1)

$$d(x,y) = \sum_{i=1}^{n} (|x_i - y_i|^3)$$

For $x, y \in R^n$; $d(x,y)$ is always positive due to the fact that the absolute value is always taken of the distance.

$d(x,y) = 0$ i.f.f. $\left(\sum_{i=1}^{n}(|x_i - y_i|^3)\right) = 0$ i.f.f. $\sum_{i=1}^{n}(|x_i - y_i|^3) = 0$
iff $|x_i - y_i|^3 = 0$ for $i = 1, 2, 3, \ldots, n$
iff $|x_i - y_i| = 0$ iff $x_i = y_i$ for $i = 1, 2, 3, \ldots, n$
iff $x = y$

$$d(x,z) \leq d(x,y) + d(y,z)$$

$$\sum_{i=1}^{n} (|x_i - z_i|^3) \leq \sum_{i=1}^{n} (|x_i - y_i|^3) + \sum_{i=1}^{n} (|y_i - z_i|^3)$$

$$\sum_{i=1}^{n} (|x_i - z_i|^3) = \sum_{i=1}^{n} |(x_i - y_i) + (y_i - z_i)|^3$$

$$\leq \sum_{i=1}^{n} (|x_i - y_i|^3) + \sum_{i=1}^{n} (|y_i - z_i|^3)$$

Since all 3 conditions are met for a proper distance formula, the equation is a correct distance formula.

Distance between $a = (0,0,0)$ $b = (0,1,0)$ $c = (0,1,1)$ $d = (1,1,1)$:

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

$d(a,b) = \sqrt{(0-0)^2 + (1-0)^2 + (0-0)^2} = 1$
$d(a,c) = \sqrt{(0-0)^2 + (1-0)^2 + (1-0)^2} = \sqrt{2}$
$d(a,d) = \sqrt{(1-0)^2 + (1-0)^2 + (1-0)^2} = \sqrt{3}$
$d(b,c) = \sqrt{(0-0)^2 + (1-1)^2 + (1-0)^2} = 1$
$d(b,d) = \sqrt{(1-0)^2 + (1-1)^2 + (1-0)^2} = \sqrt{2}$
$d(c,d) = \sqrt{(1-0)^2 + (1-1)^2 + (1-1)^2} = 1$