

$$\sqrt[4]{5^2 \sqrt[2]{5^5 \sqrt[5]{5^3 \sqrt[3]{5}}}} =$$

$$4 \times 2 \times 3 \times 5 \sqrt[5]{5^{2 \times 5 \times 3} 5^{5 \times 3} 5^3 5^1} = {}^{120}\sqrt{5^{30} 5^{15} 5^1} =$$

$${}^{120}\sqrt{5^{30+15+1}} = {}^{120}\sqrt{5^{49}}$$