LESSON MAKER PRO

Build It to Scale

Scale and position parts of a 3-D model

HIGH SCHOOL · MM.D3D.A.13

MM.D3D.A.13 "Create a scale model of a complex three-dimensional structure based on observed measurements and indirect measurements, using translations, reflections, rotations, and dilations of its components."

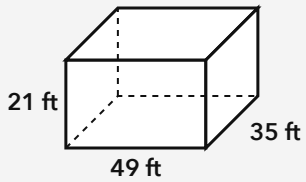
NAME _____ DATE _____

MODEL EACH PART

Divide each real dimension by the scale's real-world length to get a model dimension. A 90° rotation about a vertical axis swaps a rectangular part's x- and y-extents, but not its height. For a point, reflection across the yz-plane changes the sign of x, while translation adds to its coordinates.

WORKED EXAMPLE

The roof module shown has its length along x. At 1 cm for 7 ft, what are its x-, y-, and z-extents after a 90° rotation about its vertical centerline?



1. Scale the dimensions: 49 / 7 = 7, 35 / 7 = 5, and 21 / 7 = 3 cm.
2. The rotation swaps the x- and y-extents. The z-extent stays 3 cm.

Answer: 5 cm along x, 7 cm along y, and 3 cm along z

PRACTICE 4 problems

1 A model stage part measures 9 cm along x, 13 cm along y, and 10 cm along z. Rotate it 90° about its vertical centerline. Give its new x-, y-, and z-extents.

ANSWER _____

2 A model corner is at (12, -4, 9) cm. Reflect it across the yz-plane, then translate it 3 cm in the positive y-direction. Where is it?

ANSWER _____

3 A ramp part is 27 ft long and 15 ft wide. At 1 cm for 3 ft, what are its model length and width?

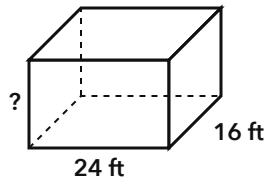
ANSWER _____

4 Rotate the point (-8, 11, 2) cm 90° counterclockwise about the z-axis through the origin. Give its new coordinates.

ANSWER _____

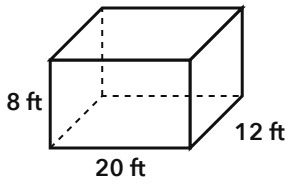
APPLY IT Show your work

1 A festival crew models the tower shown. An 8 ft pole casts a 6 ft shadow when the tower casts a 24 ft shadow. At 1 cm for 8 ft, find the tower's model dimensions.



ANSWER _____

2 A gaming expo models the booth shown at 1 cm for 4 ft. Find its model dimensions. Then reflect a model corner at (6, -3, 2) cm across the yz-plane. Where does it land?



ANSWER _____

CHALLENGE One step up

Two blocks form an exhibit platform. Each is 24 ft along x, 12 ft along y, and 12 ft high. At 1 cm for 6 ft, block A's model center is (2, 1, 1) cm. Rotate A 90° counterclockwise about the z-axis through the origin, then translate it (4, 2, 0) cm to place block B. Find B's center and x-, y-, and z-extents. Explain why the blocks touch.

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A model stage part measures 9 cm along x, 13 cm along y, and 10 cm along z. Rotate it 90° about its vertical centerline. Give its new x-, y-, and z-extents.	**13 cm, 9 cm, 10 cm**
2	A model corner is at (12, -4, 9) cm. Reflect it across the yz-plane, then translate it 3 cm in the positive y-direction. Where is it?	**(-12, -1, 9) cm**
3	A ramp part is 27 ft long and 15 ft wide. At 1 cm for 3 ft, what are its model length and width?	**9 cm long and 5 cm wide**
4	Rotate the point (-8, 11, 2) cm 90° counterclockwise about the z-axis through the origin. Give its new coordinates.	**(-11, -8, 2) cm**

PART 2 · APPLY IT

1. **3 cm long, 2 cm wide, and 4 cm high** Similar shadow triangles give a tower height of 24 × 8 / 6 = 32 ft. Divide each tower dimension by 8.
2. **5 cm long, 3 cm wide, and 2 cm high; reflected corner (-6, -3, 2) cm** Divide the three dimensions by 4. Reflection across the yz-plane changes only the corner's x-coordinate.

CHALLENGE

B's center is (3, 4, 1) cm, and its extents are 2 cm, 4 cm, and 2 cm. A reaches y = 2, and B begins at y = 2; their x- and z-ranges overlap, so they touch along a face.

Accept dimensions in another order when each axis is clearly labeled. In the challenge, accept any explanation that correctly identifies the shared face at y = 2.