

Simplify completely. If needed, rationalize the denominator.

$$1. \sqrt{\frac{144}{64t^2}} = \frac{\sqrt{144}}{\sqrt{64t^2}} = \frac{12}{8t} = \boxed{\frac{3}{2t}}$$

$$2. \frac{5}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \boxed{\frac{5\sqrt{3}}{3}}$$

$$3. \frac{\sqrt{11}}{\sqrt{5x}} \cdot \frac{\sqrt{5x}}{\sqrt{5x}} = \frac{\sqrt{55x}}{5x}$$

$$4. \sqrt{\frac{a^6}{3a^2}} = \sqrt{\frac{a^4}{3a^2}} = \sqrt{\frac{a^4}{3}} = \frac{a^2}{\sqrt{3}} \frac{\sqrt{3}}{\sqrt{3}} = \boxed{\frac{a^2\sqrt{3}}{3}}$$

$$5. \frac{3}{(4+4\sqrt{2})} \cdot \frac{(4-4\sqrt{2})}{(4-4\sqrt{2})}$$

$$= \frac{3(4-4\sqrt{2})}{16-16 \cdot 2} = \frac{3 \cdot 4(1-\sqrt{2})}{-16}$$

$$= \boxed{\frac{3(1-\sqrt{2})}{-4}}$$

$$6. \frac{(\sqrt{5}+3)}{(4-\sqrt{5})} \cdot \frac{(4+\sqrt{5})}{(4+\sqrt{5})} = \frac{4\sqrt{5}+5+12+3\sqrt{5}}{16-5}$$

$$= \boxed{\frac{17+7\sqrt{5}}{11}}$$

Review: Simplify each radical expression completely.

$$7. -\sqrt{448} = -\sqrt{4 \cdot 112} = -\sqrt{4 \cdot 4 \cdot 4 \cdot 7}$$

$$= -4 \cdot 2\sqrt{7} = \boxed{-8\sqrt{7}}$$

$$8. \sqrt{27x^3y^8z^5} = \sqrt{9 \cdot 3x^3y^8z^5}$$

$$= \boxed{3xy^4z^2\sqrt{3xz}}$$

$$9. 8\sqrt{64a^2b^2}$$

$$8 \cdot 8ab = \boxed{64ab}$$

$$10. 4a^6b^3\sqrt{28a^9b^3}$$

$$4a^6b^3\sqrt{4 \cdot 7a^9b^3}$$

$$= 4a^6b^3 \cdot 2a^4b\sqrt{7ab}$$

$$= \boxed{8a^{10}b^4\sqrt{7ab}}$$

$$11. 4\sqrt{10}(2\sqrt{15}-3\sqrt{6})$$

$$= 8\sqrt{10 \cdot 15} - 12\sqrt{10 \cdot 6}$$

$$= 8\sqrt{2 \cdot 5 \cdot 5 \cdot 3} - 12\sqrt{5 \cdot 2 \cdot 2 \cdot 3}$$

$$= 8 \cdot 5\sqrt{6} - 12 \cdot 2\sqrt{15}$$

$$= \boxed{40\sqrt{6} - 24\sqrt{15}}$$

$$12. \sqrt[4]{(2x-3)^4}$$

$$= (2x-3)$$

$$\begin{aligned}
 13. \quad & 2\sqrt{5x^3y} \cdot 3\sqrt{10x^3y} \\
 &= 2 \cdot 3 \sqrt{5 \cdot 5 \cdot 2 x^3 x^3 y^2} \\
 &= 6 \cdot 5 x^3 y \sqrt{2} \\
 &= \boxed{30x^3y\sqrt{2}}
 \end{aligned}$$

$$\begin{aligned}
 14. \quad & 4\sqrt{7} - 3\sqrt{7} + 2\sqrt{7} \\
 &= \boxed{3\sqrt{7}}
 \end{aligned}$$

$$\begin{aligned}
 15. \quad & (5+4\sqrt{3})(3+\sqrt{3}) \\
 &= 15 + 5\sqrt{3} + 12\sqrt{3} + 4 \cdot 3 \\
 &= 15 + 17\sqrt{3} + 12 \\
 &= \boxed{27+17\sqrt{3}}
 \end{aligned}$$

$$\begin{aligned}
 16. \quad & \sqrt{3}(-5\sqrt{10}+\sqrt{6}) \\
 &= -5\sqrt{30} + \sqrt{3 \cdot 3 \cdot 2} \\
 &= \boxed{-5\sqrt{30} + 3\sqrt{2}}
 \end{aligned}$$

$$\begin{aligned}
 17. \quad & -2\sqrt{20} + 2\sqrt{18} - 2\sqrt{5} \\
 &= -2\sqrt{4 \cdot 5} + 2\sqrt{9 \cdot 2} - 2\sqrt{5} \\
 &= -2 \cdot 2\sqrt{5} + 2 \cdot 3\sqrt{2} - 2\sqrt{5} \\
 &= -4\sqrt{5} + 6\sqrt{2} - 2\sqrt{5} \\
 &= \boxed{-6\sqrt{5} + 6\sqrt{2}}
 \end{aligned}$$

$$\begin{aligned}
 18. \quad & \sqrt[4]{48m^4n^{15}} \\
 &= \sqrt[4]{16 \cdot 3 m^4 n^{15}} \\
 &= \boxed{2mn^3 \sqrt[4]{3n^3}}
 \end{aligned}$$

$$\begin{aligned}
 19. \quad & \sqrt[3]{-48m^4n^{15}} \\
 &= \sqrt[3]{(-8) \cdot 6 m^4 n^{15}} \\
 &= \boxed{-2m n^5 \sqrt[3]{6m}}
 \end{aligned}$$

$$\begin{aligned}
 20. \quad & \sqrt[5]{64m^4n^{15}} \\
 &= \sqrt[5]{32 \cdot 2 m^4 n^{15}} \\
 &= \boxed{2n^3 \sqrt[5]{2m^4}}
 \end{aligned}$$

Extra Critical Thinking Problems (Mandatory for Honors!):

$$\begin{aligned}
 21. \quad & \frac{5}{\sqrt{8x}} \cdot \frac{\sqrt{8x}}{\sqrt{8x}} = \frac{5\sqrt{8x}}{8x} \\
 &= \frac{5\sqrt{4 \cdot 2x}}{8x} = \frac{5 \cdot 2\sqrt{2x}}{8x} \\
 &= \frac{10\sqrt{2x}}{8x} = \boxed{\frac{5\sqrt{2x}}{4x}}
 \end{aligned}$$

$$\begin{aligned}
 22. \quad & \left(\frac{5+\sqrt[4]{x}}{\sqrt[4]{x}} \right) \frac{\sqrt[4]{x^3}}{\sqrt[4]{x^3}} \\
 &= \frac{5\sqrt[4]{x^3} + \sqrt[4]{x^4}}{\sqrt[4]{x^4}} = \boxed{\frac{5\sqrt[4]{x^3} + x}{x}}
 \end{aligned}$$

$$\begin{aligned}
 23. \quad & \sqrt[3]{\frac{5}{2xy}} \cdot \frac{\sqrt[3]{(2xy)^2}}{\sqrt[3]{(2xy)^2}} \\
 &= \boxed{\frac{\sqrt[3]{20x^2y^2}}{2xy}}
 \end{aligned}$$

$$\begin{aligned}
 24. \quad & \sqrt[3]{p^{3x}q^{5r}r^{r+2}} \\
 &= \boxed{p^x q^{\frac{5}{3}r} r^{\frac{r+2}{3}}}
 \end{aligned}$$