① $(\sqrt{6}-6)(\sqrt{5}+3)$

$$\boxed{\sqrt{30}-6\sqrt{5}+3\sqrt{6}-18}$$

② $(6+\sqrt[3]{2})(6-\sqrt[3]{2})$

$$(6)^2-(\sqrt[3]{2})^2$$

$$\boxed{36-\sqrt[3]{4}}$$

③ $(7+\sqrt{3})^2 = a^2+2ab+b^2 = 7^2+2(7)(\sqrt{3})+(\sqrt{3})^2$

$$=49+14\sqrt{3}+3$$

$$\boxed{=52+14\sqrt{3}}$$

④ $(\sqrt{13}+5)(\sqrt{13}-5)=(\sqrt{13})^2-(5)^2$

$$=13-25=\boxed{-12}$$

⑤ $\sqrt{3}\ \sqrt[3]{4} = (3^{1/2})(4^{1/3})=3^{3/6}4^{2/6}$

$$=\sqrt[6]{3^3}\sqrt[6]{4^2}$$

$$=\sqrt[6]{27\cdot16}=\sqrt[6]{432}$$