Questions

1. Write down the rules of exponents.
2. Simplify $\left(\frac{3xy^{-2}}{y^3}\right)^{-2}$.
3. Simplify $\left(\frac{5x^{-2}y}{x^4}\right)^{-2}$.
4. Simplify $2a^{-1/6}b^{3/4}$ so there are no negative exponents.
5. Simplify $-5y^{-2/3}$ so there are no negative exponents.
6. Simplify $(27)^{2/3}$.
7. Simplify $(-27)^{5/3}$.
8. Simplify $(-64)^{2/3}$.
9. Simplify $\left(x^{-1/3}y^{2/3}\right)\left(x^{1/3}y^{1/4}\right)$.
10. Factor the common factor $2a$ in $10a^{5/4} - 4a^{8/5}$.
11. Factor the common factor $2a$ in $6a^{4/3} - 8a^{3/2}$.
12. Factor the common factor $3x$ in $21x^{13/8} - 12x^{4/3}$.
13. Simplify $-\sqrt{\frac{1}{9}}$.
14. Simplify $\sqrt{0.04}$.
15. 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 $f(x)$?
16. 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 $f(x)$?
17. Simplify $\sqrt[3]{-\frac{8}{27}}$.
18. Replace radicals with rational exponents in $\sqrt[5]{2x}$.
19. Replace radicals with rational exponents in $\sqrt[4]{3y}$.
20. Replace radicals with rational exponents in $\sqrt[7]{(a+b)^3}$.
21. Simplify $\sqrt[3]{-125x^{30}}$.
22. Simplify $\sqrt[3]{-27a^6}$.
23. Simplify $\sqrt[4]{a^{12}b^4}$.
24. Simplify $\sqrt[4]{a^4b^{20}}$.
25. Simplify $\sqrt{54}$.
26. Simplify $\sqrt{44}$.
27. Simplify $\sqrt{90}$.
28. Simplify $5\sqrt{75} + \sqrt{48}$.
29. Simplify $\sqrt{45} + \sqrt{80} - 3\sqrt{20}$.
30. Simplify $-\sqrt{12} + 2\sqrt{48} - \sqrt{75}$.
31. Simplify $5\sqrt{27x} - 4\sqrt{75x}$.
32. Simplify $\sqrt{75a^3} + a\sqrt{12a}$.
33. Simplify $\sqrt[3]{128} - 4\sqrt[3]{16}$.
34. Simplify $(3\sqrt{3} + \sqrt{5})(\sqrt{3} - 2\sqrt{5})$.
35. Simplify $(\sqrt{7} + 4\sqrt{5x})(2\sqrt{7} + 3\sqrt{5x})$.
36. Simplify $(3\sqrt{5} + \sqrt{3})(\sqrt{2} + 2\sqrt{5})$.
37. Simplify $\sqrt{\frac{49}{25}}$.
38. Simplify $\sqrt{\frac{16}{36}}$.
39. Simplify $\sqrt{\frac{12x}{49y^6}}$.
40. Rationalize denominator in $\frac{3x}{\sqrt{10} - \sqrt{2}}$.
41. Rationalize denominator in $\frac{\sqrt{5} + \sqrt{3}}{\sqrt{5} - \sqrt{3}}$.
42. Rationalize numerator in $\frac{\sqrt{5} + \sqrt{3}}{\sqrt{5} - \sqrt{3}}$.
43. Rationalize denominator in $\frac{\sqrt{3x} - 2\sqrt{y}}{\sqrt{3x} + \sqrt{y}}$.
44. Rationalize numerator in $\frac{\sqrt{3x} - 2\sqrt{y}}{\sqrt{3x} + \sqrt{y}}$.
45. Rationalize numerator in $\frac{\sqrt{3} + 2\sqrt{7}}{8}$.

Solutions

1. The rules of exponents are:
   - $x^0 = 1$ if $x \neq 0$ (0^0 is indeterminant and is dealt with in calculus).
   - Product Rule: $x^a \cdot x^b = x^{a+b}$.
   - Quotient Rule: $\dfrac{x^a}{x^b} = x^{a-b}$.
   - Power Rule: $(x^a)^b = x^{ab}$.
   - Product Raised to Power Rule: $(xy)^a = x^a y^a$.
   - Quotient Raised to a Power Rule: $\left(\dfrac{x}{y}\right)^a = \dfrac{x^a}{y^a}$ if $y \neq 0$.
   - Negative Exponent: $x^{-n} = \dfrac{1}{x^n}$, if $x \neq 0$.

2.

$$\begin{aligned}
\left(\frac{3xy^{-2}}{y^3}\right)^{-2} &= \frac{(3)^{-2}(x)^{-2}(y^{-2})^{-2}}{(y^3)^{-2}} && \text{(Product Raised to Power Rule)} \\
&= \frac{y^4}{3^2x^2(y^{-6})} && \text{(simplify, using Power Rule and Negative Exponent Rule)} \\
&= \frac{y^4 y^6}{9x^2} && \text{(simplify, using Negative Exponent Rule)} \\
&= \frac{y^{4+6}}{9x^2} && \text{(simplify, using Product Rule)} \\
&= \frac{y^{10}}{9x^2} && \text{(simplify)}
\end{aligned}$$

3.

$$\begin{aligned}
\left(\frac{5x^{-2}y}{x^4}\right)^{-2} &= \frac{5^{-2}(x^{-2})^{-2}y^{-2}}{(x^4)^{-2}} && \text{(Product Raised to Power Rule)} \\
&= \frac{x^4x^8}{5^2y^2} && \text{(simplify, using Power Rule and Negative Exponent Rule)} \\
&= \frac{x^{12}}{25y^2} && \text{(simplify, using Product Rule)}
\end{aligned}$$

4. $2a^{-1/6}b^{3/4} = \dfrac{2b^{3/4}}{a^{1/6}}$.

5. $-5y^{-2/3} = \dfrac{-5}{y^{2/3}}$.

6. $(27)^{2/3} = \left(3^3\right)^{2/3} = (3)^{3\times 2/3} = (3)^2 = 9$.

7. $(-\mathbf{27})^{5/3} = \left((\mathbf{-3})^{\mathbf{3}}\right)^{5/3} = (-3)^{3\times 5/3} = (-3)^5 = -243.$

8. $(-\mathbf{64})^{2/3} = \left((\mathbf{-4})^{\mathbf{3}}\right)^{2/3} = (-4)^{3\times 2/3} = (-4)^2 = 16.$

9. $\left(x^{-1/3}y^{2/3}\right)\left(x^{1/3}y^{1/4}\right) = x^{-1/3+1/3}y^{2/3+1/4} = x^0y^{8/12+3/12} = y^{11/12}$

10. $10a^{5/4} - 4a^{8/5} = \mathbf{2a}\cdot 5a^{1/4} - \mathbf{2a}\cdot 2a^{3/5} = \mathbf{2a}(5a^{1/4} - 2a^{3/5}).$

11. $6a^{4/3} - 8a^{3/2} = \mathbf{2a}\cdot 3a^{1/3} - \mathbf{2a}\cdot 4a^{1/2} = \mathbf{2a}(3a^{1/3} - 4a^{1/2}).$

12. $21x^{13/8} - 12x^{4/3} = \mathbf{3x}\cdot 7x^{5/8} - \mathbf{3x}\cdot 4x^{1/3} = \mathbf{3x}(7x^{5/8} - 4x^{1/3}).$

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

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

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

$$\begin{aligned} f(x) &= \sqrt{10x+5} \\ f(\mathbf{0}) &= \sqrt{10(\mathbf{0})+5} = \sqrt{5} \sim 2.2 \\ f(\mathbf{1}) &= \sqrt{10(\mathbf{1})+5} = \sqrt{15} \sim 3.9 \\ f(\mathbf{2}) &= \sqrt{10(\mathbf{2})+5} = \sqrt{25} = 5 \\ f(\mathbf{3}) &= \sqrt{10(\mathbf{3})+5} = \sqrt{35} \sim 5.9 \end{aligned}$$

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

$$\begin{aligned} 10x+5 &\geq 0 \\ 10x &\geq -5 \\ x &\geq -\frac{5}{10} \\ x &\geq -\frac{1}{2} \end{aligned}$$

The domain is $x \geq -1/2$ or $x \in [-1/2, \infty)$.

16. Use a calculator to approximate the square roots.

$$\begin{aligned} f(x) &= \sqrt{1.5x-4} \\ f(\mathbf{4}) &= \sqrt{1.5(\mathbf{4})-4} = \sqrt{2} \sim 1.4 \\ f(\mathbf{6}) &= \sqrt{1.5(\mathbf{6})-4} = \sqrt{5} \sim 2.2 \\ f(\mathbf{8}) &= \sqrt{1.5(\mathbf{8})-4} = \sqrt{8} \sim 2.8 \\ f(\mathbf{14}) &= \sqrt{1.5(\mathbf{14})-4} = \sqrt{17} \sim 4.1 \end{aligned}$$

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

$$\begin{aligned} 1.5x - 4 &\geq 0 \\ 1.5x &\geq 4 \\ x &\geq \frac{4}{1.5} \\ x &\geq \frac{4}{3/2} \\ x &\geq \frac{8}{3} \end{aligned}$$

The domain is $x \geq 8/3$ or $x \in [8/3, \infty)$.

17.

$$\begin{aligned} \sqrt[3]{-\frac{8}{27}} &= \left(-\frac{\mathbf{8}}{\mathbf{27}}\right)^{1/3} && \text{(radical to rational notation)} \\ &= \left(-\frac{\mathbf{2^3}}{\mathbf{3^3}}\right)^{1/3} && \text{(identify cubed numbers)} \\ &= \left(-\frac{\mathbf{2^3}}{\mathbf{3^3}}\right)^{1/3} \\ &= \left(\left(-\frac{\mathbf{2}}{\mathbf{3}}\right)^{\mathbf{3}}\right)^{1/3} && \text{(Quotient Raised to Power Rule)} \\ &= -\frac{2}{3} && \text{(Power Rule)} \end{aligned}$$

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18. $\sqrt[5]{2x} = (2x)^{1/5}$.

19. $\sqrt[4]{3y} = (3y)^{1/4}$.

20. $\sqrt[7]{(a+b)^3} = \left((a+b)^3\right)^{1/7} = (a+b)^{3/7}$.

21.

$$\begin{aligned} \sqrt[3]{-125x^{30}} &= (-125x^{30})^{\mathbf{1/3}} && \text{(radical to rational notation)} \\ &= (\mathbf{-125})^{\mathbf{1/3}}(x^{30})^{\mathbf{1/3}} && \text{(Product Raised to Power Rule)} \\ &= ((\mathbf{-5})^{\mathbf{3}})^{1/3}x^{10} && \text{(identify cubed numbers)} \\ &= (-5)x^{10} && \text{(Power Rule)} \\ &= -5x^{10} \end{aligned}$$

22.

$$\begin{aligned}
\sqrt[3]{-27a^6} &= \left(-27a^6\right)^{\mathbf{1/3}} && \text{(radical to rational notation)}\\
&= (\mathbf{-27})^{\mathbf{1/3}}\left(a^6\right)^{\mathbf{1/3}} && \text{(Product Raised to Power Rule)}\\
&= \left((\mathbf{-3})^{\mathbf{3}}\right)^{1/3} a^2 && \text{(identify cubed numbers)}\\
&= (-3)a^2 && \text{(Power Rule)}\\
&= -3a^2
\end{aligned}$$

23.

$$\begin{aligned}
\sqrt[4]{a^{12}b^4} &= \left(a^{12}b^4\right)^{\mathbf{1/4}} && \text{(radical to rational notation)}\\
&= \left(\boldsymbol{a^{12}}\right)^{\mathbf{1/4}}\left(b^4\right)^{\mathbf{1/4}} && \text{(Product Raised to Power Rule)}\\
&= \left((\boldsymbol{a^3})^{\mathbf{4}}\right)^{1/4}\left|b\right| && \text{(note: Need to use rule that } (x^n)^{1/n} = \left|x\right| \text{ if } n \text{ is even)}\\
&= \left|a^3\right|\left|b\right|\\
&= \left|a^3b\right|
\end{aligned}$$

24.

$$\begin{aligned}
\sqrt[4]{a^4b^{20}} &= (a^4b^{20})^{\mathbf{1/4}} && \text{(radical to rational notation)}\\
&= (a^4)^{\mathbf{1/4}}(b^{20})^{\mathbf{1/4}} && \text{(Product Raised to Power Rule)}\\
&= \left|a\right|((b^5)^4)^{1/4} && \text{(Power Rule)}\\
&= \left|a\right|\left|b^5\right| && \text{(note: Need to use rule that } (x^n)^{1/n} = \left|x\right| \text{ if } n \text{ is even)}\\
&= \left|ab^5\right|
\end{aligned}$$

25. $\sqrt{54} = \sqrt{9 \cdot 6} = \sqrt{9}\sqrt{6} = 3\sqrt{6}.$

26. $\sqrt{44} = \sqrt{4 \cdot 11} = \sqrt{4}\sqrt{11} = 2\sqrt{11}.$

27. $\sqrt{90} = \sqrt{9 \cdot 10} = \sqrt{9}\sqrt{10} = 3\sqrt{10}.$

28.

$$\begin{aligned}
5\sqrt{\mathbf{75}} + \sqrt{\mathbf{48}} &= 5\sqrt{\mathbf{25 \cdot 3}} + \sqrt{\mathbf{16 \cdot 3}} && \text{(factor, identified squared numbers)}\\
&= 5\sqrt{25}\sqrt{3} + \sqrt{16}\sqrt{3}\\
&= 5 \cdot 5\sqrt{3} + 4\sqrt{3}\\
&= 25\sqrt{3} + 4\sqrt{3} && \text{(combine like terms)}\\
&= 29\sqrt{3}
\end{aligned}$$

29.

$$\begin{aligned}
\sqrt{\mathbf{45}} + \sqrt{\mathbf{80}} - 3\sqrt{\mathbf{20}} &= \sqrt{\mathbf{9 \cdot 5}} + \sqrt{\mathbf{16 \cdot 5}} - 3\sqrt{\mathbf{4 \cdot 5}} && \text{(factor, identified squared numbers)}\\
&= \sqrt{9}\sqrt{5} + \sqrt{16}\sqrt{5} - 3\sqrt{4}\sqrt{5}\\
&= 3\sqrt{5} + 4\sqrt{5} - 6\sqrt{5} && \text{(combine like terms)}\\
&= \sqrt{5}
\end{aligned}$$

30.

$$\begin{aligned} -\sqrt{\mathbf{12}} + 2\sqrt{\mathbf{48}} - \sqrt{\mathbf{75}} &= -\sqrt{\mathbf{4 \cdot 3}} + 2\sqrt{\mathbf{16 \cdot 3}} - \sqrt{\mathbf{25 \cdot 3}} && \text{(factor, identified squared numbers)} \\ &= -\sqrt{4}\sqrt{3} + 2\sqrt{16}\sqrt{3} - \sqrt{25}\sqrt{3} \\ &= -2\sqrt{3} + 8\sqrt{3} - 5\sqrt{3} && \text{(combine like terms)} \\ &= \sqrt{3} \end{aligned}$$

31.

$$\begin{aligned} 5\sqrt{\mathbf{27}x} - 4\sqrt{\mathbf{75}x} &= 5\sqrt{\mathbf{9 \cdot 3}x} - 4\sqrt{\mathbf{25 \cdot 3}x} && \text{(factor, identified squared numbers)} \\ &= 5\sqrt{9}\sqrt{3x} - 4\sqrt{25}\sqrt{3x} \\ &= 15\sqrt{3x} - 20\sqrt{3x} && \text{(combine like terms)} \\ &= -5\sqrt{3x} \end{aligned}$$

32.

$$\begin{aligned} \sqrt{75a^3} + a\sqrt{12a} &= \sqrt{25a^2 \cdot 3a} + a\sqrt{4 \cdot 3a} && \text{(factor, identified squared numbers)} \\ &= \sqrt{25a^2}\sqrt{3a} + a\sqrt{4}\sqrt{3a} \\ &= 5a\sqrt{3a} + 2a\sqrt{3a} && \text{(combine like terms)} \\ &= 7a\sqrt{3a} \end{aligned}$$

33. Since this involves a cube root, look for numbers that are cubed, like $8 = 2^3$ and $64 = 4^3$.

$$\begin{aligned} \sqrt[3]{\mathbf{128}} - 4\sqrt[3]{\mathbf{16}} &= \sqrt[3]{\mathbf{64 \cdot 2}} - 4\sqrt[3]{\mathbf{8 \cdot 2}} && \text{(factor, identified cubed numbers)} \\ &= \sqrt[3]{64}\sqrt[3]{2} - 4\sqrt[3]{8}\sqrt[3]{2} \\ &= \sqrt[3]{4^3}\sqrt[3]{2} - 4\sqrt[3]{2^3}\sqrt[3]{2} \\ &= 4\sqrt[3]{2} - 4(2)\sqrt[3]{2} \\ &= 4\sqrt[3]{2} - 8\sqrt[3]{2} && \text{(combine like terms)} \\ &= -4\sqrt[3]{2} \end{aligned}$$

34. Distribute, Distribute!

$$\begin{aligned} (3\sqrt{3} + \sqrt{5})\boldsymbol{(\sqrt{3} - 2\sqrt{5})} &= (3\sqrt{3})\boldsymbol{(\sqrt{3} - 2\sqrt{5})} + (\sqrt{5})\boldsymbol{(\sqrt{3} - 2\sqrt{5})} \\ &= \boldsymbol{(3\sqrt{3})}(\sqrt{3} - 2\sqrt{5}) + \boldsymbol{(\sqrt{5})}(\sqrt{3} - 2\sqrt{5}) \\ &= \boldsymbol{(3\sqrt{3})}(\sqrt{3}) - \boldsymbol{(3\sqrt{3})}(2\sqrt{5}) + \boldsymbol{(\sqrt{5})}(\sqrt{3}) - \boldsymbol{(\sqrt{5})}(2\sqrt{5}) \\ &= 3(\sqrt{3})^2 - 6\sqrt{3}\sqrt{5} + \sqrt{5}\sqrt{3} - 2(\sqrt{5})^2 \\ &= 3(3) - 6\sqrt{3 \cdot 5} + \sqrt{5 \cdot 3} - 2(5) \\ &= -1 - 5\sqrt{15} \end{aligned}$$

35. Distribute, Distribute!

$$\begin{aligned}(\sqrt{7}+4\sqrt{5x})\boldsymbol{(2\sqrt{7}+3\sqrt{5x})} &= (\sqrt{7})\boldsymbol{(2\sqrt{7}+3\sqrt{5x})}+(4\sqrt{5x})\boldsymbol{(2\sqrt{7}+3\sqrt{5x})}\\ &= \boldsymbol{(\sqrt{7})}(2\sqrt{7}+3\sqrt{5x})+\boldsymbol{(4\sqrt{5x})}(2\sqrt{7}+3\sqrt{5x})\\ &= \boldsymbol{(\sqrt{7})}(2\sqrt{7})+\boldsymbol{(\sqrt{7})}(3\sqrt{5x})+\boldsymbol{(4\sqrt{5x})}(2\sqrt{7})+\boldsymbol{(4\sqrt{5x})}(3\sqrt{5x})\\ &= 2(7)+3\sqrt{7\cdot 5x}+8\sqrt{5x\cdot 7}+12(5x)\\ &= 14+11\sqrt{35x}+60x\end{aligned}$$

36. Distribute, Distribute!

$$\begin{aligned}(3\sqrt{5}+\sqrt{3})\boldsymbol{(\sqrt{2}+2\sqrt{5})} &= (3\sqrt{5})\boldsymbol{(\sqrt{2}+2\sqrt{5})}+(\sqrt{3})\boldsymbol{(\sqrt{2}+2\sqrt{5})}\\ &= \boldsymbol{(3\sqrt{5})}(\sqrt{2}+2\sqrt{5})+\boldsymbol{(\sqrt{3})}(\sqrt{2}+2\sqrt{5})\\ &= \boldsymbol{(3\sqrt{5})}(\sqrt{2})+\boldsymbol{(3\sqrt{5})}(2\sqrt{5})+\boldsymbol{(\sqrt{3})}(\sqrt{2})+\boldsymbol{(\sqrt{3})}(2\sqrt{5})\\ &= 3\sqrt{5\cdot 2}+(6)(5)+\sqrt{3\cdot 2}+2\sqrt{3\cdot 5}\\ &= 3\sqrt{10}+30+\sqrt{6}+2\sqrt{15}\end{aligned}$$

37. $\sqrt{\dfrac{49}{25}}=\dfrac{7}{5}$.

38. $\sqrt{\dfrac{16}{36}}=\dfrac{4}{6}=\dfrac{2}{3}$.

39. $\sqrt{\dfrac{12x}{49y^6}}=\sqrt{\dfrac{2^2\cdot 3x}{(7y^3)^2}}=\dfrac{\sqrt{2^2}\cdot\sqrt{3x}}{\sqrt{(7y^3)^2}}=\dfrac{2\sqrt{3x}}{7y^3}$.

40. Note the sign change when you rationalize! This is so the cross terms will cancel when you distribute.

$$\begin{aligned}\frac{3x}{\sqrt{10}-\sqrt{2}} &= \frac{(3x)\boldsymbol{(\sqrt{10}+\sqrt{2})}}{(\sqrt{10}-\sqrt{2})\boldsymbol{(\sqrt{10}+\sqrt{2})}}\\ &= \frac{3x(\sqrt{10}+\sqrt{2})}{10-2}\\ &= \frac{3x(\sqrt{10}+\sqrt{2})}{8}\end{aligned}$$

41.

$$\begin{aligned}\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}} &= \frac{(\sqrt{5}+\sqrt{3})\boldsymbol{(\sqrt{5}+\sqrt{3})}}{(\sqrt{5}-\sqrt{3})\boldsymbol{(\sqrt{5}+\sqrt{3})}}\\ &= \frac{5+2\sqrt{15}+3}{5-3}\\ &= \frac{8+2\sqrt{15}}{2}\\ &= 4+\sqrt{15}\end{aligned}$$

42.

$$\begin{aligned}\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}} &= \frac{(\sqrt{5}+\sqrt{3})\boldsymbol{(\sqrt{5}-\sqrt{3})}}{(\sqrt{5}-\sqrt{3})\boldsymbol{(\sqrt{5}-\sqrt{3})}} \\ &= \frac{5-3}{5-2\sqrt{15}+3} \\ &= \frac{2}{8-2\sqrt{15}} \\ &= \frac{1}{4-\sqrt{15}}\end{aligned}$$

43.

$$\begin{aligned}\frac{\sqrt{3x}-2\sqrt{y}}{\sqrt{3x}+\sqrt{y}} &= \frac{(\sqrt{3x}-2\sqrt{y})\boldsymbol{(\sqrt{3x}-\sqrt{y})}}{(\sqrt{3x}+\sqrt{y})\boldsymbol{(\sqrt{3x}-\sqrt{y})}} \\ &= \frac{3x-2\sqrt{3x}\sqrt{y}-\sqrt{3x}\sqrt{y}+2(y)}{3x-y} \\ &= \frac{3x-3\sqrt{3xy}+2y}{3x-y}\end{aligned}$$

44.

$$\begin{aligned}\frac{\sqrt{3x}-2\sqrt{y}}{\sqrt{3x}+\sqrt{y}} &= \frac{(\sqrt{3x}-2\sqrt{y})\boldsymbol{(\sqrt{3x}+2\sqrt{y})}}{(\sqrt{3x}+\sqrt{y})\boldsymbol{(\sqrt{3x}+2\sqrt{y})}} \\ &= \frac{3x-4y}{3x+2\sqrt{3x}\sqrt{y}+\sqrt{3x}\sqrt{y}+2y} \\ &= \frac{3x-4y}{3x+3\sqrt{3xy}+2y}\end{aligned}$$

45.

$$\begin{aligned}\frac{\sqrt{3}+2\sqrt{7}}{8} &= \frac{(\sqrt{3}+2\sqrt{7})\boldsymbol{(\sqrt{3}-2\sqrt{7})}}{8\boldsymbol{(\sqrt{3}-2\sqrt{7})}} \\ &= \frac{3-4(7)}{8(\sqrt{3}-2\sqrt{7})} \\ &= \frac{-25}{8(\sqrt{3}-2\sqrt{7})}\end{aligned}$$