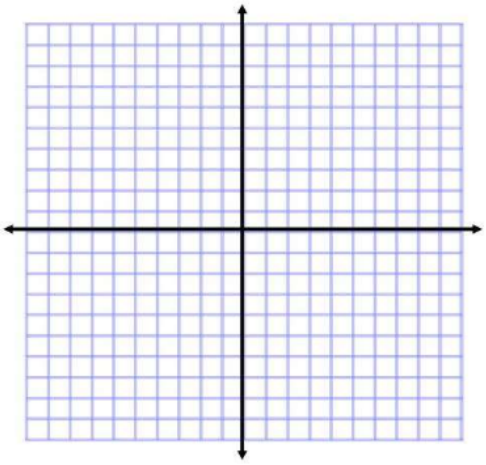
Bell Ringer - Get out Volume I book!

Section 9.4 – Composition of Isometries

1. ΔXYZ has vertices X(-4, 0), Y(-6, 6) and Z(-1, 5). What are the coordinates of the vertices of $(R_{x=3} \circ T_{<3,4>})(\Delta XYZ)$

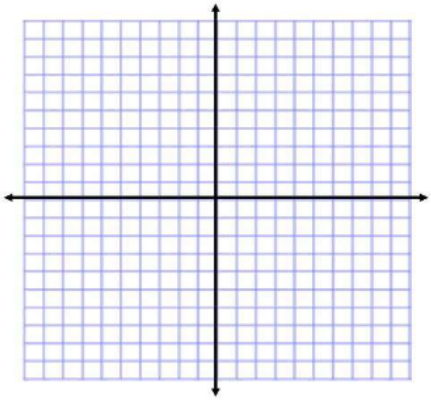
X''(,), Y''(,), Z''(,)



2. Write a single transformation rule that has the same effect on the point shown as each composition of transformations.

a. $T_{<-3,5>} \circ T_{<-1,2>}$

b. $R_{y=-2} \circ R_{y=5}$



3. Write an exponential equation with a y-intercept of 3 and a common ratio of ½

4. Write a linear equation with a y-intercept of 3 and a slope of ½

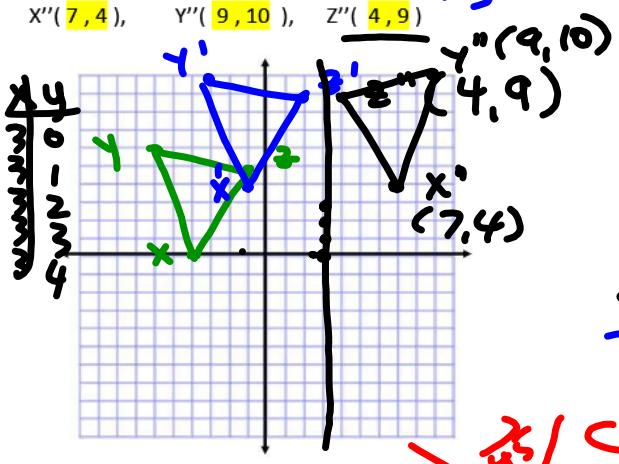
5. Write an exponential equation of a geometric sequence with an initial value of 3 and a common ratio of ½

Solutions

Section 9.4 – Composition of Isometries

1. ΔXYZ has vertices X(-4, 0), Y(-6, 6) and Z(-1, 5). What are the coordinates of the vertices of $(R_{x=3} \circ T_{<3,4>})(\Delta XYZ)$

X''(7 , 4), Y''(9 , 10), Z''(4 , 9)



2. Write a single transformation rule that has the same effect on the point shown as each composition of transformations.

a. $T_{<-3,5>} \circ T_{<-1,2>}$

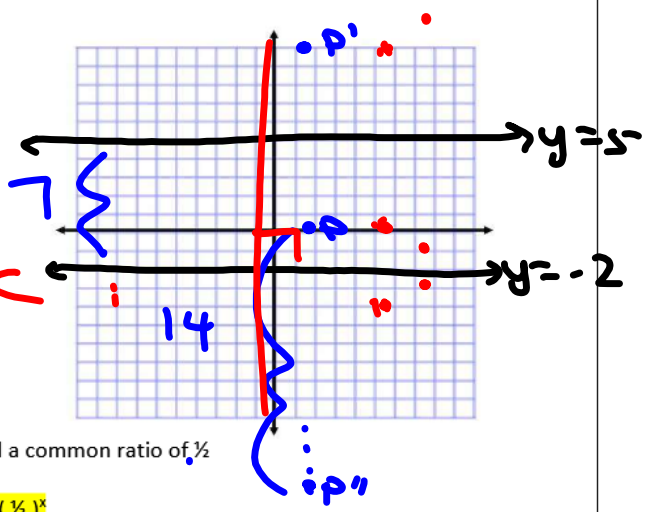
$T_{<-4,7>}$

(left 4 and up 7)

b. $R_{y=-2} \circ R_{y=5}$

$T_{<0,-14>}$

Translates down 14



3. Write an exponential equation with a y-intercept of 3 and a common ratio of ½

$Y = 3(\frac{1}{2})^x$

4. Write a linear equation with a y-intercept of 3 and a slope of ½

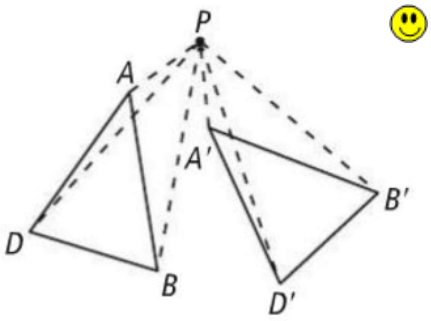
$Y = \frac{1}{2}x + 3$

5. Write an exponential equation of a geometric sequence with an initial value of 3 and a common ratio of ½

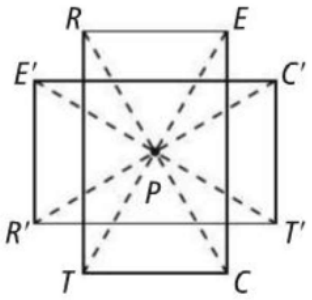
$y = 3(\frac{1}{2})^{x-1}$ $A(n) = 3(\frac{1}{2})^{n-1}$

correct 9.3 #s 1-4, 7-9, 11-14, 20, 27-32

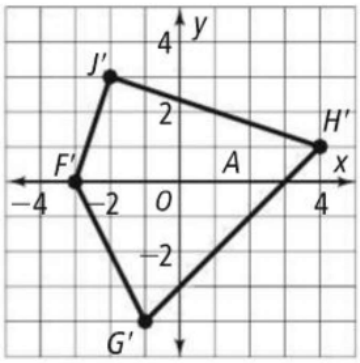
1.



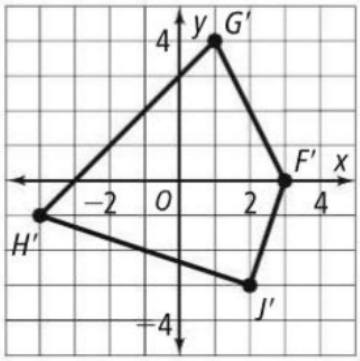
2.



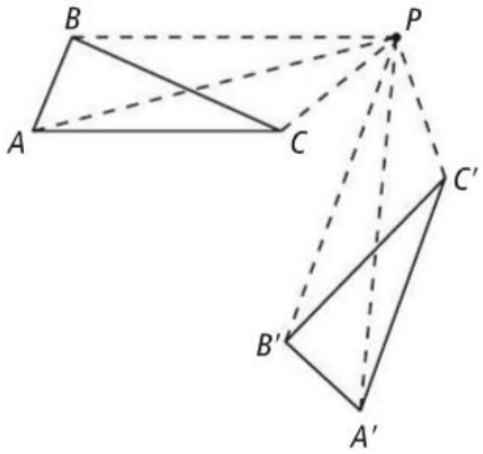
3.



4.



7.

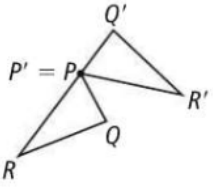


8. R

9. $\overline{SE}$

11. Draw $\overline{AO}$ and $\overline{A'O}$ and then measure $\angle AOA'$.

12. The diagram shows a reflection, not a rotation. R' is a 115° clockwise rotation of R. All points of $\triangle PQR$ must be rotated counterclockwise.



13. Both are rigid motions. A reflection reverses orientation. A rotation has the same orientation.

14. $(-x, -y)$; Sample: The coordinates are the same as a single rotation of 180° since 135° + 45° = 180°.

20. 168.75°

27. H

28. M

29. $\overline{BC}$

30. C

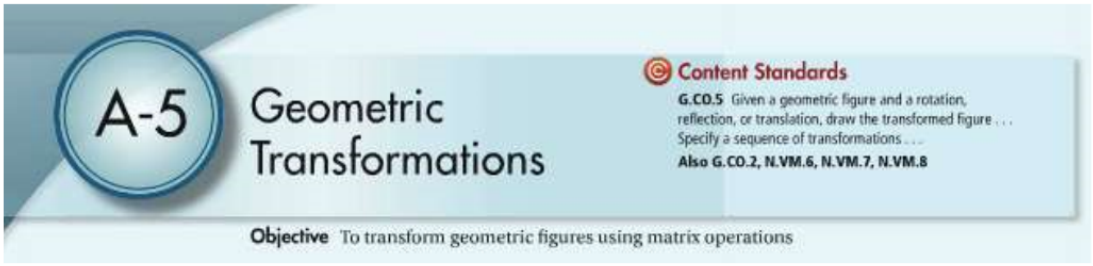
31. $\overline{LM}$

32. A

due tomorrow
9.4 #s 1-8, 10-16 evens, 19-20, 26-32 evens

GRAB OLD BOOK - Volume I

pg H39


A-5
Geometric Transformations
Content Standards
G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure . . . Specify a sequence of transformations . . .
Also G.CO.2, N.VM.6, N.VM.7, N.VM.8
Objective To transform geometric figures using matrix operations

PH39

Solve It: Getting Ready!

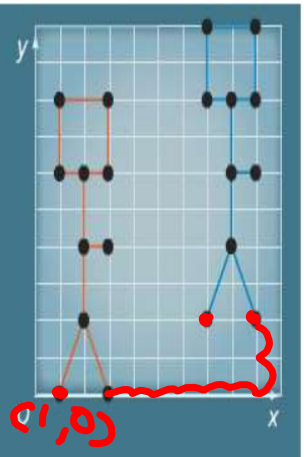
The matrix R contains the 10 points that define the red figure.

$$R = \begin{bmatrix} 1 & 3 & 2 & 2 & 3 & 1 & 2 & 3 & 1 & 3 \\ 0 & 0 & 2 & 4 & 4 & 6 & 6 & 6 & 8 & 8 \end{bmatrix} + \begin{bmatrix} 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 \\ 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 \end{bmatrix} =$$

x
y

Find the matrix B that contains the 10 corresponding points of the blue figure. What is the matrix T for which $R + T = B$? Explain your reasoning.

$$\begin{bmatrix} 7 & 9 & 8 & 8 & 9 & 7 & 8 & 9 & 7 & 9 \\ 2 & 2 & 4 & 6 & 6 & 8 & 8 & 10 & 10 & 10 \end{bmatrix}$$

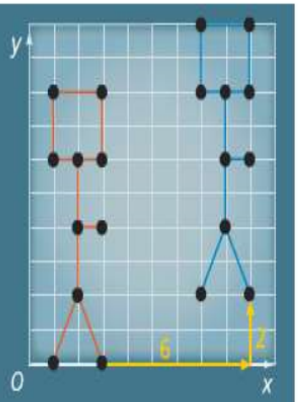


Solve It: Getting Ready!

The matrix R contains the 10 points that define the red figure.

$$R = \begin{bmatrix} 1 & 3 & 2 & 2 & 3 & 1 & 2 & 3 & 1 & 3 \\ 0 & 0 & 2 & 4 & 4 & 6 & 6 & 6 & 8 & 8 \end{bmatrix}$$

Find the matrix B that contains the 10 corresponding points of the blue figure. What is the matrix T for which $R + T = B$? Explain your reasoning.



Answer:

$B = \begin{bmatrix} 7 & 9 & 8 & 8 & 9 & 7 & 8 & 9 & 7 & 9 \\ 2 & 2 & 4 & 6 & 6 & 8 & 8 & 8 & 10 & 10 \end{bmatrix}$; The red figure corresponds with the blue figure given a translation of 6 horizontal units and 2 vertical units. So you add a matrix to R that adds 6 to each x-value and 2 to each y-value to get matrix B: $T = \begin{bmatrix} 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 \\ 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 \end{bmatrix}$.

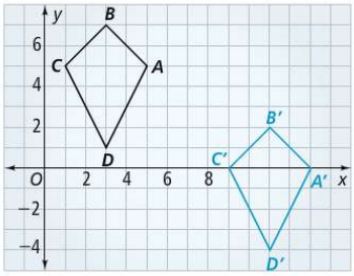
pg H40

Problem 1 Translating a Figure

Kite *ABCD* has vertices (5, 5), (3, 7), (1, 5), and (3, 1). If you translate it 8 units to the right and 5 units down, what are the coordinates of the vertices of its image *A'B'C'D'*? Use matrix addition. Draw *ABCD* and its image.

Preimage Vertices		Translation Matrix		Image Vertices
$A\ B\ C\ D$		Add 8 to each x-coordinate.		$A'\ B'\ C'\ D'$
$\begin{bmatrix} 5 & 3 & 1 & 3 \\ 5 & 7 & 5 & 1 \end{bmatrix}$	$+$	$\begin{bmatrix} 8 & 8 & 8 & 8 \\ -5 & -5 & -5 & -5 \end{bmatrix}$	$=$	$\begin{bmatrix} 13 & 11 & 9 & 11 \\ 0 & 2 & 0 & -4 \end{bmatrix}$
		Subtract 5 from each y-coordinate.		

The vertices of the preimage, $A(5, 5)$, $B(3, 7)$, $C(1, 5)$, and $D(3, 1)$ translate to the vertices $A'(13, 0)$, $B'(11, 2)$, $C'(9, 0)$, and $D'(11, -4)$ of the image.



PH40

Got It? got it pg H40

Reasoning Kite $ABCD$ has vertices (5, 5), (3, 7), (1, 5), and (3, 1). If you translate it 8 units to the right and 5 units down, its image $A'B'C'D'$ has vertices (13, 0), (11, 2), (9, 0), and (11, −4). How would you translate the kite image $A'B'C'D'$ to the kite preimage $ABCD$?

Got It? 1. a. **Reasoning** How would you translate the kite image $A'B'C'D'$ to the kite preimage $ABCD$?

8 right
5 down

b. A pentagon has vertices (0, −5), (−1, −1), (−5, 0), (1, 3), and (4, 0). Use matrix addition to translate the pentagon 3 units left and 2 units up. What are the vertices of the image? Graph the preimage and the image.

$T = \begin{bmatrix} 8 & 8 & 8 & 8 \\ -5 & -5 & -5 & -5 \end{bmatrix}$

$T = \begin{bmatrix} -3 & -3 & -3 & -3 \\ 2 & 2 & 2 & 2 \end{bmatrix}$

Just list vertices...

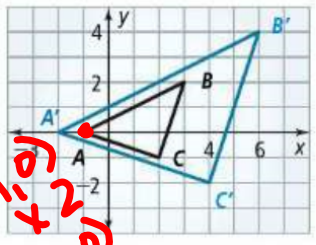
PH40

pg H40 Dilation...

You enlarge or reduce a figure with a **dilation**. You use scalar multiplication to dilate a figure with center of dilation at the origin. In this book, dilations have their centers at the origin.

$$2\begin{bmatrix} A & B & C \\ -1 & 3 & 2 \\ 0 & 2 & -1 \end{bmatrix} = \begin{bmatrix} A' & B' & C' \\ -2 & 6 & 4 \\ 0 & 4 & -2 \end{bmatrix}$$

Scale factor is 2



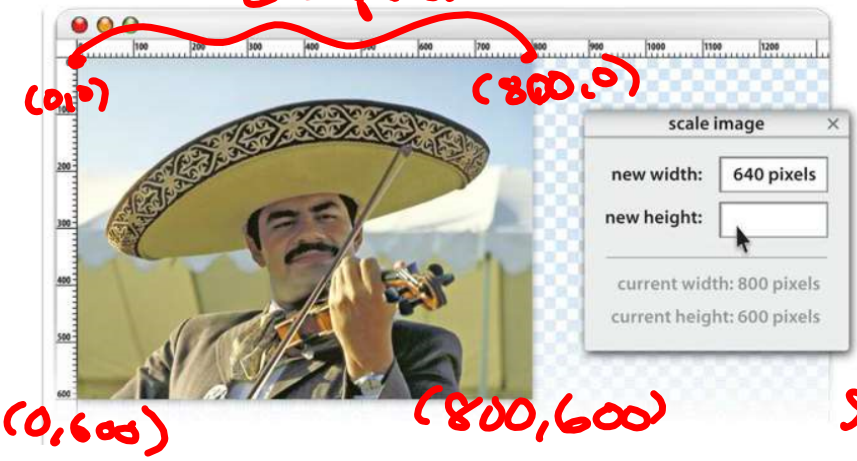
(-1,0) ×2 (-2,0)

PH40

pg H41

Problem 2 **Dilating a Figure**

Digital Media The width of the digital picture is presently 800 pixels (approximately 11.1 in.). Its height is 600 pixels (approximately 8.3 in.). You want to reduce its width as shown. This will allow the picture to fit on any computer screen without scrolling. Using a dilation, what are the coordinates of the vertices of the reduced image?



old current width: 800 pixels (Pre-Image)

new width: 640 pixels (Image)

Find scale factor...

$\frac{\text{Image}}{\text{Pre-Image}} = \frac{640}{800}$

scale factor = 0.8

PH41

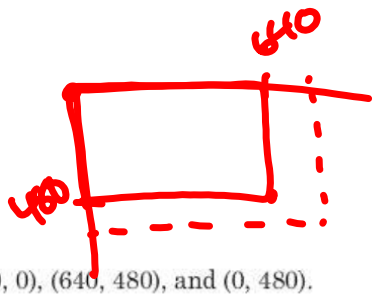
pg H41

Step 1 Find the scale factor.

Dilated picture width: 640 pixels

Current picture width: 800 pixels

Scale factor $= \frac{\text{Dilated Width}}{\text{Current Width}} = \frac{640}{800}$, or 0.8.



Step 2 Multiply the preimage matrix by the scale factor, 0.8.

$$0.8\begin{bmatrix} 0 & 800 & 800 & 0 \\ 0 & 0 & 600 & 600 \end{bmatrix} = \begin{bmatrix} 0 & 640 & 640 & 0 \\ 0 & 0 & 480 & 480 \end{bmatrix}$$

The coordinates of the vertices of the reduced image are (0, 0), (640, 0), (640, 480), and (0, 480).

PH41

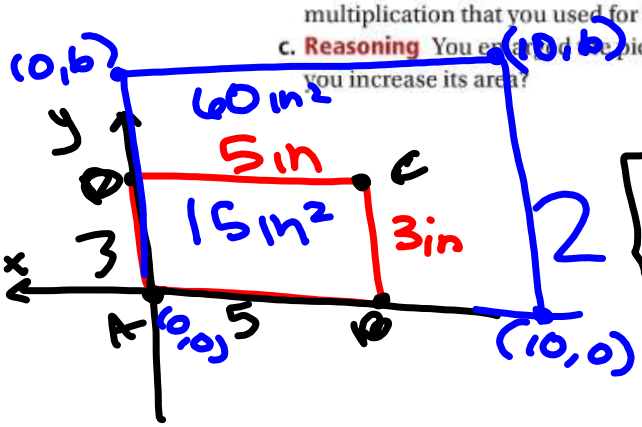
Got it pg H41

Got It? 2. You are to enlarge a picture by the factor 2. The preimage is 5 in. by 3 in.

a. Write a matrix of coordinates of the preimage vertices. Make one vertex (0, 0).

b. What are the coordinates of the vertices of the image? Show the multiplication that you used for the dilation.

c. **Reasoning** You enlarged the picture by the factor 2. By what factor did you increase its area?



$$2\begin{bmatrix} 0 & 5 & 5 & 0 \\ 0 & 0 & 3 & 3 \end{bmatrix} = \begin{bmatrix} 0 & 10 & 10 & 0 \\ 0 & 0 & 6 & 6 \end{bmatrix}$$

$\frac{60}{15} = 4\times$ bigger

PH41

pg H42

Rotation

A **rotation** turns a figure about a fixed point—the **center of rotation**. You can multiply a figure's vertex matrix by a rotation matrix to find the vertices of the rotation image. In this book, rotations are counterclockwise about the origin.

The matrix $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ rotates a figure 90°. A 90° rotation followed by another 90° rotation, or

$$\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}^2 = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix},$$

is a 180° rotation. Rotate another 90° for a 270° rotation.

*

take note

Properties **Rotation Matrices for the Coordinate Plane**

90° Rotation	180° Rotation	270° Rotation	360° Rotation
$\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$	$\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$	$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$	$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

PH42

Got it pg H42

D'(0, 3) E'(4, 4) F'(1, -1)

Got It? 3. Rotate the triangle with vertices $D(-3, 0)$, $E(-4, 4)$, and $F(1, 1)$ the indicated amount. What are the vertices of the image? Graph the preimage and the image in the same coordinate plane.

a. 270° (2x2) (2x3)

$$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} -3 & -4 & 1 \\ 0 & 4 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 4 & 1 \\ 3 & 4 & -1 \end{bmatrix}$$

b. 360°

pg H43 Reflections...

A *reflection* maps a point or figure in the coordinate plane to its mirror image using a specific line as its line of reflection. In this book, the lines of reflection are $y = 0$ (the x-axis), $x = 0$ (the y-axis), $y = x$, and $y = -x$.

take note

Properties Reflection Matrices for the Coordinate Plane

across x-axis	across y-axis	across $y = x$	across $y = -x$
$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$	$\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$	$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$	$\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$

PH43

Got it pg H43

Got It? **4.** Reflect the quadrilateral with vertices $E(1, 1)$, $F(3, 1)$, $G(6, 4)$, and $H(1, 3)$ across the indicated line. What are vertices of the image? Graph the preimage and the image in the same coordinate plane.

a. x-axis **b.** $y = x$

(2x2) (2x4)

$$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 6 & 1 \\ 1 & 1 & 4 & 3 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 3 & 6 & 1 \\ -1 & -1 & -4 & -3 \end{bmatrix}$$

E'(1,-1)
F'(3,-1)
G'(6,-4)
H'(1,-3)

hw A5 #s 11-12, 17-18, 23-24, 26-27, 30, 32