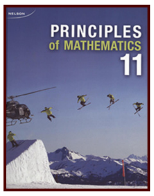
Lesson 1.3: Radical Expressions and Equations



Refer to *Principles of Mathematics 11* page 222 to do the following questions.

- Page 222, #4a, 4b, 6a, 6b, 6d, 7, 11.

Questions 4a and 4b, page 222

a. $\sqrt{4x} = 4$

$x \geq 0, x \in \mathrm{R}$

$$\begin{aligned} \sqrt{4x} &= 4 \\ (\sqrt{4x})^2 &= (4)^2 \\ 4x &= 16 \\ \frac{4}{4}x &= \frac{16}{4} \\ x &= 4 \end{aligned}$$

Left Side	Right Side
$\sqrt{4x}$	4
$= \sqrt{4(4)}$	
$= \sqrt{16}$	
$= 4$	4

Left side = Right Side

b. $\sqrt[3]{8x} = 2$

Positive and negative numbers have cube roots so there is no restriction on x.

$$\begin{aligned} (\sqrt[3]{8x})^3 &= (2)^3 \\ 8x &= 8 \\ \frac{8}{8}x &= \frac{8}{8} \\ x &= 1 \end{aligned}$$

Left Side	Right Side
$\sqrt[3]{8x}$	2
$= \sqrt[3]{8(1)}$	
$= \sqrt[3]{8}$	
$= 2$	2

Left side = Right Side

Questions 6a, 6b, and 6d, page 222

a.
$$\begin{aligned}\sqrt{x-3} &= 5\\ x-3 &\geq 0\\ x-3+3 &\geq 0+3\\ x &\geq 3, x \in \mathrm{R}\end{aligned}$$

$$\begin{aligned}\sqrt{x-3} &= 5\\ \left(\sqrt{x-3}\right)^2 &= (5)^2\\ x-3 &= 25\\ x-3+3 &= 25+3\\ x &= 28\end{aligned}$$

Left Side	Right Side
$\sqrt{x-3}$	5
$=\sqrt{28-3}$	
$=\sqrt{25}$	
$=5$	5

Left side = Right Side

b.
$$\begin{aligned}\sqrt[3]{4x+7} &= 3\\ \left(\sqrt[3]{4x+7}\right)^3 &= (3)^3\\ 4x+7 &= 27\\ 4x+7-7 &= 27-7\\ \frac{4}{4}x &= \frac{20}{4}\\ x &= 5\end{aligned}$$

Positive and negative numbers have cube roots so there is no restriction on x.

Left Side	Right Side
$\sqrt[3]{4x+7}$	3
$=\sqrt[3]{20+7}$	
$=\sqrt[3]{27}$	
$=3$	3

Left side = Right Side

d. $$\frac{1}{2}\sqrt{3x-2} = 4$$

$$3x - 2 \geq 0$$
$$3x - 2 + 2 \geq 0 + 2$$
$$\frac{3}{3}x \geq \frac{2}{3}$$
$$x \geq \frac{2}{3}, x \in \mathrm{R}$$

$$\frac{1}{2}\sqrt{3x-2} = 4$$
$$2 \cdot \frac{1}{2}\sqrt{3x-2} = 4 \cdot 2$$
$$\sqrt{3x-2} = 8$$
$$\left(\sqrt{3x-2}\right)^2 = (8)^2$$
$$3x - 2 = 64$$
$$3x - 2 + 2 = 64 + 2$$
$$3x = 66$$
$$\frac{3}{3}x = \frac{66}{3}$$
$$x = 22$$

Left Side	Right Side
$\frac{1}{2}\sqrt{3x-2}$	4
$= \frac{1}{2}\sqrt{3(22)-2}$	
$= \frac{1}{2}\sqrt{64}$	
$= \frac{1}{2}(8)$	
$= 4$	4

Left side = Right Side

Question 7, page 222

$$V = \sqrt{P \bullet R}$$
$$P = ?$$
$$V = 120$$
$$R = 2$$
$$120 = \sqrt{P \bullet 2}, P \geq 0, P \in \mathrm{R}$$

$$(120)^2 = (\sqrt{P \bullet 2})^2$$
$$14400 = 2P$$
$$\frac{14400}{2} = \frac{2}{2}P$$
$$7200 = P$$

The power needed is 7200 W.

Question 11, page 223

$$N = \frac{42}{\pi}\sqrt{\frac{5}{r}}$$
$$r = ?$$
$$N = 6.7$$
$$6.7 = \frac{42}{\pi}\sqrt{\frac{5}{r}}, r > 0, r \in \mathrm{R}$$

$$6.7 \bullet \frac{\pi}{42} = \frac{42}{\pi} \bullet \frac{\pi}{42}\sqrt{\frac{5}{r}}$$
$$6.7 \bullet \frac{\pi}{42} = \sqrt{\frac{5}{r}}$$
$$\left(\frac{6.7\pi}{42}\right)^2 = \left(\sqrt{\frac{5}{r}}\right)^2$$
$$\left(\frac{6.7\pi}{42}\right)^2 = \frac{5}{r}$$
$$r \bullet \left(\frac{6.7\pi}{42}\right)^2 = \frac{5}{r} \bullet r$$
$$r\left(\frac{6.7\pi}{42}\right)^2 = 5$$
$$r\frac{\left(\frac{6.7\pi}{42}\right)^2}{\left(\frac{6.7\pi}{42}\right)^2} = \frac{5}{\left(\frac{6.7\pi}{42}\right)^2}$$
$$r = \frac{5}{\left(\frac{6.7\pi}{42}\right)^2}$$
$$r \doteq 19.91$$

The radius is 19.91m.

Note that a calculator was not used until the end. When dealing with irrational numbers, using as much algebra as possible before using a calculator is important to maintain the accuracy of the results. It is not incorrect to use decimal numbers all the way along. However, without carefully carrying the calculator value from one step to the next, the final value may be affected.