Surd Equations SOLUTIONS

1. $x = 11$
2. $x = 8$
3. $x = 1$
4. $x = 4 \quad x = 0$
5. $x = 9$ (S*)
6. $x = 4 \quad x = 0$
7. $x = 9 \quad x = 1$
8. $x = 4$ (S*)
9. $x = 3$
10. $x = 2$
11. $x = 4 \quad x = 0$
12. $x = 6 \quad x = 2$ (S*)

Question 5

$$\begin{aligned}
\sqrt{2x-14} &= \sqrt{x} - 1 \\
(\sqrt{2x-14})^2 &= (\sqrt{x}-1)^2 \\
2x - 14 &= \sqrt{x}(\sqrt{x}-1) - 1(\sqrt{x}-1) \\
2x - 14 &= x - \sqrt{x} - \sqrt{x} + 1 \\
2x - 14 &= x - 2\sqrt{x} + 1 \\
2x - x - 14 - 1 &= 2\sqrt{x} \\
(x-15)^2 &= (2\sqrt{x})^2 \\
x^2 - 30x + 225 &= 4x \\
x^2 - 34x + 225 &= 0 \\
(x-9)(x-25) &= 0 \\
x = 9 \quad x &= 25
\end{aligned}$$

Check each solution:

$$\sqrt{2x-14} = \sqrt{x} - 1$$

$$\begin{aligned} x &= 9 \\ \sqrt{2(9)-14} &= \sqrt{9} - 1 \\ 2 &= 2 \end{aligned}$$

$x = 9$ is a solution

$$\begin{aligned} x &= 25 \\ \sqrt{2(25)-14} &= \sqrt{25} - 1 \\ 6 &\neq 4 \end{aligned}$$

$x = 25$ is **not** a solution

Question 8

$$\begin{aligned}
\sqrt{5(x+1)} &= \sqrt{x}+3 \\
(\sqrt{5x+5})^2 &= (\sqrt{x}+3)^2 \\
5x+5 &= \sqrt{x}(\sqrt{x}+3)+3(\sqrt{x}+3) \\
5x+5 &= x+3\sqrt{x}+3\sqrt{x}+9 \\
5x+5 &= x+6\sqrt{x}+9 \\
5x-x+5-9 &= 6\sqrt{x} \\
(4x-4)^2 &= (6\sqrt{x})^2 \\
16x^2-32x+16 &= 36x \\
16x^2-68x+16 &= 0 \quad (\div 4) \\
4x^2-17x+4 &= 0 \\
(4x-1)(x-4) &= 0 \\
x = \frac{1}{4} \quad x &= 4
\end{aligned}$$

Check each solution:

$$\sqrt{5x+5} = \sqrt{x}+3$$

$$\begin{aligned}
x &= \frac{1}{4} \\
\sqrt{5(\frac{1}{4})+5} &= \sqrt{\frac{1}{4}}+3 \\
\frac{5}{2} &\neq \frac{7}{2}
\end{aligned}$$

$x = \frac{1}{4}$ is **not** a solution

$$\begin{aligned}
x &= 4 \\
\sqrt{5(4)+5} &= \sqrt{4}+3 \\
5 &= 5
\end{aligned}$$

$x = 4$ is a solution

Question 12

$$\begin{aligned}
\sqrt{4x+1}-3 &= \sqrt{x-2} \\
(\sqrt{4x+1}-3)^2 &= (\sqrt{x-2})^2 \\
\sqrt{4x+1}(\sqrt{4x+1}-3)-3(\sqrt{4x+1}-3) &= x-2 \\
4x+1-3\sqrt{4x+1}-3\sqrt{4x+1}+9 &= x-2 \\
4x+10-6\sqrt{4x+1} &= x-2 \\
4x-x+10+2 &= 6\sqrt{4x+1} \\
(3x+12)^2 &= (6\sqrt{4x+1})^2 \\
9x^2+72x+144 &= 36(4x+1) \\
9x^2+72x+144 &= 144x+36 \\
9x^2-72x+108 &= 0 \quad (\div 9) \\
x^2-8x+12 &= 0 \\
(x-6)(x-2) &= 0 \\
x=6 \quad x &= 2
\end{aligned}$$

Check each solution:

$$\sqrt{4x+1}-3=\sqrt{x-2}$$

$$\begin{aligned}
x &= 6 \\
\sqrt{4(6)+1}-3 &= \sqrt{(6)-2} \\
2 &= 2
\end{aligned}$$

$x = 6$ is a solution

$$\begin{aligned}
x &= 2 \\
\sqrt{4(2)+1}-3 &= \sqrt{(2)-2} \\
0 &= 0
\end{aligned}$$

$x = 2$ is a solution