Reshaping Cuboids

Junior high school

Objective

Reinforce students' understanding of the equivalence of shapes in various alignments and how this relates to multiplication within a practical context.
Develop mental skills involving factors, divisors, and systematic thinking.

Explanation of the activity

12 cubes, each with a volume of 1 cm^3, may be placed together to create any of four cuboids, each having a volume of 12 cm^3.

Find the equivalent equations for each of the cuboids; for example,
1 x 1 x 12 = 12, 2 x 2 x 3 = 12, etc.

Using the calculator

Calculator functions used: Multiplication, Multi-line Playback

Press the following buttons and then start operation.

[ON/C] [MODE] [0]

Introduce students to the calculator's Multi-line playback feature, which will be useful to display sets of solutions for each "volume" number.

1 [×] 1 [×] 12 [=]

DEG
1X1X12=
12.

2 [×] 2 [×] 3 [=]

DEG
2X2X3=
12.

1 [×] 3 [×] 4 [=]   etc.

DEG
1X3X4=
12.

Each press of a [▲] [▼] key takes you one calculation step forward or backward.

[2ndF] [▲]

Display the first calcualtion with [2ndF] [▲]

DEG
1X1X12=
12.

[▼] [▲]

DEG
2X2X3=
12.

[▼] [▲]

DEG
1X3X4=
12.

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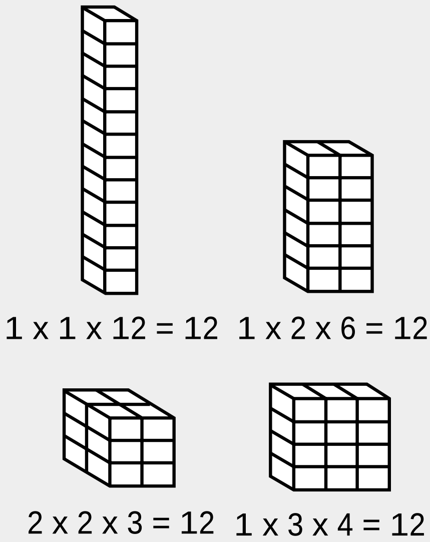
Find the five calculations that represent cuboids that each have a volume of 30 cm^3.

e.g. 1 $\boxed{\times}$ 1 $\boxed{\times}$ 30 $\boxed{=}$ etc.

In a similar way, find the twelve calculations for cuboids each having a volume of 96 cm^3.

How many similar calculations must there be for 180 cm^3?
Which of these cuboids is nearest to looking like a cube?

For volumes between 150 cm^3 and 200 cm^3, which particular ones can be represented by at least 16 cuboids each? Which volumes have the smallest number of cuboids each?



Using the activity in the classroom

Students may benefit from the use of actual blocks that can be stacked to form the different cubic combinations. An OHP calculator could also be used to collect solutions from the entire class.

Points for students to discuss

The number of divisors for a number expressed as $p^a \times q^b \times r^c$ (where p, q, and r are all prime) is $(a + 1)(b + 1)(c + 1)$. For example, $360 = 2^3 \times 3^2 \times 5^1$. Here, $a = 3$, $b = 2$, and $c = 1$, so the number of divisors is given by the expression $(3 + 1)(2 + 1)(1 + 1) = 24$. Therefore, 360 has 24 divisors.

Further Ideas

- Use trial and improvement to find the side of a cube having a volume of 180 cm^3.

- Move into “four (or more) dimensions” as a means of finding the factors of a number. For example, 6006 = 77 x 78 = (7 x 11) x (6 x 13) = 2 x 3 x 7 x 11 x 13. All stages can be displayed using the replay function.