Simplifying Radicals

1. Simplify.

a. $\sqrt{12}$ b. $\sqrt{20}$ c. $\sqrt{45}$ d. $\sqrt{50}$ e. $\sqrt{24}$ f. $\sqrt{63}$

2. Simplify.

a. $\frac{\sqrt{14}}{\sqrt{7}}$ b. $\frac{\sqrt{10}}{\sqrt{2}}$ c. $\frac{\sqrt{60}}{\sqrt{3}}$ d. $\frac{\sqrt{40}}{\sqrt{5}}$ e. $\frac{\sqrt{33}}{\sqrt{3}}$ f. $\frac{\sqrt{7}}{\sqrt{4}}$

3. Simplify

a. $\sqrt{2}\times\sqrt{10}$ b. $\sqrt{3}\times\sqrt{6}$ c. $\sqrt{15}\times\sqrt{5}$ d. $\sqrt{7}\times\sqrt{11}$ e. $4\sqrt{3}\times\sqrt{7}$ f. $3\sqrt{6}\times3\sqrt{6}$

4. Simplify

a. $\frac{10+15\sqrt{5}}{5}$ b. $\frac{21-7\sqrt{6}}{7}$ c. $\frac{6+\sqrt{8}}{2}$ d. $\frac{12-\sqrt{27}}{3}$ e. $\frac{-10-\sqrt{50}}{5}$ f. $\frac{-12+\sqrt{48}}{4}$

5. Simplify

a. $2\sqrt{5}+3\sqrt{5}+6\sqrt{5}$ b. $4\sqrt{3}+2\sqrt{3}-\sqrt{3}$ c. $6\sqrt{2}-\sqrt{2}+7\sqrt{2}-3\sqrt{2}$

d. $5\sqrt{7}+3\sqrt{7}-2\sqrt{7}$ e. $8\sqrt{10}-2\sqrt{10}-7\sqrt{10}$ f. $\sqrt{2}-3\sqrt{2}-9\sqrt{2}+11\sqrt{2}$

6. Simplify.

a. $5\sqrt{3}+2\sqrt{6}+3\sqrt{3}$ b. $8\sqrt{5}-3\sqrt{7}+7\sqrt{7}-4\sqrt{5}$ c. $2\sqrt{2}+3\sqrt{10}+5\sqrt{2}-4\sqrt{10}$

d. $7\sqrt{6}-4\sqrt{13}-\sqrt{13}+\sqrt{6}$ e. $12\sqrt{7}+9-3\sqrt{7}+4$ f. $9\sqrt{11}-\sqrt{11}+6\sqrt{14}-3\sqrt{14}-2\sqrt{11}$

7. Simplify

a. $\sqrt{12}+\sqrt{27}$ b. $\sqrt{20}+\sqrt{45}$ c. $\sqrt{18}-\sqrt{8}$

d. $\sqrt{50}+\sqrt{98}-\sqrt{2}$ e. $\sqrt{75}+\sqrt{48}+\sqrt{27}$ f. $\sqrt{54}+\sqrt{24}+\sqrt{72}-\sqrt{32}$

8. Simplify.

a. $8\sqrt{7}+2\sqrt{28}$ b. $3\sqrt{50}-2\sqrt{32}$ c. $5\sqrt{27}+4\sqrt{48}$

d. $3\sqrt{8}+\sqrt{18}+3\sqrt{2}$ e. $\sqrt{5}+2\sqrt{45}-3\sqrt{20}$ f. $4\sqrt{3}+3\sqrt{20}-2\sqrt{12}+\sqrt{45}$

9. Expand and Simplify

a. $\sqrt{2}\left(\sqrt{10}+4\right)$ b. $\sqrt{3}\left(\sqrt{6}-1\right)$ c. $\sqrt{6}\left(\sqrt{2}+\sqrt{6}\right)$

d. $2\sqrt{2}\left(3\sqrt{6}-\sqrt{3}\right)$ e. $\sqrt{2}\left(\sqrt{3}+4\right)$ f. $3\sqrt{2}\left(2\sqrt{6}+\sqrt{10}\right)$

10. Rationalize the denominator.

a. $\frac{1}{\sqrt{3}}$ b. $\frac{2}{\sqrt{5}}$ c. $\frac{2}{\sqrt{7}}$ d. $\frac{\sqrt{1}}{\sqrt{2}}$ e. $\frac{5\sqrt{5}}{2\sqrt{3}}$ f. $\frac{2\sqrt{2}}{\sqrt{18}}$

11. Rationalize the denominator.

a. $\frac{1}{\sqrt{2}+2}$ b. $\frac{3}{\sqrt{5}-1}$ c. $\frac{\sqrt{2}}{\sqrt{6}-3}$ d. $\frac{2}{\sqrt{6}+\sqrt{3}}$ e. $\frac{3}{\sqrt{5}-\sqrt{2}}$ f. $\frac{\sqrt{3}}{\sqrt{3}+\sqrt{2}}$

Answers:

1. a. $2\sqrt{3}$ b. $2\sqrt{5}$ c. $3\sqrt{5}$ d. $5\sqrt{2}$ e. $2\sqrt{6}$ f. $3\sqrt{7}$

2. a. $\sqrt{2}$ b. $\sqrt{5}$ c. $2\sqrt{5}$ d. $2\sqrt{2}$ e. $\sqrt{11}$ f. $\frac{\sqrt{7}}{2}$

3. a. $2\sqrt{5}$ b. $3\sqrt{2}$ c. $5\sqrt{3}$ d. $\sqrt{77}$ e. $4\sqrt{21}$ f. 54

4. a. $2+3\sqrt{5}$ b. $3-\sqrt{6}$ c. $3+\sqrt{2}$ d. $4-\sqrt{3}$ e. $-2-\sqrt{2}$ f. $-3+\sqrt{3}$

5. a. $11\sqrt{5}$ b. $5\sqrt{3}$ c. $9\sqrt{2}$ d. $6\sqrt{7}$ e. $-\sqrt{10}$ f. 0

6. a. $8\sqrt{3}+2\sqrt{6}$ b. $4\sqrt{5}+4\sqrt{7}$ c. $7\sqrt{2}-\sqrt{10}$ d. $8\sqrt{6}-5\sqrt{13}$
e. $13+9\sqrt{7}$ f. $6\sqrt{11}+3\sqrt{14}$

7. a. $5\sqrt{3}$ b. $5\sqrt{5}$ c. $\sqrt{2}$ d. $11\sqrt{2}$ e. $12\sqrt{3}$ f. $5\sqrt{6}$

8. a. $12\sqrt{7}$ b. $7\sqrt{2}$ c. $31\sqrt{3}$ d. $12\sqrt{2}$ e. $\sqrt{5}$ f. $9\sqrt{5}$

9. a. $2\sqrt{5}+4\sqrt{2}$ b. $3\sqrt{2}-\sqrt{3}$ c. $2\sqrt{3}+6$ d. $12\sqrt{3}-2\sqrt{6}$
e. $\sqrt{6}+4\sqrt{2}$ f. $12\sqrt{3}+6\sqrt{5}$

10. a. $\frac{\sqrt{3}}{3}$ b. $\frac{2\sqrt{5}}{5}$ c. $\frac{2\sqrt{7}}{7}$ d. $\frac{\sqrt{2}}{2}$ e. $\frac{5\sqrt{15}}{6}$ f. $\frac{2}{3}$

11. a. $\frac{2-\sqrt{2}}{2}$ b. $\frac{3+3\sqrt{5}}{4}$ c. $-\frac{3\sqrt{2}+2\sqrt{3}}{3}$
d. $\frac{2\sqrt{6}-2\sqrt{3}}{3}$ e. $\sqrt{5}+\sqrt{2}$ f. $3-\sqrt{6}$