

52. $4\sqrt{14}$: Count out those 2's carefully.

$$\sqrt{224} = \sqrt{2 \times 2 \times 2 \times 2 \times 7} = \sqrt{2 \times 2} \times \sqrt{2 \times 2} \times \sqrt{2 \times 7} = 2 \times 2 \times \sqrt{14} = 4\sqrt{14}$$

53. $7\sqrt{7}$:

$$\sqrt{343} = \sqrt{7 \times 7 \times 7} = \sqrt{7 \times 7} \times \sqrt{7} = 7\sqrt{7}$$

54. $4\sqrt{13}$:

$$\sqrt{208} = \sqrt{2 \times 2 \times 2 \times 2 \times 13} = \sqrt{2 \times 2} \times \sqrt{2 \times 2} \times \sqrt{13} = 2 \times 2 \times \sqrt{13} = 4\sqrt{13}$$

55. $12\sqrt{3}$:

$$\sqrt{432} = \sqrt{2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3} = \sqrt{2 \times 2} \times \sqrt{2 \times 2} \times \sqrt{3 \times 3} \times \sqrt{3} = 2 \times 2 \times 3 \times \sqrt{3} = 12\sqrt{3}$$

Drill 8

56. **39:** It is tempting to use the square root to eliminate the exponents on 36 and 15 immediately, but you cannot break up a root over addition. You could multiply out both terms and add them, but you should always try to simplify before doing large calculations. Pull out the greatest common factor of 36^2 and 15^2 , namely 3^2 . (Tip: Find the greatest number that 36 and 15 have in common. Then square that number. $15 = 3 \times 5$. 36 contains a 3 but not a 5.)

$$\sqrt{3^2(12^2 + 5^2)} = \sqrt{3^2(144 + 25)} = \sqrt{3^2(169)}$$

Both 3^2 and 169 are perfect squares ($169 = 13^2$). Therefore:

$$\sqrt{3^2(169)} = \sqrt{3^2(13^2)} = 3 \times 13 = 39$$

57. **28:** Pull out the greatest common factor of 35^2 and 21^2 , namely 7^2 .

$$\sqrt{7^2(5^2 - 3^2)} = \sqrt{7^2(25 - 9)} = \sqrt{7^2(16)}$$

Both 7^2 and 16 are perfect squares ($16 = 4^2$). Therefore:

$$\sqrt{7^2(16)} = \sqrt{7^2(4^2)} = 7 \times 4 = 28$$

58. **1,210:** Pull out the greatest common factor of 11^4 and 11^5 , namely 11^4 .

$$\sqrt{10(11^5 - 11^4)} = \sqrt{10(11^4(11 - 1))} = \sqrt{10(11^4(10))}$$

$(10)(10)$ is the same as 10^2 . The other term, 11^4 , is also a perfect square ($11^4 = 11^2 \times 11^2$). Pull the squares out of the square root.

$$\sqrt{10(11^4(10))} = (10)(11^2) = (10)(121) = 1,210$$