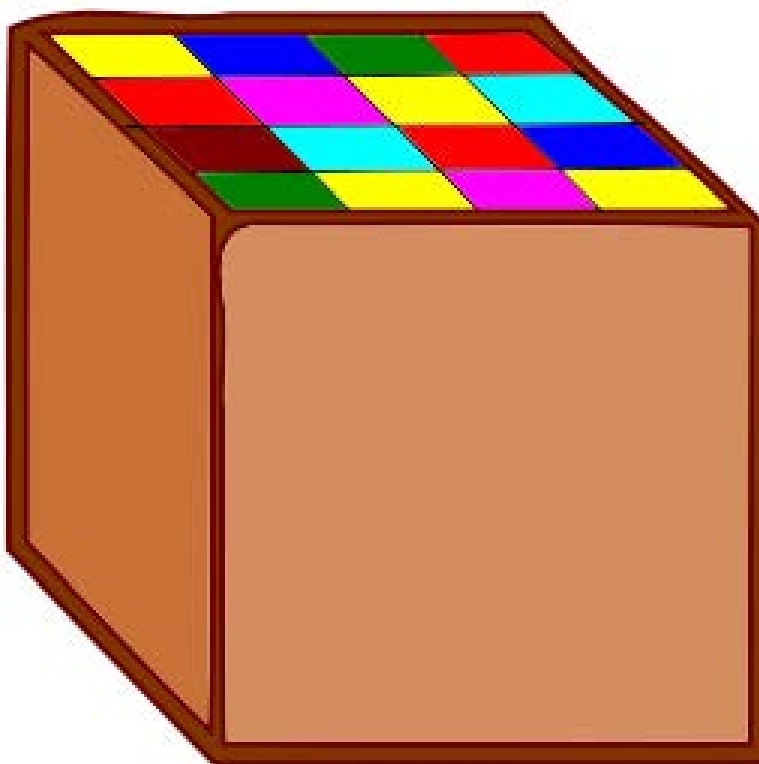


Puzzle of the Week

Boxed Blocks

THE CHALLENGE: There is a wooden box, without a lid, holding a $4 \times 4 \times 4$ collection of 64 blocks. How many of the blocks touch some part of the box?



EXPLORATION: What happens for a $5 \times 5 \times 5$ collection of 125 blocks in a bigger box? What about other sizes of boxes? How do these answers change if the boxes have a lid that touches the top row of blocks?

Puzzle of the Week

Boxed Blocks – Notes

THE CHALLENGE: There are different ways to go about solving this problem.

1. Think of the $2 \times 2 \times 3 = 12$ core of blocks that don't touch the sides.
2. If it had a lid, there would be $2 \times 2 \times 2 = 8$ blocks not touching the box. In addition to those 8, there would be $2 \times 2 \times 1 = 4$ blocks only touching the lid.
3. You can add up the blocks along the sides and subtract them from the $4 \times 4 \times 4 = 64$ total. This is the hardest way. There are $4 \times 4 \times 1 = 16$ blocks on the bottom of the box. There are $3 \times 12 = 36$ blocks around the sides that don't touch the bottom. Therefore, there are $64 - (16 + 36) = 12$ blocks on the inside.

EXPLORATION: Look at these only using the first method.

$5 \times 5 \times 5$. Without a lid, there are $3 \times 3 \times 4 = 36$ blocks not touching the box. With a lid, there are $3 \times 3 \times 3 = 27$ blocks not touching.

$a \times b \times c$, where c is the height. Assume these numbers are each at least three. Without a lid, a and b are reduced by 2 and c by 1, so there are $(a - 2) \times (b - 2) \times (c - 1)$ blocks. With a lid, $(a - 2) \times (b - 2) \times (c - 2)$ blocks not touching.