Changes to original questions:

2C) The original problem was stated:

Usually radicals with different indices cannot be combined.

Given: *A*, *B* are integers and 0 < *A*, *B* < 4

Compute the ordered triple (*N*, *C*, *X*), where *N*, *C* and *X* are positive integers and *C* is as small as possible, for which

$$\sqrt[12]{16(27)(128)(1024)}+3\sqrt[4]{2^A3^B}=N\left(\sqrt[C]{X}\right)$$

The appeal argued that 0 < *A*, *B* < 4 was ambiguous and could be interpreted as 0 < *A* and *B* < 4. The intent was that the values of both *A* and *B* were strictly between 0 and 4 and I thought single "and" connector made it clear that there were two conditions, not three. However, the appeal was not without merit and I decided to grant the appeal.

Here is the solution submitted by Amelia Paine (Winchester HS):

$$\sqrt[12]{16(27)(128)(1024)}+3\sqrt[4]{2^A3^B}=N\left(\sqrt[C]{X}\right)$$

$$\sqrt[12]{2^{21}\cdot 3^3}+3\sqrt[4]{2^A3^B}=$$

$$2^{\frac{21}{12}}\cdot 3^{\frac{3}{12}}+3\cdot 2^{\frac{A}{4}}\cdot 3^{\frac{B}{4}}=$$

$$2^{\frac{7}{4}}\cdot 3^{\frac{1}{4}}+2^{\frac{A}{4}}\cdot 3^{\frac{B+4}{4}}$$

Let $A = 7$, $B = -3$. Then:

$$2^{\frac{7}{4}}\cdot 3^{\frac{1}{4}}+2^{\frac{7}{4}}\cdot 3^{\frac{1}{4}}=2\left(2^{\frac{7}{4}}\cdot 3^{\frac{1}{4}}\right)=2^{\frac{11}{4}}\cdot 3^{\frac{1}{4}}=\sqrt[4]{2^{11}\cdot 3^1}=4\sqrt[4]{2^3\cdot 3}=4\sqrt[4]{24}$$

Therefore, (*N*, *C*, *X*) = **<u>(4, 4, 24)</u>**.