

1. Simplify. Use absolute value symbols as needed.

a) $\sqrt[4]{162a^6b^{13}c^{19}}$ b) $\sqrt[3]{-24m^{14}n^{23}}$ c) $\sqrt{72w^5x^{11}}$

2. Simplify each. Assume that all variables are positive numbers.

a) $5\sqrt{180} + 3\sqrt{96} - 2\sqrt{20} + \sqrt{54}$ b) $\sqrt{12e^4g^3} \cdot \sqrt{66eg^9}$ c) $\frac{\sqrt[3]{250c^7r^{10}}}{\sqrt[3]{2c^2r}}$

d) $(3 - 2\sqrt{6})(4 + \sqrt{6})$ e) $(5 + \sqrt{11})(5 - \sqrt{11})$ f) $\sqrt[3]{12a^4b^7} \cdot \sqrt[3]{10a^3b^4}$

g) $\sqrt{21g^6h^7} \cdot \sqrt{35g^5h^8}$ h) $\frac{\sqrt{24j^7k^6}}{\sqrt{16j^4k^{12}}}$ i) $(4 - 7\sqrt{3})^2$ j) $\sqrt[4]{33w^5x^3} \cdot \sqrt[4]{9wx^6} \cdot \sqrt[4]{24w^2}$

k) $(4\sqrt{5} + 3\sqrt{2})(6\sqrt{2} - \sqrt{5})$

3. Rationalize each denominator and simplify. Assume all variables are positive numbers.

a) $\frac{2x}{\sqrt{6x^7yz^3}}$ b) $\frac{11a^5}{\sqrt[3]{9a^8b^4}}$ c) $\frac{8}{\sqrt[5]{2k^3mn^7}}$ d) $\frac{4}{7 + \sqrt{10}}$ e) $\frac{10PQ^4}{\sqrt[4]{4P^6Q^{13}}}$

4. Rewrite in radical form. a) $7a^{\frac{2}{5}}$ b) $(6b)^{\frac{1}{3}}$

5. Rewrite in exponential form. a) $\sqrt[3]{h^4}$ b) $\sqrt{5c}$ c) $8 \cdot \sqrt[4]{m^3}$

6. Simplify each. Assume that all variables are positive numbers. No decimals. Give fractional answers in reduced form.

a) $(7k^{\frac{5}{6}})^3$ b) $(4r^6)^{\frac{3}{2}}$ c) $(27n^9)^{-\frac{2}{3}}$ d) $\left(\frac{x^{\frac{-5}{2}}}{y^3}\right)^{-4}$ e) $\left(\frac{32^{-1}m^{-2}n^{-3}}{2m^{\frac{1}{3}}n^{-9}}\right)^{-\frac{4}{3}}$

1. a) $3|a||b^3|c^4 \cdot \sqrt[4]{2a^2bc^3}$ b) $-2m^4n^7 \cdot \sqrt[3]{3m^2n^2}$ c) $6w^2|x^5|\sqrt{2wx}$

2. a) $26\sqrt{5} + 15\sqrt{6}$ b) $6e^2g^6\sqrt{22e}$ c) $5cr^3 \cdot \sqrt[3]{c^2}$ d) $-5\sqrt{6}$ e) 14

f) $2a^2b^3 \cdot \sqrt[3]{15ab^2}$ g) $7g^5h^7\sqrt{15gh}$ h) $\frac{j\sqrt{6j}}{2k^3}$ i) $163 - 56\sqrt{3}$

j) $3w^2x^2 \cdot \sqrt[4]{88x}$ k) $21\sqrt{10} + 16$

3. a) $\frac{\sqrt{6xyz}}{3x^3yz^2}$ b) $\frac{11a^2 \cdot \sqrt[3]{3ab^2}}{3b^2}$ c) $\frac{4\sqrt[5]{2^4k^2m^4n^3}}{kmn^2}$ d) $\frac{28 - 4\sqrt{10}}{39}$ e) $\frac{5 \cdot \sqrt[4]{2^2P^2Q^3}}{P}$

4. a) $7 \cdot \sqrt[5]{a^2}$ or $7(\sqrt[5]{a})^2$ b) $\sqrt[3]{6b}$ 5. a) $h^{\frac{4}{7}}$ b) $(5c)^{\frac{1}{2}}$ c) $8m^{\frac{3}{4}}$

6. a) $343k^{\frac{5}{2}}$ b) $8r^9$ c) $\frac{1}{9n^6}$ d) $x^{10}y^{12}$ e) $\frac{256m^{\frac{28}{9}}}{n^8}$