

p. 732) 3-13, 21, 28

③ 4 ④ $\frac{81}{4}$ ⑤ 48 ⑥ \emptyset ⑦ 29 ⑧ 12

⑨ 8 ⑩ $\frac{109}{9}$ ⑪ $-\frac{75}{2}$ ⑫ 7 ⑬ 47 ⑭ B

⑳ $x=27$ is an extraneous solution. There are no real solutions

Solution

$$\begin{array}{r} ③ \quad 3\sqrt{x} - 6 = 0 \\ \quad \quad +6 \quad +6 \\ \hline 3\sqrt{x} = 6 \\ \quad \quad 3 \quad 3 \\ \hline (\sqrt{x})^2 = 2^2 \\ \hline \boxed{x=4} \end{array}$$

check!

$$\begin{array}{l} 3\sqrt{4} - 6 = 0 \\ 3 \cdot 2 - 6 = 0 \\ 0 = 0 \checkmark \end{array}$$

$$\begin{array}{r} ④ \quad 2\sqrt{x} - 9 = 0 \\ \quad \quad +9 \quad +9 \\ \hline 2\sqrt{x} = 9 \\ \quad \quad 2 \quad 2 \\ \hline (\sqrt{x})^2 = \left(\frac{9}{2}\right)^2 \\ \hline \boxed{x = \frac{81}{4}} \end{array}$$

check!

$$\begin{array}{l} 2\sqrt{\frac{81}{4}} - 9 = 0 \\ 2 \cdot \frac{9}{2} - 9 = 0 \\ 9 - 9 = 0 \\ 0 = 0 \checkmark \end{array}$$

$$\begin{array}{r} ⑤ \quad \sqrt{3x} + 4 = 16 \\ \quad \quad -4 \quad -4 \\ \hline (\sqrt{3x})^2 = (12)^2 \\ \hline 3x = 144 \\ \quad \quad 3 \quad 3 \\ \hline \boxed{x=48} \end{array}$$

check!

$$\begin{array}{l} \sqrt{3 \cdot 48} + 4 = 16 \\ \sqrt{144} + 4 = 16 \\ 12 + 4 = 16 \\ 16 = 16 \checkmark \end{array}$$

$$\begin{array}{r} ⑥ \quad \sqrt{5x} + 5 = 0 \\ \quad \quad -5 \quad -5 \\ \hline (\sqrt{5x})^2 = (-5)^2 \\ \hline 5x = \frac{25}{5} \\ \hline \cancel{x=5} \end{array}$$

check!

$$\begin{array}{l} \sqrt{5(5)} + 5 = 0 \\ \sqrt{25} + 5 = 0 \\ 5 + 5 = 0 \\ 10 \neq 0 \\ \uparrow \\ \text{NO!} \end{array}$$

no real solution

$$\begin{array}{r} ⑦ \quad \sqrt{x+7} + 5 = 11 \\ \quad \quad -5 \quad -5 \\ \hline (\sqrt{x+7})^2 = 6^2 \\ \hline x+7 = 36 \\ \quad \quad -7 \quad -7 \\ \hline \boxed{x=29} \end{array}$$

check!

$$\begin{array}{l} \sqrt{29+7} + 5 = 11 \\ \sqrt{36} + 5 = 11 \\ 6 + 5 = 11 \\ 11 = 11 \checkmark \end{array}$$

$$\begin{array}{r} ⑧ \quad \sqrt{x-8} - 4 = -2 \\ \quad \quad +4 \quad +4 \\ \hline (\sqrt{x-8})^2 = 2^2 \\ \hline x-8 = 4 \\ \quad \quad +8 \quad +8 \\ \hline \boxed{x=12} \end{array}$$

check!

$$\begin{array}{l} \sqrt{12-8} - 4 = -2 \\ \sqrt{4} - 4 = -2 \\ 2 - 4 = -2 \\ -2 = -2 \checkmark \end{array}$$

$$\begin{array}{r} ⑨ \quad 2\sqrt{x-4} - 2 = 2 \\ \quad \quad +2 \quad +2 \\ \hline \end{array}$$

check!

$$2\sqrt{18-4} - 2 = 2$$

$$\begin{array}{r} ⑩ \quad 3\sqrt{x-1} - 5 = 5 \\ \quad \quad +5 \quad +5 \\ \hline \end{array}$$

check!

$$3\sqrt{109-1} - 5 = 5$$

$$\begin{aligned} \textcircled{9} \quad 2\sqrt{x-4} - 2 &= 2 \\ &\quad +2 \quad +2 \\ \hline 2\sqrt{x-4} &= 4 \\ \frac{2\sqrt{x-4}}{2} &= \frac{4}{2} \\ (\sqrt{x-4})^2 &= 2^2 \\ x-4 &= 4 \\ +4 \quad +4 \\ \hline \boxed{x=8} \end{aligned}$$

check!

$$\begin{aligned} 2\sqrt{8-4} - 2 &= 2 \\ 2\sqrt{4} - 2 &= 2 \\ 2 \cdot 2 - 2 &= 2 \\ 4 - 2 &= 2 \\ 2 &= 2 \checkmark \end{aligned}$$

$$\begin{aligned} \textcircled{10} \quad 3\sqrt{x-1} - 5 &= 5 \\ &\quad +5 \quad +5 \\ \hline 3\sqrt{x-1} &= 10 \\ \frac{3\sqrt{x-1}}{3} &= \frac{10}{3} \\ (\sqrt{x-1})^2 &= \left(\frac{10}{3}\right)^2 \\ x-1 &= \frac{100}{9} \\ +1 \quad +1 \\ \hline \boxed{x = \frac{109}{9}} \end{aligned}$$

check!

$$\begin{aligned} 3\sqrt{\frac{109}{9}-1} - 5 &= 5 \\ 3\sqrt{\frac{100}{9}} - 5 &= 5 \\ 3 \cdot \frac{10}{3} - 5 &= 5 \\ 10 - 5 &= 5 \\ 5 &= 5 \checkmark \end{aligned}$$

$$\begin{aligned} \textcircled{11} \quad \sqrt{6-2x} + 12 &= 21 \\ &\quad -12 \quad -12 \\ \hline (\sqrt{6-2x})^2 &= 9^2 \\ 6-2x &= 81 \\ -6 \quad -6 \\ \hline -2x &= 75 \\ \frac{-2x}{-2} &= \frac{75}{-2} \\ \boxed{x = -\frac{75}{2}} \end{aligned}$$

check!

$$\begin{aligned} \sqrt{6-2\left(-\frac{75}{2}\right)} + 12 &= 21 \\ \sqrt{6+75} + 12 &= 21 \\ \sqrt{81} + 12 &= 21 \\ 9 + 12 &= 21 \\ 21 &= 21 \checkmark \end{aligned}$$

$$\begin{aligned} \textcircled{12} \quad 5\sqrt{x-3} + 4 &= 14 \\ &\quad -4 \quad -4 \\ \hline 5\sqrt{x-3} &= 10 \\ \frac{5\sqrt{x-3}}{5} &= \frac{10}{5} \\ (\sqrt{x-3})^2 &= 2^2 \\ x-3 &= 4 \\ +3 \quad +3 \\ \hline \boxed{x=7} \end{aligned}$$

check!

$$\begin{aligned} 5\sqrt{7-3} + 4 &= 14 \\ 5\sqrt{4} + 4 &= 14 \\ 5 \cdot 2 + 4 &= 14 \\ 14 &= 14 \checkmark \end{aligned}$$

$$\begin{aligned} \textcircled{13} \quad 2\sqrt{x-11} - 8 &= 4 \\ &\quad +8 \quad +8 \\ \hline 2\sqrt{x-11} &= 12 \\ \frac{2\sqrt{x-11}}{2} &= \frac{12}{2} \\ (\sqrt{x-11})^2 &= 6^2 \\ x-11 &= 36 \\ +11 \quad +11 \\ \hline \boxed{x=47} \end{aligned}$$

check!

$$\begin{aligned} 2\sqrt{47-11} - 8 &= 4 \\ 2\sqrt{36} - 8 &= 4 \\ 2 \cdot 6 - 8 &= 4 \\ 4 &= 4 \checkmark \end{aligned}$$

$$\begin{aligned} \textcircled{21} \quad 10\sqrt{x+3} + 3 &= 18 \\ &\quad -3 \quad -3 \\ \hline 10\sqrt{x+3} &= 15 \\ \frac{10\sqrt{x+3}}{10} &= \frac{15}{10} \\ (\sqrt{x+3})^2 &= \left(\frac{3}{2}\right)^2 \\ x+3 &= \frac{9}{4} \\ -3 \quad -3 \\ \hline \boxed{x = \frac{9}{4} - 3} \end{aligned}$$

check!

$$\begin{aligned} 10\sqrt{\frac{9}{4}+3} + 3 &= 18 \\ 10\sqrt{\frac{9}{4}} + 3 &= 18 \\ 10 \cdot \frac{3}{2} + 3 &= 18 \\ 5 \cdot 3 + 3 &= 18 \\ 18 &= 18 \checkmark \end{aligned}$$

$$\begin{array}{r} x+5 = \frac{1}{4} \\ -3 \quad -3 \end{array}$$

$$x = -\frac{3}{4} \quad \text{(B)}$$

$$5 \cdot 3 + 3 = 18$$

$$18 = 18 \checkmark$$