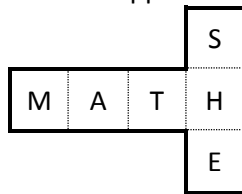
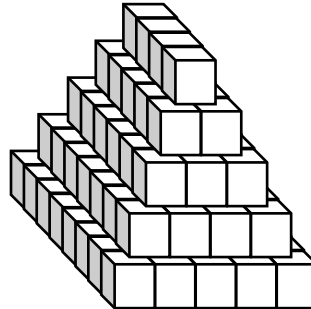


1. What is the volume in cubic centimeters of a cube with side length 7 centimeters?
2. A rectangular box is 2 cm high, 4 cm wide and 6 cm deep. Michelle packs the box with cubes, each 2 cm by 2 cm by 2 cm, with no space left over. How many cubes does she fit into the box?
3. A group of toy makers want to wrap the world's biggest toy block with wrapping paper. The block has dimensions of 8 feet by 6 feet by 12 feet. How much wrapping paper, in square feet, will they need in order to wrap the entire toy block? Assume there is no overlap in wrapping paper.
4. A rectangular prism with a square base has a volume of 144 cubic centimeters. If the height is four centimeters, what is the length of the base in centimeters?

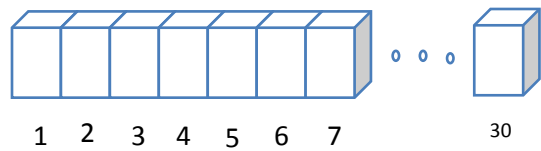
5. The figure below is cut out on the thick outer lines and folded on the thin inner lines to form a cube. Which letter will be on the face of the cube opposite the letter T?



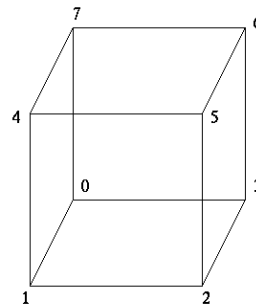
6. A supermarket clerk makes a solid pyramid out of identical cereal boxes. The top five layers are shown. What is the total number of cereal boxes in these top five layers?



7. Thirty cubes are placed in a line such that they are joined face to face. The edges of each cube are 1 cm long. Find the surface area of the resulting solid, in sq. cm.

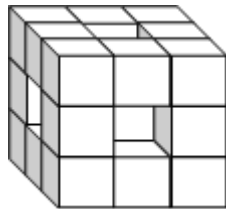


8. An ant sits at vertex 1 of a cube with edge of length 1 m. The ant moves along the edges of the cube and comes back to vertex 1 without visiting any other point twice. Find the number of meters in the length of the longest such path.

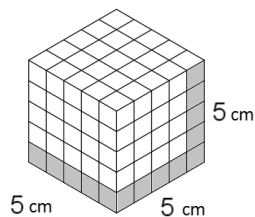


BONUS PROBLEMS

9. Anna wants to cover the outside of a rectangular box with colored paper. The box has a square base with area of 16 square inches. The volume of the box is 80 cubic inches. How many square inches of paper will Anna need to completely cover the box, including the top and bottom, with no paper left over?
10. A cubical box without a top is 4 cm on each edge. It contains 64 identical 1 cm cubes that exactly fill the box. How many of these small cubes actually touch the box?
11. Twenty unit cubes are glued together to form this figure, with "holes" which you can see through. The total figure measures $3 \times 3 \times 3$. If the figure is fully dipped in a bucket of paint, how many square units of surface area would be painted?



12. A large cube, 5 cm by 5 cm by 5 cm, is painted orange on all six faces. Then it is cut into 125 small cubes, each 1 cm by 1 cm by 1 cm. How many of the small cubes are not painted orange on any face?



SOLUTIONS:**1. 343 cm³**

$$\text{Volume} = l \times w \times h = 7 \times 7 \times 7 = 343 \text{ cm}^3$$

2. 6 cubes

Compare the volumes of a cube and the box. The volume of one cube = $2 \times 2 \times 2 = 8 \text{ cm}^3$. The volume of the box = $2 \times 4 \times 6 = 48 \text{ cm}^3$. Therefore, Michelle can fit $48 \div 8 = 6$ cubes into the box.

3. 432 ft²

Two of the faces of the block are $8 \times 6 \text{ ft}$, so each of these faces has an area of 48 ft^2 .
Two of the faces of the block are $8 \times 12 \text{ ft}$, so each of these faces has an area of 96 ft^2 .
Two of the faces of the block are $6 \times 12 \text{ ft}$, so each of these faces has an area of 72 ft^2 .

Adding them all up, $48 + 48 + 96 + 96 + 72 + 72 = 432 \text{ ft}^2$.

4. 6 cm

If the volume is 144, and the height is 4, then the area of the base is $144 \div 4 = 36 \text{ cm}^2$. Since the base is square, each side must be 6 cm.

5. M

M is on the face opposite the letter T. Start by eliminating all the faces that touch the face that contains T. T touches both A and H. After folding, both S and E also touch T. That leaves only M. Therefore, M is opposite T.

6. 100 boxes

Break up the problem into layers. The top layer has 4 boxes. The next layer has $2 \times 5 = 10$ boxes. The third has $3 \times 6 = 18$ boxes. The fourth, $4 \times 7 = 28$ boxes, and the fifth, $5 \times 8 = 40$ boxes. Adding them all up: $4 + 10 + 18 + 28 + 40 = 100$.

7. 122 cm²

Find the area of each face of the entire solid. The front face of the entire solid is a rectangle with length 30 cm and width 1 cm. Its area is 30×1 or 30 cm^2 . The top, back and bottom faces are congruent to the front face. Each has an area of 30 cm^2 . The left and right ends of the solid are squares 1 cm by 1 cm. Each has an area of 1 cm^2 . The surface area of the solid is $4 \times 30 + 2 \times 1 = 122 \text{ cm}^2$.

8. 8 m

By tracing possible paths on the cube, notice that each possible path has a length of 4, 6, or 8 m. The longest such path is 8 m.

9. 112 in²

Find the dimensions of the box. Then add the areas of the faces. The base is a square of area 16 in² so each of the base's sides is 4 inches long. The given volume of 80 in³ = base x height, so the height is 5 inches. The top and bottom each have an area of 16 in². Each side has an area of 4 x 5 = 20 in². The amount of paper needed is 16 + 16 + 20 + 20 + 20 + 20 = 112 in².

10. 52 cubes

Count the cubes that touch the box in each horizontal layer. In the bottom layer, all 16 cubes touch the box. In each of the three other layers, all the outer cubes touch either one or two sides of the box. That is 12 outer cubes per layer. Thus there are a total of 16 + 3 x 12 = 52 small cubes that touch the bottom or a side of the box.

11. 72

Count in an organized way: exterior vs. interior squares. Each face of the figure has 8 painted squares for a total of 6 x 8 = 48 painted faces. Inside each "hole" 4 squares are painted for a total of 6 x 4 = 24 painted faces. The total number of square units of painted surface is 24 + 48 = 72.

12. 27

Separate the problem into parts:

Painted on 3 faces:	8	(all the corner cubes)
Painted on 2 faces:	36	(3 cubes on each of the 12 edges)
Painted on 1 face:	54	(9 cubes on each of the 6 faces)

$8 + 36 + 54 = 98$ = total # of cubes painted on one or more faces. Then $125 - 98 = 27$ small cubes which are not painted orange on any face.