Reproducing Scale Drawings at a Different Scale

Explore ideas and representations

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

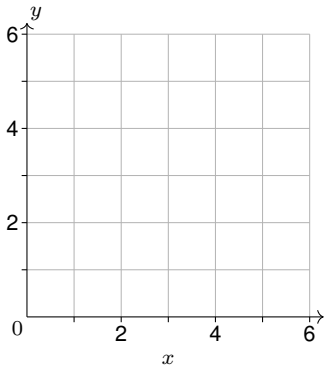
A line is 3 cm at 4 m/cm. How long is it on a redraw at 2 m/cm?

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

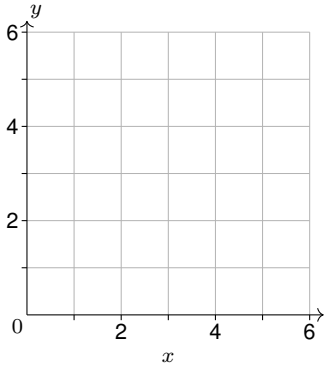
Show your thinking.

1. A plan is 2 by 1 grid units, at 6 m per unit. Find its dimensions at 3 m per unit. Draw the new rectangle from $(0, 0)$. Verify one actual length.



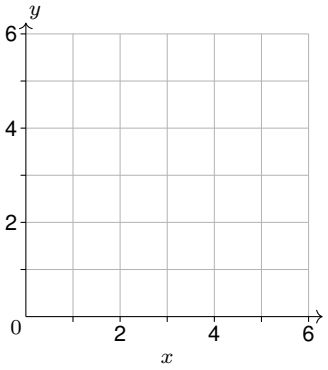
2. A plan is 3 by 2 grid units, at 4 m per unit. Find its dimensions at 2 m per unit. Give the midpoint of the new diagonal from the origin to the far corner.

3. A plan is 4 by 2 grid units, at 3 m per unit. Find its dimensions at 6 m per unit. Draw the new rectangle from $(0, 0)$. Find the old and new perimeters.



4. A plan is 2 by 3 grid units, at 2 m per unit. Find its dimensions at 4 m per unit. Check by recovering the old dimensions.

5. A plan is 3 by 1 grid units, at 10 m per unit. Find its dimensions at 5 m per unit. Draw the new rectangle from $(0, 0)$. Find the old and new drawing areas and the new-to-old area ratio.



6. A plan is 4 by 3 grid units, at 5 m per unit. Find its dimensions at 10 m per unit. 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. Vertices $(0,0), (4,0), (4,2), (0,2)$.
2. Factor 2; new size 6 by 4 units. Diagonal midpoint $(3,2)$.
3. Factor $\frac{1}{2}$; new size 2 by 1 units. Perimeters 12 and 6 units. 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.
5. Factor 2; new size 6 by 2 units. Areas 3 and 12 sq units; ratio 4. Vertices $(0,0), (6,0), (6,2), (0,2)$.
6. Factor $\frac{1}{2}$; new size 2 by $\frac{3}{2}$ units. Unused area 33 sq units.

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. Join the four corners in order: $(0,0), (4,0), (4,2), (0,2)$.

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: $(6/2, 4/2) = (3,2)$.

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. 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 $\frac{3}{2}(2) = 3$.

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. Join the four corners in order: $(0,0), (6,0), (6,2), (0,2)$.

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.

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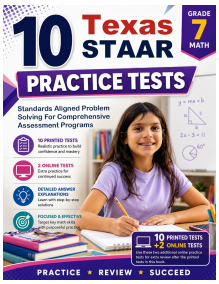

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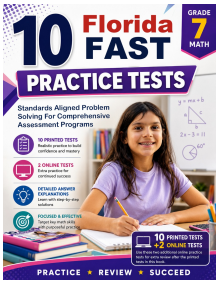

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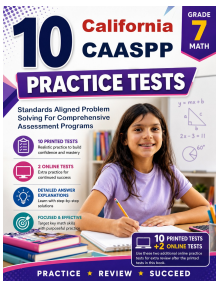

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