EXERCISE 4.2

1. Plot graph for the following absolute valued functions:

(i) $f(x) = |x-2|$ (ii) $f(x) = 3|x+3| - 4$
(iii) $f(x) = 5|x|$ (iv) $f(x) = |x+2| + 3$
(v) $f(x) = 2|x+4| - 3$ (vi) $f(x) = 2|x+1| - 6$

2. Solve and express the solution on number line:

(i) $|x-2| = 6$ (ii) $|2x+1| = 7$ (iii) $|4x-9| = 3$ (iv) $|7-2x| = 1$

3. Solve and express the solution on number line:

(i) $|5x+8| \le 3$ (ii) $|4x-12| \le 0$
(iii) $|3-4x| > 0$ (iv) $1-2\left|\frac{3}{2}x-5\right| > -3$
(v) $|3x-2| \le 12$ (vi) $|1-2x| > 5$

EXERCISE 4.2 - Complete Solutions with Number Lines

Part 1: Graphs of Absolute Valued Functions

(Descriptions provided - plot on graph paper using vertex and points given)

(i) $\mathbf{f(x) = |x-2|}$

- **Vertex:** (2, 0)
- **Shape:** V-shape opens upward
- **Key points:** (0, 2), (2, 0), (4, 2)

(ii) $\mathbf{f(x) = 3|x+3| - 4}$

- **Vertex:** (-3, -4)
- **Shape:** V-shape opens upward, steeper
- **Key points:** (-4, -1), (-3, -4), (-2, -1)

(iii) $\mathbf{f(x) = 5|x|}$

- **Vertex:** (0, 0)
- **Shape:** V-shape opens upward, very steep
- **Key points:** (-1, 5), (0, 0), (1, 5)

(iv) $\mathbf{f(x) = |x+2| + 3}$

- **Vertex:** (-2, 3)
- **Shape:** V-shape opens upward
- **Key points:** (-3, 4), (-2, 3), (-1, 4)

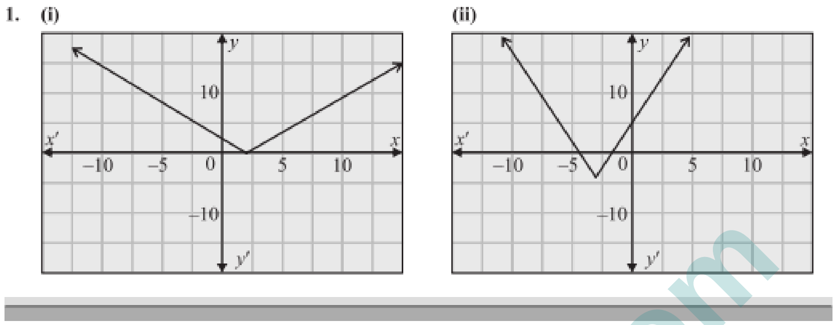
(v) $\mathbf{f(x) = 2|x+4| - 3}$

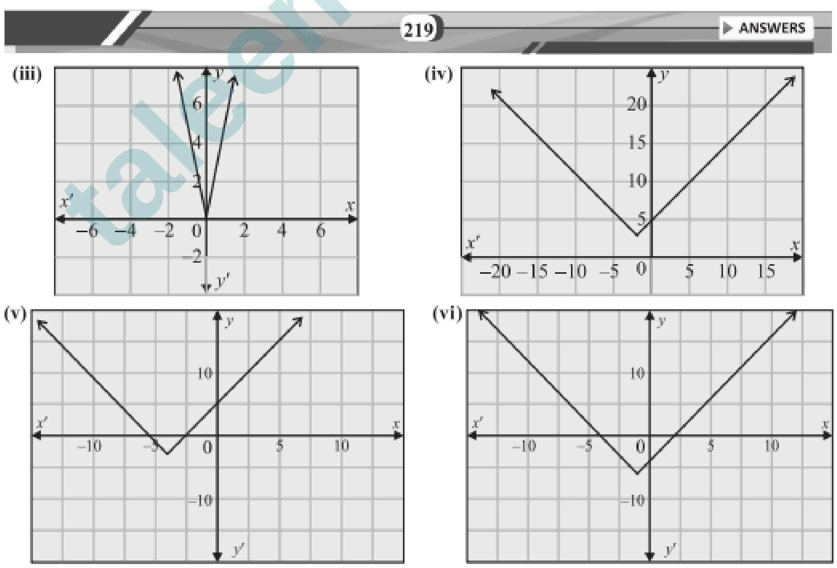
- **Vertex:** (-4, -3)
- **Shape:** V-shape opens upward, steeper

- **Key points:** (-5, -1), (-4, -3), (-3, -1)

(vi) $\mathbf{f(x) = 2|x + 1| - 6}$

- **Vertex:** (-1, -6)
- **Shape:** V-shape opens upward, steeper
- **Key points:** (-2, -4), (-1, -6), (0, -4)





Part 2: Solve and Express Solution on Number Line

2(i) $\mathbf{|x - 2| = 6}$

Solution:

- $x - 2 = 6 \rightarrow x = 8$

- $x - 2 = -6 \rightarrow x = -4$

Answer: $x = \{-4, 8\}$

Number Line:

text

<--- ------------------------------------ --->

-4 8

2(ii) $|\mathbf{2x + 1}| = \mathbf{7}$

Solution:

- $2x + 1 = 7 \rightarrow 2x = 6 \rightarrow x = 3$
- $2x + 1 = -7 \rightarrow 2x = -8 \rightarrow x = -4$

Answer: $x = \{-4, 3\}$

Number Line:

text

<--- ----------- ---------------------------->

-4 3

(= closed circle, points included)

2(iii) $|\mathbf{4x - 9}| = \mathbf{3}$

Solution:

- $4x - 9 = 3 \rightarrow 4x = 12 \rightarrow x = 3$
- $4x - 9 = -3 \rightarrow 4x = 6 \rightarrow x = \frac{3}{2}$

Answer: $x = \{\frac{3}{2}, 3\}$

Number Line:

text

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1.5 3

(= closed circle, points included)

2(iv) $|\mathbf{7 - 2x}| = \mathbf{1}$

Solution:

- $7 - 2x = 1 \rightarrow -2x = -6 \rightarrow x = 3$
- $7 - 2x = -1 \rightarrow -2x = -8 \rightarrow x = 4$

Answer: $x = \{3, 4\}$

Number Line:

text

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3 4

(= closed circle, points included)

Part 3: Solve and Express Solution on Number Line

3(i) $|\mathbf{5x+8}| \leq \mathbf{3}$

Solution:

- $-3 \leq 5x+8 \leq 3$
- $-11 \leq 5x \leq -5$
- $-\frac{11}{5} \leq x \leq -1$

Answer: $x \in [-\frac{11}{5}, -1]$ or $[-2.2, -1]$

Number Line:

text

<=====[==================]=====>

-2.2 -1

(Shaded region between -2.2 and -1 inclusive; [ ] = closed interval)

3(ii) $|\mathbf{4x-12}| \leq \mathbf{0}$

Solution:

- Since $|4x-12| \geq 0$ always, the only way it's 0 is when it equals 0.
- $4x-12=0 \rightarrow 4x=12 \rightarrow x=3$

Answer: $x=\{3\}$

Number Line:

text

<----------------- ------------------->

3

(= only this single point is included)

3(iii) $|\mathbf{3-4x}| > \mathbf{0}$

Solution:

- Absolute value >0 means the expression inside cannot be 0.
- $3-4x \neq 0 \rightarrow -4x \neq -3 \rightarrow x \neq \frac{3}{4}$

Answer: $x \in (-\infty, \frac{3}{4}) \cup (\frac{3}{4}, \infty)$

Number Line:

text

<================ ==================>

0.75

(Shaded everywhere except 0.75; = open circle, point excluded)

3(iv) $|\mathbf{1-2}| \cdot |\mathbf{\frac{3}{2}x-5}| > \mathbf{-3}$

Note: $|1-2|=1$, *so this simplifies to:*

$$\left|\frac{3}{2}x-5\right| > -3$$

Solution:

- Since absolute value is always 0, it is always > -3 for all real numbers.

Answer: $x \in \mathbb{R}$ (All real numbers)

Number Line:

text

<====================================>

-∞ ∞

(Entire number line shaded; all real numbers are solutions)

3(v) $|\mathbf{3x-2}| \leq \mathbf{12}$

Solution:

- $-12 \leq 3x - 2 \leq 12$
- $-10 \leq 3x \leq 14$
- $-\frac{10}{3} \leq x \leq \frac{14}{3}$

Answer: $x \in \left[-\frac{10}{3}, \frac{14}{3}\right]$ or $[-3.33, 4.67]$

Number Line:

text

<====[=================]====>

-3.33 4.67

(Shaded region between -3.33 and 4.67 inclusive; [ ] = closed interval)

3(vi) $|\mathbf{1-2x}| > \mathbf{5}$

Solution:

- $1 - 2x > 5$ OR $1 - 2x < -5$
- $-2x > 4 \rightarrow x < -2$
- $-2x < -6 \rightarrow x > 3$

Answer: $x \in (-\infty, -2) \cup (3, \infty)$

Number Line:

text

<==== ----------------- ====>

-2 3

(Shaded from -∞ to -2 and from 3 to ∞; = open circles, endpoints excluded)

Summary Table

		Number Line
2(i)	$x = \{-4, 8\}$	Two points at -4 and 8
2(ii)	$x = \{-4, 3\}$	Two points at -4 and 3
2(iii)	$x = \{\frac{3}{2}, 3\}$	Two points at 1.5 and 3
2(iv)	$x = \{3, 4\}$	Two points at 3 and 4
3(i)	$[-\frac{11}{5}, -1]$	Closed interval between -2.2 and -1

		Number Line
3(ii)	$\{3\}$	Single point at 3
3(iii)	$\left(-\infty, \frac{3}{4}\right) \cup \left(\frac{3}{4}, \infty\right)$	All except 0.75
3(iv)	$\mathbb{R}$	Entire number line
3(v)	$\left[-\frac{10}{3}, \frac{14}{3}\right]$	Closed interval between -3.33 and 4.67
3(vi)	$(-\infty, -2) \cup (3, \infty)$	Two open intervals

Legend:

- = Closed circle (included)
- = Open circle (not included)
- [or] = Closed interval endpoint (included)
- (or) = Open interval endpoint (not included)
- ==== = Shaded region representing solution set