The mathematical concept of a function is used here in the text, but a more detailed study of functions is seen in Math 1011 Precalculus: Functions.

At this time, we are only concerned with the idea of domain, which essentially means the set of $x$ values we can put into an expression and get a real value out. We use the shorthand notation $f(x)$ to refer to the expression.

Questions

1. Simplify $-\sqrt{\frac{1}{9}}$
2. Simplify $\sqrt{0.04}$.
3. Find the value of the function $f(x) = \sqrt{10x + 5}$ at $x = 0$, $x = 1$, $x = 2$, and $x = 3$. What is the domain of the function $f(x)$?
4. Find the value of the function $f(x) = \sqrt{1.5x - 4}$ at $x = 4$, $x = 6$, $x = 8$, and $x = 14$. What is the domain of the function $f(x)$?
5. Simplify $\sqrt[4]{\frac{8}{27}}$.
6. Replace the radicals with rational exponents in $\sqrt[5]{2x}$.
7. Replace the radicals with rational exponents in $\sqrt[4]{3y}$.
8. Replace the radicals with rational exponents in $\sqrt[7]{(a + b)^3}$.
9. Simplify $\sqrt[3]{-125x^{30}}$.
10. Simplify $\sqrt[3]{-27a^6}$.
11. Simplify $\sqrt[4]{a^{12}b^4}$.
12. Simplify $\sqrt[4]{a^{44}b^{20}}$. 
Solutions

1. \(-\sqrt{\frac{1}{9}} = -\sqrt{\left(\frac{1}{3}\right)^2} = -\frac{1}{3}\).

2. \(\sqrt{0.04} = \sqrt{(0.2)^2} = 0.2\).

3. Use a calculator to approximate some of the square roots.

\[
\begin{align*}
f(x) &= \sqrt{10x + 5} \\
f(0) &= \sqrt{10(0) + 5} = \sqrt{5} \approx 2.2 \\
f(1) &= \sqrt{10(1) + 5} = \sqrt{15} \approx 3.9 \\
f(2) &= \sqrt{10(2) + 5} = \sqrt{25} = 5 \\
f(3) &= \sqrt{10(3) + 5} = \sqrt{35} \approx 5.9
\end{align*}
\]

For the domain, we know that we can only get a real number out of a square root if we put in a number greater than or equal to zero, so for this expression the domain is

\[
10x + 5 \geq 0 \\
10x \geq -5 \\
x \geq -\frac{5}{10} \\
x \geq -\frac{1}{2}
\]

The domain is \(x \geq -1/2\).

4. Use a calculator to approximate the square roots.

\[
\begin{align*}
f(x) &= \sqrt{1.5x - 4} \\
f(4) &= \sqrt{1.5(4) - 4} = \sqrt{2} \approx 1.4 \\
f(6) &= \sqrt{1.5(6) - 4} = \sqrt{5} \approx 2.2 \\
f(8) &= \sqrt{1.5(8) - 4} = \sqrt{8} \approx 2.8 \\
f(14) &= \sqrt{1.5(14) - 4} = \sqrt{17} \approx 4.1
\end{align*}
\]

For the domain, we know that we can only get a real number out of a square root if we put in a number greater than or equal to zero, so for this expression the domain is

\[
1.5x - 4 \geq 0 \\
1.5x \geq 4 \\
x \geq \frac{4}{1.5} \\
x \geq \frac{4}{3/2} \\
x \geq \frac{8}{3}
\]

The domain is \(x \geq 8/3\).
5. 
\[ \sqrt[3]{-\frac{8}{27}} = \left( -\frac{8}{27} \right)^{1/3} \]
\[ = \left( -\frac{2^3}{3^3} \right)^{1/3} \]
\[ = \left( -\frac{2}{3} \right)^{3} \]
\[ = -\frac{2}{3} \]

6. \[ \sqrt[5]{2x} = (2x)^{1/5} \]
7. \[ \sqrt[4]{3y} = (3y)^{1/4} \]
8. \[ \sqrt[7]{(a+b)^3} = ((a+b)^3)^{1/7} = (a+b)^{3/7} \]
9. 
\[ \sqrt[3]{-125x^{30}} = (-125x^{30})^{1/3} \]
\[ = (-125)^{1/3}(x^{30})^{1/3} \]
\[ = ((-5)^3)^{1/3}x^{10} \]
\[ = (-5)x^{10} \]
\[ = -5x^{10} \]

10. 
\[ \sqrt[3]{-27a^6} = (-27a^6)^{1/3} \]
\[ = (-27)^{1/3}(a^6)^{1/3} \]
\[ = ((-3)^3)^{1/3}a^2 \]
\[ = (-3)a^2 = -3a^2 \]

11. 
\[ \sqrt[4]{a^{12}b^8} = (a^{12}b^8)^{1/4} \]
\[ = (a^{12})^{1/4}(b^8)^{1/4} \]
\[ = ((a^3)^4)^{1/4}|b| \text{ Note: Need to use rule that } (x^n)^{1/n} = |x| \text{ if } n \text{ is even.} \]
\[ = |a^3||b| = |a^3b| \]

12. 
\[ \sqrt[4]{a^{4}b^{20}} = (a^{4}b^{20})^{1/4} \]
\[ = (a^4)^{1/4}(b^{20})^{1/4} \]
\[ = |a||b^5| = |ab^5| \]