# Math in Living C O L O R !!

To see Section 5.04 with explanations, examples, and exercises, click here!

## 5.04 Multiplying Square Roots

*Basic Algebra: One Step at a Time.*
Page 420-430 #25, 54, 60, 62, 64, 66, 70, 77, 78, Extra Problem.

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**P. 422: 25.** $4\sqrt{3} \bullet 6\sqrt{15}$

You have a product of two numbers times the product of two more numbers. This is actually the product of four numbers. You may multiply these numbers in any order you wish. It will be helpful to multiply the numbers that are OUTSIDE the square root and keep them OUTSIDE the square root, then multiply the numbers that are INSIDE the square root, and keep them INSIDE the square root.

**Solution:** $4\sqrt{3} \bullet 6\sqrt{15}$

$24\sqrt{45}$

Now, simplify the square root (if possible)!

$24\sqrt{9}\sqrt{5}$

$24 \bullet 3\sqrt{5}$

**Final Answer:** $72\sqrt{5}$

No Extra Charge: Why not check your answer with your calculator!!

Calculate the problem: $4\sqrt{3} \bullet 6\sqrt{15} \approx 160.9968944$

Calculate the answer: $72\sqrt{5} \approx 160.9968944$

# Product of Binomials: "F OI L"

F O I L

**P. 427: 54.** $(\sqrt{5} - \sqrt{2})(\sqrt{10} + \sqrt{6}) = (\sqrt{50} + \sqrt{30} - \sqrt{20} - \sqrt{12})$

$= (\sqrt{50} + \sqrt{30} - \sqrt{20} - \sqrt{12})$

If radicals can be simplified, make two separate radicals for the radicals above:

$= (\sqrt{\ }\sqrt{\ } + \sqrt{30} - \sqrt{\ }\sqrt{\ } - \sqrt{\ }\sqrt{\ })$

Place the perfect square in the first radical:.

$= (\sqrt{25}\sqrt{\ } + \sqrt{30} - \sqrt{4}\sqrt{\ } - \sqrt{4}\sqrt{\ })$

Place the other factor that is "left-over" in the second radical.

$= (\sqrt{25}\sqrt{2} + \sqrt{30} - \sqrt{4}\sqrt{5} - \sqrt{4}\sqrt{3})$

Take square roots of the perfect squares: $= (5\sqrt{2} + \sqrt{30} - 2\sqrt{5} - 2\sqrt{3})$

There are no like terms, so this is the final answer.

F O I L

**P.428: 60.** $(2\sqrt{3} - 5\sqrt{6})(2\sqrt{3} + 5\sqrt{6}) = (4\sqrt{9} + 10\sqrt{18} - 10\sqrt{18} - 25\sqrt{36})$

$= 4 \bullet 3 - 25 \bullet 6$

$= 12 - 150$

$= -138$

Can you do the calculator check? Does $(2\sqrt{3} - 5\sqrt{6})(2\sqrt{3} + 5\sqrt{6}) = -138$ ?

**62.** $(6\sqrt{2} - 4\sqrt{3})(3\sqrt{2} - 8\sqrt{3})$

F O I L

$= (18\sqrt{4} - 48\sqrt{6} - 12\sqrt{6} + 32\sqrt{9})$

$= (18 \bullet 2 - 60\sqrt{6} + 32 \bullet 3)$

$= (36 - 60\sqrt{6} + 96)$

$= (132 - 60\sqrt{6})$

There are no like terms, so this is the final answer.

DO NOT COMBINE the **132** and the **60** !! These are NOT like terms!!

**64.** $(4\sqrt{5} + 8\sqrt{2})(3\sqrt{10} + 4\sqrt{5})$

F O I L

$= (12\sqrt{50} + 16\sqrt{25} + 24\sqrt{20} + 32\sqrt{10})$

$= 12 \bullet \sqrt{25}\sqrt{2} + 16 \bullet 5 + 24 \bullet \sqrt{4}\sqrt{5} + 32 \bullet \sqrt{10}$

$= 12 \bullet 5\sqrt{2} + 16 \bullet 5 + 24 \bullet 2\sqrt{5} + 32 \bullet \sqrt{10}$

$= 60\sqrt{2} + 80 + 48\sqrt{5} + 32 \bullet \sqrt{10}$

Calculator check: $(4\sqrt{5} + 8\sqrt{2})(3\sqrt{10} + 4\sqrt{5})$ = 373.3769618 approx.

$60\sqrt{2} + 80 + 48\sqrt{5} + 32 \bullet \sqrt{10}$ = 373.3769618 approx.

**66.** $(6\sqrt{3} - 5\sqrt{6})(2\sqrt{3} - 8\sqrt{6})$

F O I L

$= (12\sqrt{9} - 48\sqrt{18} - 10\sqrt{18} + 40\sqrt{36})$

$= (12 \bullet 3 - 58\sqrt{18} + 40 \bullet 6)$

$= (36 - 58\sqrt{9}\sqrt{2} + 240)$

$= (276 - 58 \bullet 3\sqrt{2})$

$= (276 - 174\sqrt{2})$

Calculator check: $(6\sqrt{3} - 5\sqrt{6})(2\sqrt{3} - 8\sqrt{6})$ = 29.92684015 approx.

$(276 - 174\sqrt{2})$ = 29.92684015 approx.

**70.** $(\sqrt{6} - \sqrt{3})^2$ F O I L

$(\sqrt{6} - \sqrt{3})(\sqrt{6} - \sqrt{3}) = (\sqrt{36} - \sqrt{18} - \sqrt{18} + \sqrt{9})$

$= (6 - 2\sqrt{18} + 3)$

$= (9 - 2\sqrt{9}\sqrt{2})$

$= (9 - 2 \bullet 3\sqrt{2})$

$= (9 - 6\sqrt{2})$

Calculator check: $(\sqrt{6} - \sqrt{3})^2 = 0.5147$ approx.

$(9 - 6\sqrt{2}) = 0.5147$ approx.

**77.** $(6\sqrt{12} + 10\sqrt{6})^2$ F O I L

$(6\sqrt{12} + 10\sqrt{6})(6\sqrt{12} + 10\sqrt{6}) = (36\sqrt{144} + 60\sqrt{72} + 60\sqrt{72} + 100\sqrt{36})$

$= (36 \bullet 12 + 120\sqrt{72} + 100 \bullet 6)$

$= (432 + 120 \bullet \sqrt{36}\sqrt{2} + 600)$

$= (1032 + 120 \bullet 6\sqrt{2})$

$= (1032 + 720\sqrt{2})$

Calculator check: $(6\sqrt{12} + 10\sqrt{6})^2 = 2050.233765$ approx.

$(1032 + 720\sqrt{2}) = 2050.233765$ approx.

**78.** $(6\sqrt{3} - 5\sqrt{15})^2$ F O I L

$(6\sqrt{3} - 5\sqrt{15})(6\sqrt{3} - 5\sqrt{15}) = (36\sqrt{9} - 30\sqrt{45} - 30\sqrt{45} + 25\sqrt{15^2})$

$= (36 \bullet 3 - 60\sqrt{45} + 25 \bullet 15)$

$= (108 - 60 \bullet \sqrt{9}\sqrt{5} + 375)$

$= (483 - 60 \bullet 3\sqrt{5})$

$= (483 - 180\sqrt{5})$

Calculator check: $(6\sqrt{3} - 5\sqrt{15})^2 = 80.50776$ approx.

$(483 - 180\sqrt{5}) = 80.50776$ approx.

## Extra Problem:

F O I L

$(\sqrt{2} - 1)(\sqrt{2} - \sqrt{3}) = (\sqrt{4} - \sqrt{6} - \sqrt{2} + \sqrt{3})$

$= (2 - \sqrt{6} - \sqrt{2} + \sqrt{3})$

Calculator check: $(\sqrt{2} - 1)(\sqrt{2} - \sqrt{3}) = -0.1316524976$ approx.

$(2 - \sqrt{6} - \sqrt{2} + \sqrt{3}) = -0.1316524976$ approx.