11.

(i) $|x-3|=8$

1) Let $x-3\geq 0 \Longrightarrow x\geq 3$. Then $\Big(x-3=8\Big) \Longrightarrow \Big(x=11\Big)$.

2) Let $x-3\leq 0 \Longrightarrow x\leq 3$. Then $\Big(-(x-3)=8\Big) \Longrightarrow \Big(3-x=8\Big) \Longrightarrow \Big(x=-5.\Big)$.

Therefore $x=11$ or $x=-5$.

(ii) $|x-3|<8$

1) Let $x-3\geq 0 \Longrightarrow x\geq 3$. Then $\Big(x-3<8\Big) \Longrightarrow \Big(3\leq x<11\Big)$.

2) Let $x-3\leq 0 \Longrightarrow x\leq 3$. Then $\Big(-(x-3)<8\Big) \Longrightarrow \Big(3-x<8\Big) \Longrightarrow \Big(3\geq> x>-5.\Big)$.

Therefore $3\geq x>-5$ or $3\leq x<11$ for $x\in\mathbb{R}$.

(iii) $|x+4|<2$

$$\textbf{1)}x+4\geq 0 \Longrightarrow x\geq -4$$
$$\Big(x+4<2\Big) \Longrightarrow \Big(-4\leq x<-2\Big).$$
$$\textbf{2)}x+4\leq 0 \Longrightarrow x\leq -4$$
$$\Big(-x-4<2\Big) \Longrightarrow \Big(-x<6\Big) \Longrightarrow \Big(x>-6\Big).$$

Therefore $(x>-6$ or $-4\leq x<-2) \Longrightarrow (-6<x<-2, x\in\mathbb{R})$.

(iv) $|x-1|+|x-2|>1$

1) $x-1\geq 0 \Longrightarrow x\geq 1$

1.1) $x-2\geq 0 \Longrightarrow x\geq 2$

$(x-1)+(x-2)>1 \Longrightarrow 2x-3>1 \Longrightarrow x>2.$

1.2) $x-2\leq 0 \Longrightarrow x\leq 2$

$(x-1)+(-x+2)>1 \Longrightarrow (x-x)+1>1 \Longrightarrow$ No solution.

2) $x-1\leq 0 \Longrightarrow x\leq 1$

2.1) $x-2\geq 0 \Longrightarrow x\geq 2$

No solution.

2.2) $x-2\leq 0 \Longrightarrow x\leq 2$

$(-x+1)+(-x+2)>1 \Longrightarrow \Big(-2x>-2\Big) \Longrightarrow \Big(x<1\Big).$

Therefore $x>2$ or $x<1$ for $x\in\mathbb{R}$.

(v) $|x-1|+|x+1|<2$

1) $x-1 \geq 0 \Longrightarrow x \geq 1$

1.1) $x+1 \geq 0 \Longrightarrow x \geq -1$

$x-1+x+1<2 \Longrightarrow 2x<2 \Longrightarrow x<1 \Longrightarrow -1 \leq x<1.$

1.2) $x+1 \leq 0 \Longrightarrow x \leq -1$

No solution.

2) $x-1 \leq 0 \Longrightarrow x \leq 1$

2.1) $x+1 \geq 0 \Longrightarrow x \geq -1$

$(-x+1)+(x+1)<2 \Longrightarrow (x-x)+2<2 \Longrightarrow$ No solution.

2.2) $x+1 \leq 0 \Longrightarrow x \leq -1$

$(-x+1)+(-x-1)<2 \Longrightarrow -2x<2 \Longrightarrow x>-1 \Longrightarrow$ No solution.

Therefore $-1 \leq x<1, x \in \mathbb{R}$.

(vi) $|x-1|+|x+1|<1$

1) $x-1 \geq 0 \Longrightarrow x \geq 1$

1.1) $x+1 \geq 0 \Longrightarrow x \geq -1$

$x-1+x+1<1 \Longrightarrow 2x<1 \Longrightarrow x<\dfrac{1}{2} \Longrightarrow -1 \leq x<\dfrac{1}{2}.$

1.2) $x+1 \leq 0 \Longrightarrow x \leq -1$

No solution.

2) $x-1 \leq 0 \Longrightarrow x \leq 1$

2.1) $x+1 \geq 0 \Longrightarrow x \geq -1$

$(-x+1)+(x+1)<1 \Longrightarrow (x-x)+2<1 \Longrightarrow$ No solution.

2.2) $x+1 \leq 0 \Longrightarrow x \leq -1$

$(-x+1)+(-x-1)<1 \Longrightarrow -2x<1 \Longrightarrow x>-\dfrac{1}{2} \Longrightarrow$ No solution.

Therefore $-1 \leq x<\dfrac{1}{2}, x \in \mathbb{R}$.

(vii) $|x-1| * |x+1| = 0$

1) $x-1 \geq 0 \Longrightarrow x \geq 1$

1.1) $x+1 \geq 0 \Longrightarrow x \geq -1$

$(x-1)(x+1) = 0 \Longrightarrow x = 1 \vee x = -1.$

1.2) $x+1 \leq 0 \Longrightarrow x \leq -1$

No solution.

2) $x-1 \leq 0 \Longrightarrow x \leq 1$

2.1) $x+1 \geq 0 \Longrightarrow x \geq -1$

$-(x-1)(x+1) = 0 \Longrightarrow x = 1 \vee x = -1.$

2.2) $x+1 \leq 0 \Longrightarrow x \leq -1$

$(-(x-1))(-(x+1)) = 0 \Longrightarrow x = 1 \vee x = -1.$

Therefore $x = 1 \vee x = -1$.

(viii) $|x-1| * |x+2| = 3$

$$\textbf{1)}\ x-1 \geq 0 \Longrightarrow x \geq 1 \tag{1}$$

$$\textbf{1.1)}\ x+2 \geq 0 \Longrightarrow x \geq -2 \tag{2}$$

$$(x-1)(x+2) = 3 \Longrightarrow \Big(x^2 + x - 5 = 0\Big) \Longrightarrow \left(x = \frac{-1 \pm \sqrt{1^2 - 4(1)(-5)}}{2(1)}\right) \Longrightarrow \left(x = \frac{-1+\sqrt{21}}{2}\right). \tag{3}$$

$$\textbf{1.2)}\ x+2 \leq 0 \Longrightarrow x \leq -2 \tag{4}$$

$$\text{No solution.} \tag{5}$$

$$\textbf{2)}\ x-1 \leq 0 \Longrightarrow x \leq 1 \tag{6}$$

$$\textbf{2.1)}\ x+2 \geq 0 \Longrightarrow x \geq -2 \tag{7}$$

$$-(x-1)(x+2) = 3 \Longrightarrow \Big(-x^2 - x - 1 = 0\Big) \Longrightarrow \left(x = \frac{1 \pm \sqrt{1^2 - 4(-1)(-1)}}{2(-1)}\right) \Longrightarrow \left(x = \frac{1 \pm \sqrt{-3}}{-2}\right) \Longrightarrow \text{No solution.} \tag{8}$$

$$\textbf{2.2)}\ x+2 \leq 0 \Longrightarrow x \leq -2 \tag{9}$$

$$(-(x-1))(-(x+2)) = (x-1)(x+2) = 3 \Longrightarrow \left(x = \frac{-1+\sqrt{21}}{2}\right) \text{ by (3).} \tag{10}$$

Therefore $x = \dfrac{-1+\sqrt{21}}{2}$.