

Unit - 7

Linear Equations and Inequalities



Mathematics-9

Unit 7 – Exercise 7.2

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- (i) $|x| = 0$ has only one solution True
- (ii) All absolute value equations have two solutions False
- (iii) The equation $|x| = 2$ is equivalent to $x = 2$ or $x = -2$ True
- (iv) The equation $|x - 4| = -4$ has no solution True
- (v) The equation $|2x - 3| = 5$ is equivalent to $2x - 3 = 5$ or $2x + 3 = 5$ False

Q.1

- (i) **Solve:** $|3x - 5| = 4$ **(K.B)**
 (LHR 2014, 17, GRW 2014, 17, FSD 2017, SWL 2016, 17, MTN 2014, 15)

Solution:

$$|3x - 5| = 4$$

$$3x - 5 = \pm 4$$

$$3x - 5 = 4 \quad \text{or} \quad 3x - 5 = -4$$

$$3x = 4 + 5 \quad \quad \quad 3x = -4 + 5$$

$$3x = 9 \quad \quad \quad 3x = 1$$

$$x = \frac{9}{3} \quad \quad \quad x = \frac{1}{3}$$

$$x = 3$$

Check

Put $x = 3$ Put $x = \frac{1}{3}$

$$|3(3) - 5| = 4 \quad \quad \quad \left| 3 \times \frac{1}{3} - 5 \right| = 4$$

$$|9 - 5| = 4 \quad \quad \quad |1 - 5| = 4$$

$$4 = 4 \text{ True} \quad \quad \quad |-4| = 4$$

$$4 = 4 \text{ True}$$

Solution Set = $\left\{ 3, \frac{1}{3} \right\}$

- (ii) $\frac{1}{2}|3x + 2| - 4 = 11$ **(K.B)**
 (LHR 2017, SWL 2015, 16, FSD 2016, MTN 2013, 16, RWP 2016)
Solution:

$$\frac{1}{2}|3x + 2| - 4 = 11$$

$$\frac{1}{2}|3x + 2| = 11 + 4$$

$$\frac{1}{2}|3x + 2| = 15$$

$$|3x + 2| = 2 \times 15$$

$$|3x + 2| = 30$$

$$3x + 2 = \pm 30$$

$$3x + 2 = 30 \quad \quad \quad 3x + 2 = -30$$

$$3x = 30 - 2 \quad \quad \quad 3x = -30 - 2$$

$$3x = 28 \quad \quad \quad 3x = -32$$

$$x = \frac{28}{3} \quad \quad \quad x = \frac{-32}{3}$$

Check

$$\frac{1}{2}|3x + 2| - 4 = 11 \quad \quad \quad \frac{1}{2}\left| 3 \times \frac{-32}{3} + 2 \right| - 4 = 11$$

$$\frac{1}{2}\left| 3 \times \frac{28}{3} + 2 \right| - 4 = 11 \quad \quad \quad \frac{1}{2}|-32 + 2| - 4 = 11$$

$$\frac{1}{2}|28 + 2| - 4 = 11 \quad \quad \quad \frac{1}{2}|-30| - 4 = 11$$

$$\frac{1}{2} \times 30 - 4 = 11 \quad \quad \quad \frac{1}{2}(30) - 4 = 11$$

$$15 - 4 = 11 \quad \quad \quad 15 - 4 = 11$$

$$11 = 11 \quad \quad \quad 11 = 11$$

Solution Set = $\left\{ \frac{28}{3}, \frac{-32}{3} \right\}$

- (iii) $|2x + 5| = 11$ **(K.B)**

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(LHR 2014, 15, 16, 17, GRW 2014, 15, 16, 17, SWL 2016, 17, FSD 2014, 15, D.G.K 2014, 15, 16, 17, BWP 2017)

Solution:

$$|2x+5|=11$$

$$2x+5=\pm 11$$

$$2x+5=11$$

$$2x=11-5$$

$$2x=6$$

$$x=\frac{6}{2}$$

$$x=3$$

$$2x+5=-11$$

$$2x=-11-5$$

$$2x=-16$$

$$x=\frac{-16}{2}$$

$$x=-8$$

Check

$$|2x+5|=11$$

$$|2(-8)-8+5|=11$$

$$|2 \times 3+5|=11$$

$$|-16+5|=11$$

$$6+5=11$$

$$|-11|=11$$

$$11=11$$

$$11=11$$

Solution Set = $\{-8, 3\}$

(iv) $|3+2x|=|6x-7|$ (K.B)

(LHR 2015, 17, FSD 2016, SWL 2013, BWP 2017)

Solution:

$$|3+2x|=|6x-7|$$

$$3+2x=\pm(6x-7)$$

$$3+2x=6x-7$$

$$3+2x=-(6x-7)$$

$$3+7=6x-7$$

$$3+2x=-6x+7$$

$$10=4x$$

$$2x+6x=7-3$$

$$\frac{10}{4}=x$$

$$\frac{4}{8}=x$$

$$x=\frac{5}{2}$$

$$x=\frac{1}{2}$$

Check

$$|3+2x|=|6x-7|$$

$$|3+2x|=|6x-7|$$

$$\left|3+2\left(\frac{5}{2}\right)\right|=\left|6\left(\frac{5}{2}\right)-7\right|$$

$$\left|3+2 \times \frac{1}{2}\right|=\left|6 \times \frac{1}{2}-7\right|$$

$$|3+5|=|15-7|$$

$$|3+1|=|3-7|$$

$$|8|=|8|$$

$$|4|=|-4|$$

$$8=8$$

$$4=4$$

Solution Set = $\left\{\frac{5}{2}, \frac{1}{2}\right\}$

(v) $|x+2|-3=5-|x+2|$ (K.B)

Solution:

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

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

$$2|x+2|=8$$

$$|x+2|=\frac{8}{2}$$

$$|x+2|=4$$

$$x+2=\pm 4$$

$$x+2=4$$

$$x+2=-4$$

$$x=4-2$$

$$x=-4-2$$

$$x=2$$

$$x=-6$$

Check

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

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

$$|2+2|-3=5-|2+2|$$

$$|-6+2|-3=5-|-6+2|$$

$$4-3=5-4$$

$$|-4|-3=5-|-4|$$

$$4-3=5-4$$

$$4-3=5-4$$

$$1=1$$

$$1=1$$

Solution Set = $\{-6, 2\}$

(vi) $\frac{1}{2}|x+3|+21=9$ (K.B) + (U.B)

Solution:

$$\frac{1}{2}|x+3|+21=9$$

$$\frac{1}{2}|x+3|=9-21$$

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

$$|x+3|=-12 \times 2$$

$$|x+3|=-24$$

Value of absolute is never negative so solution is not possible

Solution Set = $\{ \}$

(vii) $\left|\frac{3-5x}{4}\right|-\frac{1}{3}=\frac{2}{3}$ (A.B)

Solution:

$$\left|\frac{3-5x}{4}\right|-\frac{1}{3}=\frac{2}{3}$$

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$$\left| \frac{3-5x}{4} \right| = \frac{2}{3} + \frac{1}{3}$$

$$\left| \frac{3-5x}{4} \right| = \frac{2+1}{3}$$

$$\left| \frac{3-5x}{4} \right| = \frac{3}{3}$$

$$\left| \frac{3-5x}{4} \right| = 1$$

$$\frac{3-5x}{4} = \pm 1$$

$$\frac{3-5x}{4} = 1 \quad \text{and} \quad \frac{3-5x}{4} = -1$$

$$3-5x=4$$

$$-5x=4-3$$

$$-5x=1$$

$$x = \frac{1}{-5}$$

$$x = -\frac{1}{5}$$

$$3-5x=-4$$

$$-5x=-4-3$$

$$-5x=-7$$

$$x = \frac{-7}{-5}$$

$$x = \frac{7}{5}$$

$$\left| \frac{3-5 \times \left(-\frac{1}{5}\right)}{4} \right| - \frac{1}{3} = \frac{2}{3}$$

$$\left| \frac{3-5 \times \left(\frac{7}{5}\right)}{4} \right| - \frac{1}{3} = \frac{2}{3}$$

$$\left| \frac{3+1}{4} \right| - \frac{1}{3} = \frac{2}{3}$$

$$\left| \frac{4}{4} \right| - \frac{1}{3} = \frac{2}{3}$$

$$1 - \frac{1}{3} = \frac{2}{3}$$

$$\frac{3-1}{3} = \frac{2}{3}$$

$$\frac{2}{3} = \frac{2}{3}$$

$$\text{Solution Set} = \left\{ -\frac{1}{5}, \frac{7}{5} \right\}$$

(viii) $\left| \frac{x+5}{2-x} \right| = 6$

Solution:

$$\left| \frac{x+5}{2-x} \right| = 6$$

$$\frac{x+5}{2-x} = \pm 6$$

$$\frac{x+5}{2-x} = 6$$

$$x+5=6(2-x)$$

$$x+5=12-6x$$

$$x+6x=12-5$$

$$7x=7$$

$$x = \frac{7}{7}$$

$$x=1$$

$$\frac{x+5}{2-x} = -6$$

$$x+5=-6(2-x)$$

$$x+5=-12+6x$$

$$5+12=6x-x$$

$$17=5x$$

$$\frac{17}{5} = x$$

$$x = \frac{17}{5}$$

Check

$$\left| \frac{x+5}{2-x} \right| = 6$$

$$\left| \frac{1+5}{2-1} \right| = 6$$

$$\left| \frac{6}{1} \right| = 6$$

$$6=6$$

$$\left| \left(\frac{17}{5} + 5 \right) \div \left(2 - \frac{17}{5} \right) \right| = 6$$

$$\left| \frac{17+25}{5} \div \frac{10-17}{5} \right| = 6$$

$$\left| \frac{42}{5} \div \frac{-7}{5} \right| = 6$$

$$|-6| = 6$$

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$$6 = 6$$

$$\text{Solution Set} = \left\{ 1, \frac{17}{5} \right\}$$

