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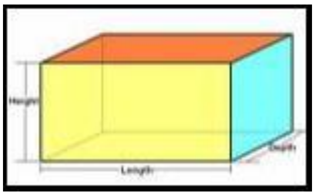
Perfect Cuboid

www.unsolvedproblems.org

An Euler Brick is just a cuboid, or a rectangular box, in which all of the edges (length, depth, and height) have integer dimensions; and in which the diagonals on all three sides are also integers.



So if the length, depth and height are a, b, and c respectively, then a, b, and c are integers, as are the quantities √(a^2+b^2) and √(b^2+c^2) and √(c^2+a^2).

The problem is to find a perfect cuboid, which is an Euler Brick in which the space diagonal, that is, the distance from any corner to its opposite corner, given by the formula √(a^2+b^2+c^2), is also an integer, or prove that such a cuboid cannot exist .

Solution

There is no rational solution to the perfect cuboid. It is the radius of a sphere. (push it back from the edge to the centre radius of the sphere)

So... $a^2 + b^2 + c^2 = d^{+2}$

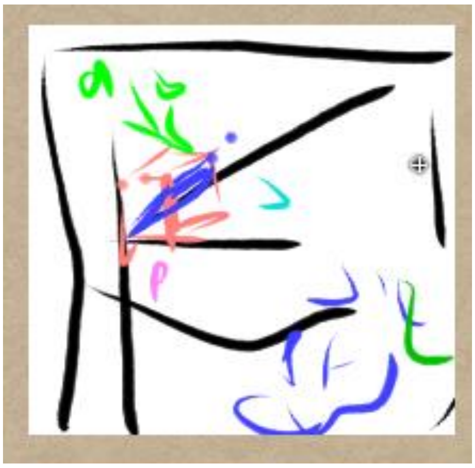
At the 45^o centre core set of lines (4 of (2 sspheres))

a = b = c therefore

$3a^2 = d^{+2}$

Implying positively that there is not a solution...

(because when you root both sides, as root 3 is not a rational, then both a and d cannot be rational)



$a^2 + b^2 + c^2 = d^2$
$(a + s_1)^2 + (b + s_2)^2 + (c + s_3)^2 = d^2$

$a^2 + b^2 + c^2 + s_1^2 + s_2^2 + s_3^2 = d^2 - 2as_1 - 2bs_2 - 2cs_3$
and they are all rational except d.. so there is conclusively no perfect rectangloid...