Lesson Three

Simplifying Radicals

#1 a) $\sqrt{8} = \sqrt{4 \cdot 2} = \sqrt{2^2 \cdot 2} = \underline{2\sqrt{2}}$

b) $\sqrt{12} = \sqrt{4 \cdot 3} = \sqrt{2^2 \cdot 3} = \underline{2\sqrt{3}}$

c) $\sqrt{18} = \sqrt{9 \cdot 2} = \sqrt{3^2 \cdot 2} = \underline{3\sqrt{2}}$

d) $\sqrt{20} = \sqrt{4 \cdot 5} = \sqrt{2^2 \cdot 5} = \underline{2\sqrt{5}}$

e) $\sqrt{24} = \sqrt{4 \cdot 6} = \sqrt{2^2 \cdot 6} = \underline{2\sqrt{6}}$

f) $6\sqrt{28} = 6\sqrt{4 \cdot 7} = 6\sqrt{2^2 \cdot 7} = 6 \cdot 2\sqrt{7} = \underline{12\sqrt{7}}$

! g) $\sqrt{30} = \sqrt{6 \cdot 5} = \sqrt{3 \cdot 10}$ ⇒ this can't be simplified any further ⇒ $\underline{\sqrt{30}}$

h) $\sqrt{32} = \sqrt{16 \cdot 2} = \sqrt{4^2 \cdot 2} = \underline{4\sqrt{2}}$

i) $3\sqrt{40} = 3\sqrt{4 \cdot 10} = 3\sqrt{2^2 \cdot 10} = 3 \cdot 2\sqrt{10} = \underline{6\sqrt{10}}$

#1

j) $\sqrt{48} = \sqrt{16 \cdot 3} = \sqrt{4^2 \cdot 3} = \underline{4\sqrt{3}}$

k) $-5\sqrt{56} = -5\sqrt{4 \cdot 14} = -5\sqrt{2^2 \cdot 14} = (-5)(2)\sqrt{14} = \underline{-10\sqrt{14}}$

l) $\sqrt{72} = \sqrt{36 \cdot 2} = \sqrt{6^2 \cdot 2} = \underline{6\sqrt{2}}$

m) $\sqrt{84} = \sqrt{4 \cdot 21} = \sqrt{2^2 \cdot 21} = \underline{2\sqrt{21}}$

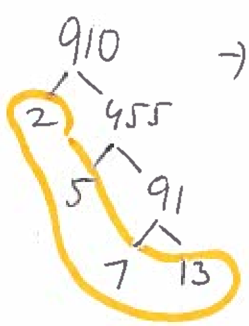
n) $2\sqrt{108} = 2\sqrt{36 \cdot 3} = 2\sqrt{6^2 \cdot 3} = (2)(6)\sqrt{3} = \underline{12\sqrt{3}}$

o) $\sqrt{200} = \sqrt{100 \cdot 2} = \sqrt{10^2 \cdot 2} = \underline{10\sqrt{2}}$

p) $4\sqrt{320} = 4\sqrt{64 \cdot 5} = 4\sqrt{8^2 \cdot 5} = (4)(8)\sqrt{5} = \underline{32\sqrt{5}}$

q) $\sqrt{910}$ = this can't be simplified any further.

How do I know for sure? Prime factorize.



→ all prime factors are unique ⇔ none of the prime factors repeat to identify a hidden square number

$\therefore \sqrt{910} = \underline{\sqrt{910}}$

#1 r)

$\sqrt{1260} = \sqrt{36 \cdot 35} = \sqrt{6^2 \cdot 35} = 6\sqrt{35}$

#2

a) $2\sqrt{11} = \sqrt{2^2 \cdot 11} = \sqrt{44}$

b) $3\sqrt{10} = \sqrt{3^2 \cdot 10} = \sqrt{90}$

c) $4\sqrt{6} = \sqrt{4^2 \cdot 6} = \sqrt{96}$

! d) $-2\sqrt{17} = \sqrt{(-2)^2 \cdot 17} = \sqrt{68}$ OR $-\sqrt{2^2 \cdot 17} = -\sqrt{68}$

e) $3\sqrt{15} = \sqrt{3^2 \cdot 15} = \sqrt{135}$

#3

a) $2\sqrt[3]{6} = \sqrt[3]{2^3 \cdot 6} = \sqrt[3]{8 \cdot 6} = \sqrt[3]{48}$

b) $3 \cdot \sqrt[3]{6} = \sqrt[3]{3^3 \cdot 6} = \sqrt[3]{27 \cdot 6} = \sqrt[3]{162}$

#3 c) $2\cdot\sqrt[3]{3} = \sqrt[3]{2^3\cdot 3} = \sqrt[3]{8\cdot 3} = \sqrt[3]{24}$

d) $3\sqrt[3]{2} = \sqrt[3]{3^3\cdot 2} = \sqrt[3]{27\cdot 2} = \sqrt[3]{54}$

#4

a) $\sqrt[3]{-16} = \sqrt[3]{(-8)(2)} = \sqrt[3]{(-2)^3\cdot 2} = -2\sqrt[3]{2}$ OR $2\sqrt[3]{-2}$

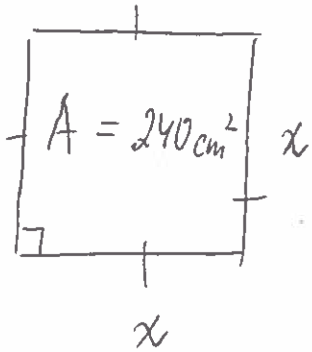
b) $\sqrt[3]{-24} = \sqrt[3]{(-8)(3)} = \sqrt[3]{(-2)^3\cdot 3} = -2\sqrt[3]{3}$ OR $2\sqrt[3]{-3}$

c) $\sqrt[3]{96} = \sqrt[3]{8\cdot 12} = \sqrt[3]{2^3\cdot 12} = 2\sqrt[3]{12}$

d) $\frac{5}{3}\cdot\sqrt[3]{243} = \frac{5}{3}\cdot\sqrt[3]{27\cdot 9} = \frac{5}{3}\cdot\sqrt[3]{3^3\cdot 9} =$

$= \frac{5}{3}\cdot 3\sqrt[3]{9} = \frac{15}{3}\sqrt[3]{9} = 5\sqrt[3]{9}$

#5



$$A_{\square} = x^2$$

$$\sqrt{240} = \sqrt{x^2}$$

$$x = \sqrt{240}$$

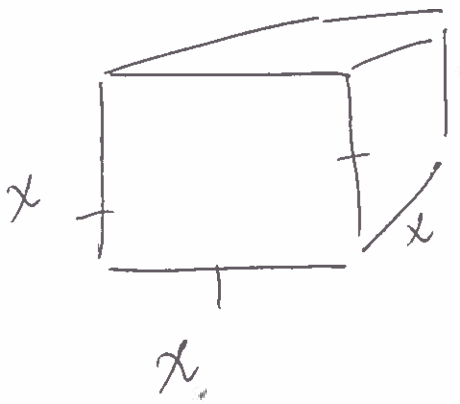
find a perfect square number that is a factor of 240

$$\sqrt{240} = \sqrt{16 \cdot 15} = \sqrt{4^2 \cdot 15} = \underline{\underline{4\sqrt{15}}}$$

$\therefore$ The length of each side is $\underline{\underline{4\sqrt{15}\ \text{cm}}}$

#6

$V = 2160\ cm^3$



$V = x^3$

$\sqrt[3]{2160} = \sqrt[3]{x^3}$

$x = \sqrt[3]{216 \cdot 10}$

$= \sqrt[3]{6^3 \cdot 10}$

$= \underline{6\sqrt[3]{10}}$

$\therefore$ The length of each side is $\underline{6\sqrt[3]{10}\ cm}$.