Simplify the following expression by writing it as a single radical.

$$\sqrt{8}\ \sqrt[4]{8}$$

$$\sqrt{8}\ \sqrt[4]{8} = 8^{\frac{1}{2}}\ 8^{\frac{1}{4}}$$

$$= 8^{\left(\frac{1}{2}+\frac{1}{4}\right)} = 8^{\frac{3}{4}}$$

$$= \sqrt[4]{8^3} = \sqrt[4]{512}$$

$$= \sqrt[4]{2^9} = \sqrt[4]{2^4\,2^4\,2}$$

$$= \sqrt[4]{2^4} \cdot \sqrt[4]{2^4} \cdot \sqrt[4]{2} = 2 \cdot 2 \cdot \sqrt[4]{2} = 4\sqrt[4]{2}$$