad \text{Solution Set} = \left\{ y \mid \frac{-34}{7} \le y - \frac{24}{7} \right\}$$

Q.4 **Solve each of the following and check for extraneous solution if any**

(i) $\sqrt{2t+4} = \sqrt{t-1}$ (**A.B**)

Solution: $\sqrt{2t+4} = \sqrt{t-1}$

Taking square on both side

$$\left(\sqrt{2t+4}\right)^2 = \left(\sqrt{t-1}\right)^2$$

$2t+4 = t-1$

$2t-t = -1-4$

$t = -5$

To check

$\sqrt{2t+4} = \sqrt{t-1}$

When $t = -5$

$\sqrt{2(-5)+4} = \sqrt{t-5-1}$

$\sqrt{-10+4} = \sqrt{-6}$

$\sqrt{-6} = \sqrt{-6}$

L.H.S = R.H.S

Solution Set $= \{-5\}$

(ii) $\sqrt{3x-1} - 2\sqrt{8-2x} = 0$ (**A.B**)

Solution: $\sqrt{3x-1} - 2\sqrt{8-2x} = 0$

$\sqrt{3x-1} = 2\sqrt{8-2x}$

Taking square on both side

$$\left(\sqrt{3x-1}\right)^2 = \left(2\sqrt{8-2x}\right)^2$$

$3x-1 = 4(8-2x)$

$3x-1 = 32-8x$

$3x+8x = 32+1$

$11x = 33$

$x = \frac{33}{11}$

$x = 3$

To check

$\sqrt{3x-1} - 2\sqrt{8-2x} = 0$

When $x = 3$

$\sqrt{3(3)-1} - 2\sqrt{8-2(3)} = 0$

$\sqrt{9-1} - 2\sqrt{8-6} = 0$

$\sqrt{8} - 2\sqrt{2} = 0$

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$2\sqrt{2} - 2\sqrt{2} = 0$

$0 = 0$

L.H.S = R.H.S

Solution Set $= \{3\}$

Q.5 **Solve for** x

(i) $|3x+14| - 2 = 5x$ **(A.B)**

Solution: $|3x+14| - 2 = 5x$

$|3x+14| = 5x+2$

$3x+14 = \pm(5x+2)$

$3x+14 = 5x+2$ $\qquad\qquad$ $3x+14 = -(5x+2)$

$14-2 = 5x-3x$

$12 = 2x$ $\qquad\qquad\qquad\qquad$ $3x+14 = -5x-2$

$\dfrac{12}{2} = x$ $\qquad\qquad\qquad\qquad$ $3x+5x = -2-14$

$x = 6$ $\qquad\qquad\qquad\qquad$ $8x = \dfrac{-16}{8}$

To check $\qquad\qquad\qquad\qquad$ $x = -2$

$|3x+14| - 2 = 5x$ $\qquad\qquad$ $|3x+14| - 2 = 5x$

When $x = 6$ $\qquad\qquad\qquad$ when $x = -2$

$|3(6)+14| - 2 = 5(6)$ $\qquad$ $|3(-2)+14| - 2 = 5(-2)$

$|18+14| - 2 = 30$ $\qquad\quad$ $|-6+14| - 2 = -10$

$32 - 2 = 30$ $\qquad\qquad\qquad$ $8 - 2 = -10$

$30 = 30$ $\qquad\qquad\qquad\qquad$ $6 = -10$

Solution Set $= \{6\}$

(ii) $\dfrac{1}{3}|x-3| = \dfrac{1}{2}|x+2|$ **(A.B)**

Solution $\dfrac{1}{3}|x-3| = \dfrac{1}{2}|x+2|$

$\dfrac{2}{3}|x-3| = |x+2|$

$\dfrac{2}{3} = \dfrac{|x+2|}{|x-3|}$

$\dfrac{x+2}{x-3} = \pm\dfrac{2}{3}$

$\dfrac{x+2}{x-3} = \dfrac{2}{3}$ $\qquad$ and $\qquad$ $\dfrac{x+2}{x-3} = -\dfrac{2}{3}$

$3(x+2) = 2(x-3)$ $\qquad\qquad\qquad$ $3(x+2) = -2(x-3)$

$3x+6 = 2x-6$ $\qquad\qquad\qquad\quad$ $3x+6 = -2x+6$

$3x-2x = -6-6$ $\qquad\qquad\qquad$ $3x+2x = +6-6$

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$x = -12$

To check

$\dfrac{1}{3}|x-3| = \dfrac{1}{2}|x+2|$

When $x = -12$

$\dfrac{1}{3}|-12-3| = \dfrac{1}{2}|-12+2|$

$\dfrac{1}{3}|-15| = \dfrac{1}{2}|-10|$

$\dfrac{1}{\cancel{3}}\left(\cancel{15}^{5}\right) = \dfrac{1}{\cancel{2}}\left(\cancel{10}^{5}\right)$

$5 = 5$

$5x = 0$

$x = \dfrac{0}{5} \Rightarrow x = 0$

$\dfrac{1}{3}|x-3| = \dfrac{1}{2}|x+2|$

when $x = 0$

$\dfrac{1}{3}|0-3| = \dfrac{1}{2}|0+2|$

$\dfrac{1}{3}|-3| = \dfrac{1}{2}|2|$

$\dfrac{1}{\cancel{3}}\left(\cancel{3}^{1}\right) = \dfrac{1}{\cancel{2}}\left(\cancel{2}^{1}\right)$

$\dfrac{1}{3}(3) = 1$

$1 = 1$

Solution Set $= \{-12, 0\}$

Q.6 **Solve the following inequality**

(iii) $-\dfrac{1}{3}x + 5 \le 1$ **(U.B)+(K.B)**

Solution $-\dfrac{1}{3}x + 5 \le 1$

$-\dfrac{1}{3}x \le 1 - 5$

$-\dfrac{1}{3}x \le -4$

$x \ge -4 \times (-3)$

$x \ge 12$

Solution Set $= \{x \mid x \ge 12\}$

(i) $-3 < \dfrac{1-2x}{5} < 1$

Solution $-3 < \dfrac{1-2x}{5} < 1$

$-3 < \dfrac{1-2x}{5} \qquad\qquad \dfrac{1-2x}{5} < 1$

$-15 < 1-2x \qquad\qquad 1-2x < 5$

$-15-1 < -2x \qquad\quad -2x < 5-1$

$-16 < -2x \qquad\qquad -2x < 4$

$\dfrac{-16}{-2} > x \qquad\qquad\quad x > \dfrac{4}{-2}$

$8 > x \qquad\qquad\qquad x > -2$

$x < 8 \qquad\qquad\qquad -2 < x$

$\qquad\qquad -2 < x < 8$

Solution Set $= \{x \mid -2 < x < 8\}$