Reproducing Scale Drawings at a Different Scale

Apply the skill to decisions and designs

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

The actual object stays fixed. New drawing length $=$ old drawing length $\times$ old actual-units-per-drawing-unit / new actual-units-per-drawing-unit. A 3 cm line at 8 m/cm represents 24 m; at 6 m/cm it becomes 4 cm. More meters per centimeter make a smaller drawing.

Worked example

A line is 3 cm at 4 m/cm. How long is it on a redraw at 2 m/cm?

1. Actual length $= 3(4) = 12$ m.
2. New length $= 12/2 = 6$ cm.
3. Check $6(2) = 12$ m and scale factor $4/2 = 2$.
Answer: 6 cm.

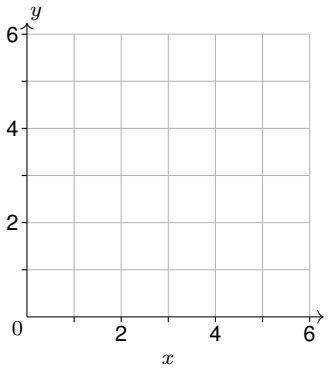
Practice Problems

Show your thinking.

1. A 2 by 1 grid-unit plan changes from 6 m/unit to 3 m/unit. Find the new size. Does it fit a 5 by 3 unit frame without rotation? Verify one actual length.

2. A 3 by 2 grid-unit plan changes from 4 m/unit to 2 m/unit. Find the new size. Does it fit a 5 by 4 unit frame without rotation? Give the midpoint of the new diagonal from the origin to the far corner.

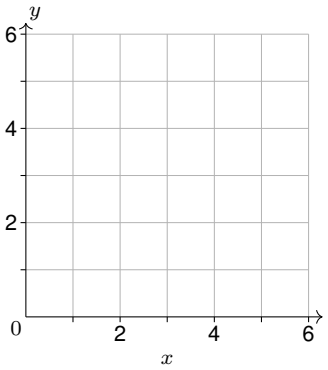
3. A 4 by 2 grid-unit plan changes from 3 m/unit to 6 m/unit. Find the new size. Does it fit a 3 by 3 unit frame without rotation? Draw the new rectangle from $(0, 0)$. Find the old and new perimeters.



4. A 2 by 3 grid-unit plan changes from 2 m/unit to 4 m/unit. Find the new size. Does it fit a 2 by 1 unit frame without rotation? Check by recovering the old dimensions.

5. A 3 by 1 grid-unit plan changes from 10 m/unit to 5 m/unit. Find the new size. Does it fit a 6 by 3 unit frame without rotation? Find the old and new drawing areas and the new-to-old area ratio.

6. A 4 by 3 grid-unit plan changes from 5 m/unit to 10 m/unit. Find the new size. Does it fit a 6 by 6 unit frame without rotation? Draw the new rectangle from $(0, 0)$. Find unused area if the redraw sits inside a 6 by 6 unit frame.



Answer Key

1. Factor 2; new size 4 by 2 units. Actual length 12 m. Fits.

2. Factor 2; new size 6 by 4 units. Diagonal midpoint $(3, 2)$. Does not fit.

3. Factor $\frac{1}{2}$; new size 2 by 1 units. Perimeters 12 and 6 units. Fits. Vertices $(0, 0), (2, 0), (2, 1), (0, 1)$.

4. Factor $\frac{1}{2}$; new size 1 by $\frac{3}{2}$ units. Old size 2 by 3 units. Does not fit.

5. Factor 2; new size 6 by 2 units. Areas 3 and 12 sq units; ratio 4. Fits.

6. Factor $\frac{1}{2}$; new size 2 by $\frac{3}{2}$ units. Unused area 33 sq units. Fits. Vertices $(0, 0), (2, 0), (2, \frac{3}{2}), (0, \frac{3}{2})$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Actual dimensions: $2(6) = 12$ m and $1(6) = 6$ m.
2. New drawing lengths: $12/3 = 4$ and $6/3 = 2$ grid units.
3. Length factor $= 6/3 = 2$; actual dimensions are unchanged.
4. $4(3) = 12$ m confirms the same actual length.
5. Compare $4 \leq 5$ and $2 \leq 3$. Both fit.

Problem 2

1. Actual dimensions: $3(4) = 12$ m and $2(4) = 8$ m.
2. New drawing lengths: $12/2 = 6$ and $8/2 = 4$ grid units.
3. Length factor $= 4/2 = 2$; actual dimensions are unchanged.
4. Halve each coordinate of the far corner: $(6/2, 4/2) = (3, 2)$.
5. Compare $6 > 5$ and $4 \leq 4$. At least one dimension exceeds the frame.

Problem 3

1. Actual dimensions: $4(3) = 12$ m and $2(3) = 6$ m.
2. New drawing lengths: $12/6 = 2$ and $6/6 = 1$ grid units.
3. Length factor $= 3/6 = \frac{1}{2}$; actual dimensions are unchanged.
4. Old perimeter $2(4 + 2) = 12$; new perimeter $2(2 + 1) = 6$.
5. Compare $2 \leq 3$ and $1 \leq 3$. Both fit.
6. Join the four corners in order: $(0, 0), (2, 0), (2, 1), (0, 1)$.

Problem 4

1. Actual dimensions: $2(2) = 4$ m and $3(2) = 6$ m.
2. New drawing lengths: $4/4 = 1$ and $6/4 = \frac{3}{2}$ grid units.
3. Length factor $= 2/4 = \frac{1}{2}$; actual dimensions are unchanged.
4. Multiply by the reverse factor 2: $1(2) = 2$ and $\frac{3}{2}(2) = 3$.
5. Compare $1 \leq 2$ and $\frac{3}{2} > 1$. At least one dimension exceeds the frame.

Problem 5

1. Actual dimensions: $3(10) = 30$ m and $1(10) = 10$ m.
2. New drawing lengths: $30/5 = 6$ and $10/5 = 2$ grid units.
3. Length factor $= 10/5 = 2$; actual dimensions are unchanged.
4. Areas: $3(1) = 3$ and $6(2) = 12$. The ratio is $12/3 = 4$.
5. Compare $6 \leq 6$ and $2 \leq 3$. Both fit.

Problem 6

1. Actual dimensions: $4(5) = 20$ m and $3(5) = 15$ m.
2. New drawing lengths: $20/10 = 2$ and $15/10 = \frac{3}{2}$ grid units.
3. Length factor $= 5/10 = \frac{1}{2}$; actual dimensions are unchanged.
4. Frame area is $6(6) = 36$; subtract the redraw area $2(\frac{3}{2}) = 3$ to leave 33.
5. Compare $2 \leq 6$ and $\frac{3}{2} \leq 6$. Both fit.
6. Join the four corners in order: $(0, 0), (2, 0), (2, \frac{3}{2}), (0, \frac{3}{2})$.

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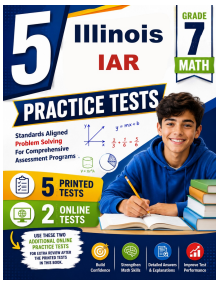

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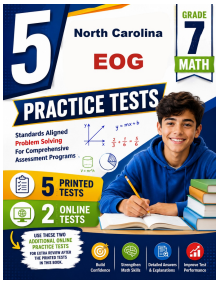

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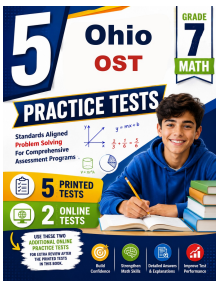

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