Name _____ Master 3–3

Adding and Subtracting Radicals

Example 1

Simplify.

$2\sqrt{3} + 4\sqrt{3}$
$= 6\sqrt{3}$

Example 2

Simplify.

$2\sqrt{8} - 3\sqrt{12} + \sqrt{18} + 2\sqrt{27}$
$= 2(\sqrt{4})(\sqrt{2}) - 3(\sqrt{4})(\sqrt{3}) + (\sqrt{9})(\sqrt{2}) + 2(\sqrt{9})(\sqrt{3})$
$= (2)(2)(\sqrt{2}) - (3)(2)(\sqrt{3}) + (3)(\sqrt{2}) + (2)(3)(\sqrt{3})$
$= 4\sqrt{2} - 6\sqrt{3} + 3\sqrt{2} + 6\sqrt{3}$
$= 7\sqrt{2}$

1. Simplify.
a. $2\sqrt{3} + 6\sqrt{3}$
b. $7\sqrt{2} + 8\sqrt{2}$
c. $3\sqrt{2} + 4\sqrt{2}$
d. $2\sqrt{x} + 3\sqrt{x}$
e. $7\sqrt{2} - 3\sqrt{2}$
f. $3\sqrt{5} - 8\sqrt{5}$

2. Simplify.
a. $6\sqrt{2} - 3\sqrt{2} + 7\sqrt{2}$
b. $4\sqrt{3} + 2\sqrt{2} - \sqrt{3} + 5\sqrt{2}$
c. $7\sqrt{10} - 3\sqrt{15} + 2\sqrt{5} + 4\sqrt{10} - 3\sqrt{5}$
d. $8\sqrt{6} + 5\sqrt{6} - 9\sqrt{6}$
e. $7\sqrt{13} + 3\sqrt{11} - 8\sqrt{13} + \sqrt{11}$

3. Simplify.
a. $\sqrt{72} + \sqrt{50}$
b. $\sqrt{75} + \sqrt{12}$
c. $\sqrt{45} + \sqrt{20}$
d. $\sqrt{54} - \sqrt{96}$
e. $3\sqrt{28} + 2\sqrt{63}$
f. $5\sqrt{108} - 2\sqrt{48}$
g. $2\sqrt{24} - 3\sqrt{6} + \sqrt{150}$
h. $4\sqrt{44} - 3\sqrt{99} + 2\sqrt{176}$

4. Simplify.
a. $3\sqrt{5} - 2\sqrt{18} + 3\sqrt{2} - 4\sqrt{20}$
b. $2\sqrt{28} - \sqrt{112} + \sqrt{63} + 3\sqrt{8}$
c. $2\sqrt{108} - 3\sqrt{75} + 2\sqrt{48} - \sqrt{27}$
d. $\sqrt{175} - 2\sqrt{27} + \sqrt{112} - 2\sqrt{3}$
e. $2\sqrt{3} - (\sqrt{5} + \sqrt{12} - 2\sqrt{45})$

5. Simplify.
a. $\sqrt{9y} + \sqrt{y^3} + \sqrt{16x^2y}$
b. $\sqrt{18a} - 2x\sqrt{20y} + \frac{3x}{y}\sqrt{45y^3} - \sqrt{32a}$
c. $3x\sqrt{28} + \sqrt{7x^2} - 2x\sqrt{63}$
d. $2\sqrt{a^3b^2} + 3\sqrt{5x^2} + \frac{5a}{b}\sqrt{ab^4} - 2x\sqrt{5}$

ANSWERS

Master 3-3
1.a. $8\sqrt{3}$ **b.** $15\sqrt{2}$ **c.** $7\sqrt{2}$ **d.** $5\sqrt{x}$ **e.** $4\sqrt{2}$ **f.** $-5\sqrt{5}$
2.a. $10\sqrt{2}$ **b.** $3\sqrt{3} + 7\sqrt{2}$ **c.** $11\sqrt{10} - 3\sqrt{15} - \sqrt{5}$
d. $4\sqrt{6}$ **e.** $-\sqrt{13} + 4\sqrt{11}$ **3.a.** $11\sqrt{2}$ **b.** $7\sqrt{3}$ **c.** $5\sqrt{5}$
d. $-\sqrt{6}$ **e.** $12\sqrt{7}$ **f.** $22\sqrt{3}$ **g.** $6\sqrt{6}$ **h.** $7\sqrt{11}$

4.a. $-5\sqrt{5} - 3\sqrt{2}$ **b.** $3\sqrt{7} + 6\sqrt{2}$ **c.** $2\sqrt{3}$
d. $9\sqrt{7} - 8\sqrt{3}$ **e.** $5\sqrt{5}$ **5.a.** $(3 + y + 4x)\sqrt{y}$
b. $-\sqrt{2a} + 5x\sqrt{5y}$ **c.** $x\sqrt{7}$ **d.** $7ab\sqrt{a} + x\sqrt{5}$ **6.** $9\sqrt{6}$ cm

Name _____ Master 3–4

Multiplying and Dividing Radicals

Example 1

Multiply.

$(3\sqrt{2}-4)(4\sqrt{2}+3)$
$=(3)(4)(\sqrt{(2)(2)})+(3)(3)(\sqrt{2})+(-4)(4)(\sqrt{2})+(-4)(3)$
$=12\sqrt{4}+9\sqrt{2}-16\sqrt{2}-12$
$=12(2)-7\sqrt{2}-12$
$=24-7\sqrt{2}-12$
$=12-7\sqrt{2}$

Example 2

Rationalize the denominator.

$\frac{2}{2\sqrt{2}+\sqrt{6}}\times\frac{2\sqrt{2}-\sqrt{6}}{2\sqrt{2}-\sqrt{6}}$
$=\frac{4\sqrt{2}-2\sqrt{6}}{8-2\sqrt{12}+2\sqrt{12}-6}$
$=\frac{4\sqrt{2}-2\sqrt{6}}{2}$
$=2\sqrt{2}-\sqrt{6}$

1. Multiply. Simplify where possible.
a. $(\sqrt{7})(\sqrt{3})$
b. $(\sqrt{5})(\sqrt{15})$
c. $(\sqrt{8})(\sqrt{6})$
d. $(\sqrt{7})(\sqrt{14})$
e. $(2\sqrt{3})(\sqrt{5})$
f. $(3\sqrt{2})(4\sqrt{3})$
g. $(3\sqrt{6})(2\sqrt{2})$
h. $(4\sqrt{18})(2\sqrt{3})$

2. Multiply. Simplify where possible.
a. $(\sqrt{5}-2)(\sqrt{3}+2)$
b. $(\sqrt{3}-2)(\sqrt{3}+4)$
c. $(2-\sqrt{6})(3-\sqrt{6})$
d. $(2-3\sqrt{2})(4+\sqrt{2})$
e. $(4-\sqrt{3})(4-\sqrt{3})$
f. $(\sqrt{3}-1)^2$
g. $(2\sqrt{6}-3)(2\sqrt{6}+3)$
h. $(2\sqrt{3}-\sqrt{2})(2\sqrt{3}+\sqrt{2})$
i. $(4\sqrt{6}-1)(2\sqrt{3}+1)$
j. $(3\sqrt{2}+\sqrt{3})(\sqrt{2}-2\sqrt{3})$

3. Rationalize the denominator.
a. $\frac{\sqrt{12}}{\sqrt{3}}$ b. $\frac{\sqrt{12}}{\sqrt{2}}$
c. $\frac{2\sqrt{18}}{3\sqrt{2}}$ d. $\frac{4\sqrt{22}}{\sqrt{11}}$
e. $\frac{-4\sqrt{10}}{2\sqrt{5}}$ f. $\frac{12\sqrt{20}}{3\sqrt{5}}$

4. Rationalize the denominator.
a. $\frac{1}{\sqrt{2}}$ b. $\frac{3}{\sqrt{5}}$
c. $\frac{2\sqrt{3}}{3\sqrt{6}}$ d. $\frac{\sqrt{2}+3}{\sqrt{3}}$
e. $\frac{\sqrt{6}-\sqrt{3}}{\sqrt{2}}$ f. $\frac{2\sqrt{3}-\sqrt{18}}{\sqrt{3}}$

ANSWERS

Master 3-4
1.a. $\sqrt{21}$ **b.** $5\sqrt{3}$ **c.** $4\sqrt{3}$ **d.** $7\sqrt{2}$ **e.** $2\sqrt{15}$ **f.** $12\sqrt{6}$
g. $12\sqrt{3}$ **h.** $24\sqrt{6}$ **2.a.** $\sqrt{15}+2\sqrt{5}-2\sqrt{3}-4$
b. $2\sqrt{3}-5$ **c.** $12-5\sqrt{6}$ **d.** $2-10\sqrt{2}$ **e.** $19-8\sqrt{3}$
f. $4-2\sqrt{3}$ **g.** 15 **h.** 10 **i.** $24\sqrt{2}+4\sqrt{6}-2\sqrt{3}-1$
j. $-5\sqrt{6}$ **3.a.** 2 **b.** $\sqrt{6}$ **c.** 2 **d.** $4\sqrt{2}$ **e.** $-2\sqrt{2}$
f. 8 **4.a.** $\frac{\sqrt{2}}{2}$ **b.** $\frac{3\sqrt{5}}{5}$ **c.** $\frac{\sqrt{2}}{3}$ **d.** $\frac{\sqrt{6}+3\sqrt{3}}{3}$ **e.** $\frac{2\sqrt{3}-\sqrt{6}}{2}$
f. $2-\sqrt{6}$