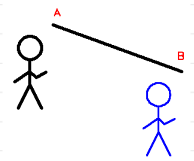
1. TRANSLATION

Movement of each point on a plane in a certain distance and direction (which is represented by a vector).

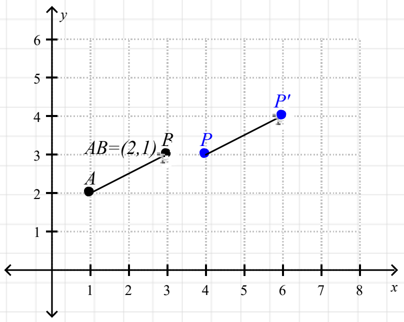
Following image is translated under the vector $\overrightarrow{AB}$.



Let $A(1,2)$ and $B(3,3)$ be two points.

Let's obverse the translation of point $P(4,3)$ under the vector

$\overrightarrow{AB} = (2,1) = \begin{pmatrix}2\\1\end{pmatrix}$.



$P'(6,4)$ is the image of $P(4,3)$ under translation represented by $\begin{pmatrix}2\\1\end{pmatrix}$ vector.

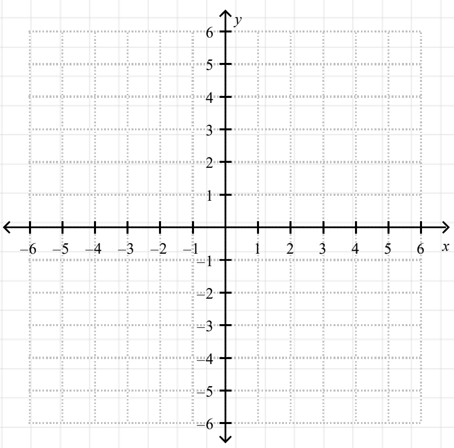
In Matrix notation, translation can be formulized as following:

Point + Translation Vector = Image

That is,

$$\overset{P}{\begin{pmatrix}4\\3\end{pmatrix}} + \overset{\overrightarrow{AB}}{\begin{pmatrix}2\\1\end{pmatrix}} = \overset{P'}{\begin{pmatrix}6\\4\end{pmatrix}}$$

Example: Find the image of points $A(-4,3)$ $B(3,2)$ $C(0,5)$ under the translation $T = \begin{pmatrix}-2\\1\end{pmatrix}$ and show them on the following coordinate plane.



Example: Find the image of $y = 2x+1$ under translation $T = \begin{pmatrix}2\\-3\end{pmatrix}$.

Solution 1:

$$\begin{pmatrix}x\\2x+1\end{pmatrix} + \begin{pmatrix}2\\-3\end{pmatrix} = \begin{pmatrix}x+2\\2x-2\end{pmatrix}$$

Let $x+2 = u$ then $2x-2 = 2u-6$

That is, $\begin{pmatrix}x+2\\2x-2\end{pmatrix} = \begin{pmatrix}u\\2u-6\end{pmatrix}$, here convert u into x, so $\begin{pmatrix}x\\2x-6\end{pmatrix}$

That is, $y = 2x-6$

Solution 2:

If $y = 2x+1$ is translated under $\begin{pmatrix}2\\-3\end{pmatrix}$, then the image is

$y-(-3) = 2(x-2)+1$

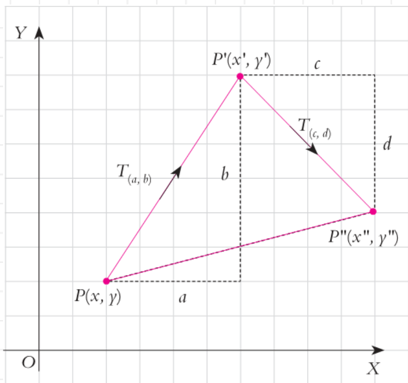
So, $y = 2x-6$

Example: Find the image of $y = x^2 - 2x + 1$ under translation $T = \begin{pmatrix}3\\-4\end{pmatrix}$

Composition of Translation

Let $P(x,y)$ is translated to $P'(x',y')$ under $T_1 = \begin{pmatrix}a\\b\end{pmatrix}$,

then $P'(x',y')$ is translated to $P''(x'',y'')$ under $T_2 = \begin{pmatrix}c\\d\end{pmatrix}$.



That is, $\overset{P}{\begin{pmatrix}x\\y\end{pmatrix}} + \begin{pmatrix}a\\b\end{pmatrix} = \overset{P'}{\begin{pmatrix}x'\\y'\end{pmatrix}} + \begin{pmatrix}c\\d\end{pmatrix} = \overset{P''}{\begin{pmatrix}x''\\y''\end{pmatrix}}$ or

$$T_1 o T_2 = \overset{P}{\begin{pmatrix}x\\y\end{pmatrix}} + \begin{pmatrix}a+c\\b+d\end{pmatrix} = \overset{P''}{\begin{pmatrix}x''\\y''\end{pmatrix}}$$

Example: Find the image of $M(4,-6)$ when translated through $T_1 = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and then $T_2 = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$.

Example: If point $M(4,-6)$ is translated through $T_1 = \begin{pmatrix} 4 \\ -7 \end{pmatrix}$ and then through T_2, then image is $M''(-5,11)$. Find T_2.

Example: (UAN 2003)

The $2x+3y=6$ line is translated with $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ matrix and then translated again with $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ matrix. The image is ...

Assignment:

1. Find the image of $A(-4,1)$, $B(-5,6)$ and $C(-1,7)$ under translation $T = \begin{pmatrix} -4 \\ 2 \end{pmatrix}$.

2. The image of $(4,9)$ under translation T is $(-1,12)$. Find translation T.

3. Given the points $A(1,4)$, $B(-3,2)$ and $C(1,4)$. Find
   a. the image of A under translation of vector BC.

   b. the image of C under translation of vector BA.

4. Find the image of $3x-4y+2=0$ under translation $T = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$.

5. Find the image of parabola $y^2+2x+3=0$ under translation $T = \begin{pmatrix} -4 \\ 2 \end{pmatrix}$.

6. Find the image of circle $x^2+y^2-3x+4y+9=0$ under translation $T = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$.

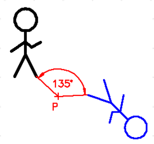
7. What is the image of $A(-1,4)$ when translated through $T_1 = \begin{pmatrix} 0 \\ -5 \end{pmatrix}$ and then $T_2 = \begin{pmatrix} -2 \\ 9 \end{pmatrix}$.

8. What is the image of $B(2,-1)$ when translated through $T_1 o T_2 o T_3$ if $T_1 = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$, $T_2 = \begin{pmatrix} -3 \\ -1 \end{pmatrix}$, and $T_3 = \begin{pmatrix} 5 \\ -6 \end{pmatrix}$.

2. ROTATION

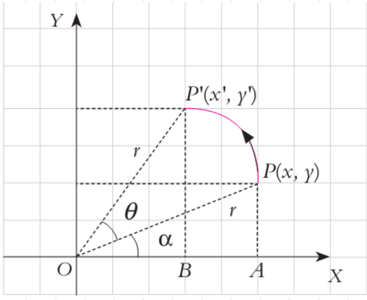
Revolving around a fixed point. Rotation is determined by three important items:

1. $P \rightarrow$ center of the rotation
2. clockwise $(-) \rightarrow$ direction of the rotation
3. $135^o \rightarrow$ measure of the rotation



1. Rotation of θ (degree or radian) around the origin $O(0,0)$

If $P(x,y)$ is rotated by θ around the origin $O(0,0)$ in a counterclockwise $(+)$ direction, then the image is $P'(x',y')$.



$$x = R\cdot\cos\alpha \qquad\qquad y = R\cdot\sin\alpha$$

$$\underline{x'} = R\cdot\cos(\alpha+\theta) = R\cdot(\cos\alpha\cdot\cos\theta - \sin\alpha\cdot\sin\theta)$$
$$= \underbrace{\qquad\qquad}_{x} \qquad \underbrace{\qquad\qquad}_{y}$$
$$= \underline{x\cdot\cos\theta - y\cdot\sin\theta}$$

$$\underline{y'} = R\cdot\sin(\alpha+\theta) = R\cdot(\sin\alpha\cdot\cos\theta + \cos\alpha\cdot\sin\theta)$$
$$= \underbrace{\qquad\qquad}_{y} \qquad \underbrace{\qquad\qquad}_{x}$$
$$= y\cdot\cos\theta + x\cdot\sin\theta$$
$$= \underline{x\cdot\sin\theta + y\cdot\cos\theta}$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix}$$

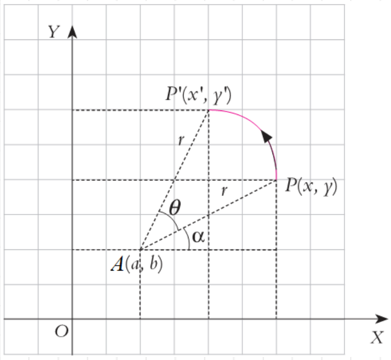
Example: Find the image of $P(2,5)$ under the rotation about origin of

- $\frac{\pi}{2}$
- $-\frac{\pi}{3}$

Example: Find the rotation of $y = 3x - 5$ under the rotation about origin of $-\pi$.

Example: (UN 2008 PAKET A/B)
Persamaan bayangan garis $y = 5x - 3$ karena rotasi dengan pusat $O(0,0)$ bersudut -90^o adalah ...
The rotation of $y = 5x - 3$ under the rotation about origin of -90^o is ...

2. Rotation of θ (degree or radian) around the center $A(a,b)$



$$x - a = R\cdot\cos\alpha \qquad\qquad y - b = R\cdot\sin\alpha$$

$$\underline{x' - a} = R\cdot\cos(\alpha+\theta) = R\cdot(\cos\alpha\cdot\cos\theta - \sin\alpha\cdot\sin\theta)$$
$$= \underbrace{\qquad\qquad}_{x-a} \qquad \underbrace{\qquad\qquad}_{y-b}$$
$$= \underline{(x-a)\cdot\cos\theta - (y-b)\cdot\sin\theta}$$

$$\underline{y' - b} = R\cdot\sin(\alpha+\theta) = R\cdot(\sin\alpha\cdot\cos\theta + \cos\alpha\cdot\sin\theta)$$
$$= \underbrace{\qquad\qquad}_{y-b} \qquad \underbrace{\qquad\qquad}_{x-a}$$
$$= (y-b)\cdot\cos\theta + (x-a)\cdot\sin\theta$$
$$= \underline{(x-a)\cdot\sin\theta + (y-b)\cdot\cos\theta}$$

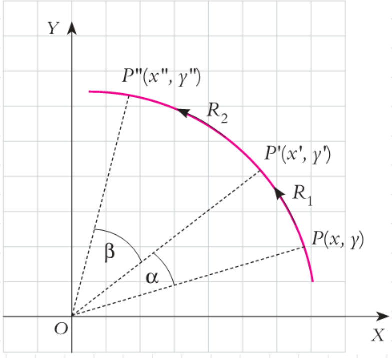
$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \cdot \begin{bmatrix} x-a \\ y-b \end{bmatrix} + \begin{bmatrix} a \\ b \end{bmatrix}$$

Example: Find the image of $P(2,5)$ under the rotation around the point $A(1,2)$ of

- $-\frac{\pi}{2}$
- $\frac{\pi}{3}$

Composition of Rotation

Let $P(x,y)$ is rotated about O through α to $P'(x',y')$, then $P'(x',y')$ is rotated about O through β to $P''(x'',y'')$.



As observed, $P''(x'',y'')$ is the rotation of $P(x,y)$ about O through $\alpha+\beta$. So,

$$\begin{bmatrix} x'' \\ y'' \end{bmatrix} = \begin{bmatrix} \cos(\alpha+\beta) & -\sin(\alpha+\beta) \\ \sin(\alpha+\beta) & \cos(\alpha+\beta) \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix}$$

Example: Find the image of $P(4,2)$ rotated through 15^o , then rotated through 75^o about origin.

Assignment:

1. Find the images of $A(-3,2)$, $B(5,-4)$ and $C(2,-6)$ under following rotations

Rotation Center & Rotation Angle	$A(-3,2)$	$B(5,-4)$	$C(2,-6)$
$O(0,0)$ & $\frac{\pi}{2}$			
$O(0,0)$ & $\frac{\pi}{3}$			
$O(0,0)$ & $-\frac{\pi}{4}$			
$Q(2,-1)$ & $-\frac{\pi}{2}$			
$Q(-3,4)$ & π			

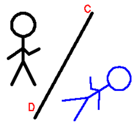
2. Find the image of $x-2y-1=0$ under the rotation of $\frac{\pi}{2}$ around the origin.

3. Find the image of $3x+y+1=0$ under the rotation of $-\frac{\pi}{2}$ around $Q(1,3)$.

4. Find the image of $P(-2,5)$ rotated through 75^o , then through 45^o about origin.

3. REFLECTION

Mirroring with respect to axis of reflection (or axis of symmetry)

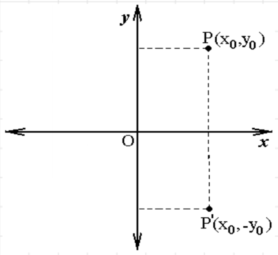


1. Reflection of a Point with respect to the Coordinate axes

The reflection of $P(x_0, y_0)$ wrt x-axis is

$P'(x_0, -y_0)$

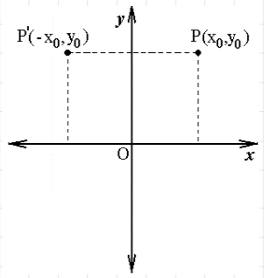
$$P' = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ y_0 \end{bmatrix}$$



The reflection of $P(x_0, y_0)$ wrt y-axis is

$P'(-x_0, y_0)$

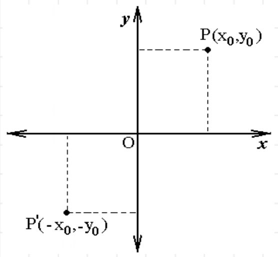
$$P' = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ y_0 \end{bmatrix}$$



The reflection of $P(x_0, y_0)$ wrt origin is

$P'(-x_0, -y_0)$

$$P' = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ y_0 \end{bmatrix}$$

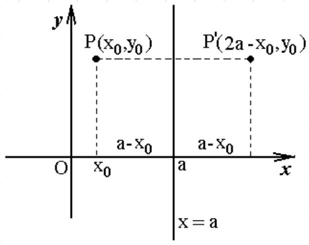


Example: Find the reflection of $B(-4,-5)$, $D(-4,5)$ & $E(a-b,-b)$ with recpect to the *x*–axis, *y*-axis, and origin.

2. Reflection of a Point with respect to Lines Parallel to axes

The reflection of $P(x_0, y_0)$ wrt $x = a$ is

$P'(2a - x_0, y_0)$

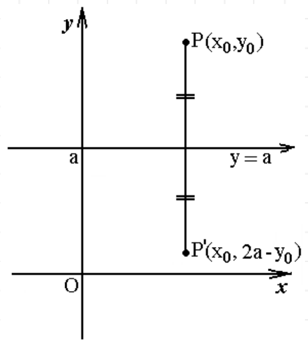


$$P' = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \cdot \left(\begin{bmatrix} x_0 \\ y_0 \end{bmatrix} - \begin{bmatrix} a \\ 0 \end{bmatrix} \right) + \begin{bmatrix} a \\ 0 \end{bmatrix} \Rightarrow P' = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} + \begin{bmatrix} 2a \\ 0 \end{bmatrix}$$

Example: Find the reflection of $M(-12,7)$ with recpect to the line $x = -3$.

The reflection of $P(x_0, y_0)$ wrt $y = a$ is

$P'(x_0, 2a - y_0)$



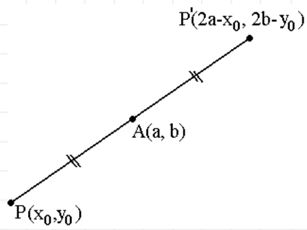
$$P' = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \cdot \left(\begin{bmatrix} x_0 \\ y_0 \end{bmatrix} - \begin{bmatrix} 0 \\ b \end{bmatrix} \right) + \begin{bmatrix} 0 \\ b \end{bmatrix} \Rightarrow P' = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} + \begin{bmatrix} 0 \\ 2b \end{bmatrix}$$

Example: Find d the reflection of $M(10,-8)$ with recpect to the $y = -10$

3. Reflection of a Point with respect to Another Point

The reflection of $P(x_0, y_0)$ wrt $A(a,b)$ is

$P'(2a - x_0, 2b - y_0)$



$$P' = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \cdot \left(\begin{bmatrix} x_0 \\ y_0 \end{bmatrix} - \begin{bmatrix} a \\ b \end{bmatrix} \right) + \begin{bmatrix} a \\ b \end{bmatrix} \Rightarrow P' = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} + \begin{bmatrix} 2a \\ 2b \end{bmatrix}$$

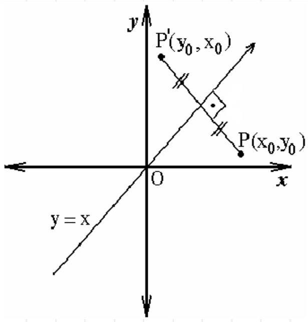
Example: Find the reflection of $A(5,-3)$ with respect to $(-4,2)$

4. Reflection of a Point wrt the Lines $y = x$ and $y = -x$

The reflection of $P(x_0, y_0)$ wrt $y = x$ is

$$P'(y_0, x_0)$$

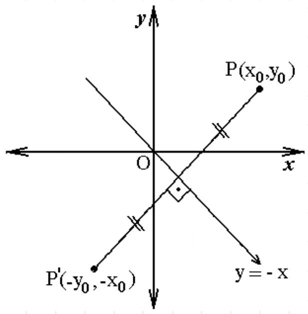
$$P' = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ y_0 \end{bmatrix}$$



The reflection of $P(x_0, y_0)$ wrt $y = -x$ is

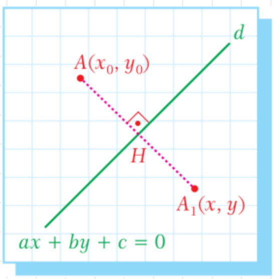
$$P'(-y_0, -x_0)$$

$$P' = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ y_0 \end{bmatrix}$$



Example: Find the reflection of $L(-7,4)$ with recpect to the line $y = x$ and $y = -x$.

5. Reflection of a Point with respect to a Line



Find the equation of line AA_1

Find intersection point H

Since H will be midpoint of AA_1,

We can find A_1

Example: Find the reflection of $(-2,4)$ wrt $x - y - 6 = 0$.

Example: Find the reflection of $y = 2x - 1$ wrt $y = x$ axis.

Hint: Choose two points of line $y = 2x - 1$

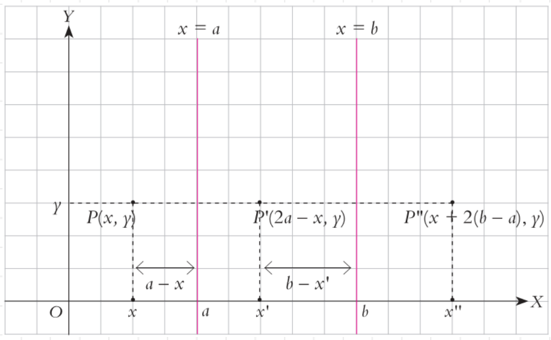
Reflect these points.

Find the line passing through these image points

Composition of Reflection

1. Reflection of a Point with respect to Parallel Lines

$P(x, y)$ is reflected wrt $x = a$ and then P' is reflected wrt $x = b$.

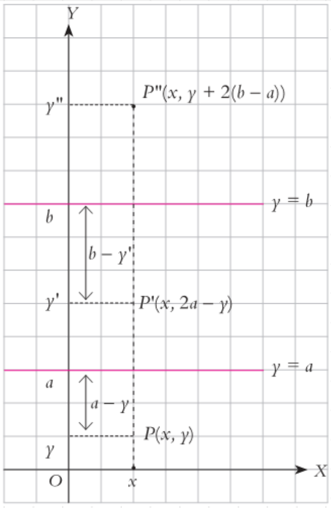


$$P'' = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \cdot \left(\overbrace{\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 2a \\ 0 \end{bmatrix}} \right) + \begin{bmatrix} 2b \\ 0 \end{bmatrix} \Rightarrow$$

$$P'' = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 2(b-a) \\ 0 \end{bmatrix}$$

Example: Find the image of $A(-2,4)$ when reflected wrt the line $x = 2$ and then reflected wrt the line $x = -5$

$P(x,y)$ is reflected wrt $y=a$, then P' is reflected wrt $y=b$.



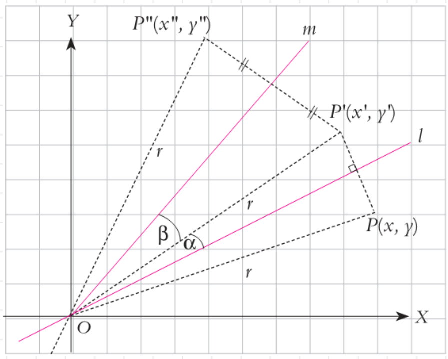
$$P''=\begin{bmatrix}1&0\\0&-1\end{bmatrix}\cdot\left(\overbrace{\begin{bmatrix}1&0\\0&-1\end{bmatrix}\cdot\begin{bmatrix}x\\y\end{bmatrix}+\begin{bmatrix}0\\2a\end{bmatrix}}\right)+\begin{bmatrix}0\\2b\end{bmatrix}\Rightarrow$$

$$P'=\begin{bmatrix}1&0\\0&1\end{bmatrix}\cdot\begin{bmatrix}x\\y\end{bmatrix}+\begin{bmatrix}0\\2(b-a)\end{bmatrix}$$

Example: Find the image of $B(3,-5)$ when reflected wrt the line $y=-3$ and then reflected wrt the line $y=7$.

2. Reflection of a Point with respect to Intersecting Lines

$P(x,y)$ is reflected wrt l line and then reflected wrt m line.



As observed, $m(POP'')=2(\alpha+\beta)$. So, we can find the image by rotation of $2(\alpha+\beta)$ around O, where O is the intersection point.

Example: (UN 2011 PAKET 12)
Persamaan bayangan garis $y=2x-3$ karena refleksi terhadap garis $y=-x$, dilanjutkan refleksi terhadap $y=x$ adalah ...
The image of $y=2x-3$ line when it is reflected with respect to $y=-x$ line and then reflected with respect to $y=x$ line is ...

Assignment:

1. Find the image of $A(-3,2)$, $B(5,-4)$ and $C(2,-6)$ with respect to following reflection axes.

with respect to	$A(-3,2)$	$B(5,-4)$	$C(2,-6)$
x–axis			
y–axis			
origin			
$x=4$			
$y=-3$			
$R(4,12)$			
$y=x$			
$y=-x$			
$y=2x-4$			

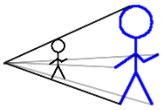
2. Find the reflection of $y=3x+5$ wrt $y=-x$ axis.

3. Find the reflection of $y=x^2-2x-3$ wrt $y=3$ line.

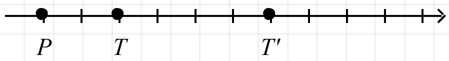
4. DILATION

Enlarging or reducing a plane without changing the shape.
Dilation is determined by two important items:

1. $P \to$ center of the dilation
2. $k \to$ dilation factor



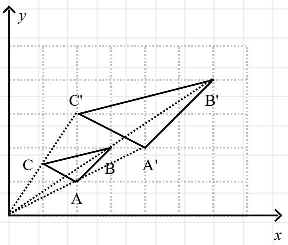
If T is dilated with center P by scale factor k, then T' is the image. So, $|PT'| = k \cdot |PT|$



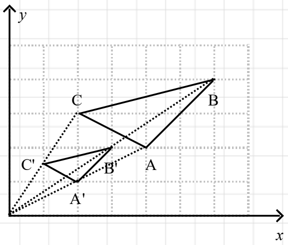
Dilation with center at P by scale factor k is denoted by $[P,k]$

Based on scale factor k, there are following possibilities:

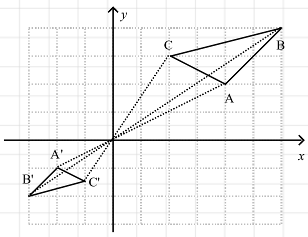
$1<k$



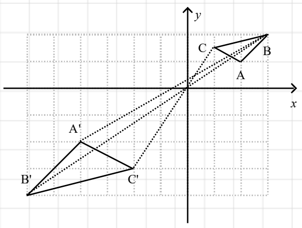
$0<k<1$



$-1<k<0$

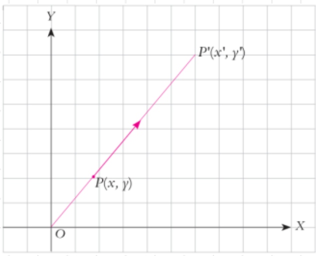


$k<-1$



1. Dilation with center at origin $O(0,0)$

Image of $P(x,y)$ under dilation $[O,k]$ is $P'(x',y')$.



$$x' = k \cdot x$$
$$y' = k \cdot y$$

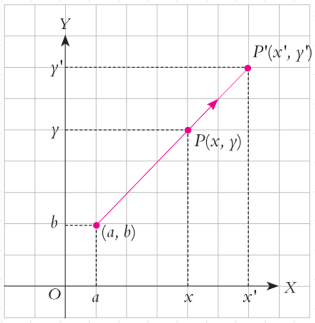
$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix}$$

Example: Find the following images under given dilations

Point	Dilation	Image
(4,12)	$[O,2]$	
	$[O,-3]$	
	$[O,-1/4]$	
	$[O,1/2]$	

2. Dilation with center at point $A(a,b)$

Image of $P(x,y)$ under dilation $[A(a,b),k]$ is $P'(x',y')$.



$$x' - a = k \cdot (x - a)$$
$$y' - b = k \cdot (y - b)$$

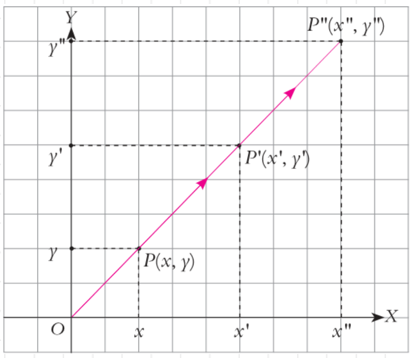
$$\begin{bmatrix} x'-a \\ y'-b \end{bmatrix} = \begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix} \cdot \begin{bmatrix} x-a \\ y-b \end{bmatrix} \Rightarrow \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix} \cdot \begin{bmatrix} x-a \\ y-b \end{bmatrix} + \begin{bmatrix} a \\ b \end{bmatrix}$$

Example: Find the following images under given dilations

Point	Dilation	Image
(4,8)	$[A(2,3),2]$	
	$[A(2,3),1/2]$	
	$[A(2,3),-1/3]$	

Composition of Dilation

Let $P(x,y)$ is dilated by scale factor k to $P'(x',y')$,
then $P'(x',y')$ is dilated by scale factor l to $P''(x'',y'')$



$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} \Rightarrow \begin{bmatrix} x'' \\ y'' \end{bmatrix} = \begin{bmatrix} l & 0 \\ 0 & l \end{bmatrix} \cdot \left(\begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} \right) \Rightarrow$$

$$\begin{bmatrix} x'' \\ y'' \end{bmatrix} = \begin{bmatrix} l \cdot k & 0 \\ 0 & l \cdot k \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix}$$

Example: Find the image of $M(-2,4)$ if it is dilated under $[O,3]$, and then dilated under $[O,-2]$.

Assignment:

1. Find the following images under given dilations

Point	Dilation	Image
$(10,4)$	$[O,1/2]$	
$(3,5)$	$[O,3]$	
$(-6,9)$	$[O,-1/3]$	
$(0,2)$	$[M(2,1),4]$	
$(7,-6)$	$[N(-2,4),-1/5]$	
$(3,6)$	$[P(-1,2),1/4]$	

2. Find the image of line $x-2y+3=0$ under the dilation of

- $[O,2]$
- $\left[O,-\dfrac{1}{2}\right]$
- $[A(2,3),-2]$

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5. COMBINATION OF TRANSFORMATIONS

Example: (UN 2007 PAKET B)
Bayangan garis $3x-y+2=0$ apabila direfleksikan terhadap garis $y=x$, dilanjutkan rotasi sebesar 90^o dengan pusat $O(0,0)$ adalah ...
The image of $3x-y+2=0$ when it is reflected with respect to $y=x$, then rotated around $O(0,0)$ by 90^o is ...

Example: (UN 2007 PAKET B)
Persamaan bayangan lingkaran $x^2+y^2=4$ bila dicerminkan terhadap garis $x=2$ dilanjutkan dengan translasi $\begin{pmatrix}-3\\4\end{pmatrix}$ adalah ...
The image of circle $x^2+y^2=4$ when it is reflected with respect to $x=2$, then translated through $\begin{pmatrix}-3\\4\end{pmatrix}$ is...

Example: (UN 2010 PAKET A)

Sebuah garis $3x+2y=6$ ditranslasikan dengan matiks $\begin{pmatrix}3\\-4\end{pmatrix}$, dilanjutkan dilatasi dengan pusat di O dan faktor 2. Hasil transformasinya adalah …

Line $3x+2y=6$ is translated through $\begin{pmatrix}3\\-4\end{pmatrix}$ and then dilated with center O by scale factor 2. The result of the transformation is…

Example: (UN 2012/D49)

Bayangan kurva $y=3x-9x^2$ jika dirotasi dengan pusat $O(0,0)$ sejauh 90^o dilanjutkan dengan dilatasi dengan pusat $O(0,0)$ dan faktor skala 3 adalah …

The image of curve $y=3x-9x^2$ when it is rotated around $O(0,0)$ by 90^o and then dilated with center $O(0,0)$ by scale factor 3 is …

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Review Test

1. The point B is translated by $\begin{pmatrix}2\\1\end{pmatrix}$ gives the point B^1. Then the point B^1 is translated by $\begin{pmatrix}4\\3\end{pmatrix}$ gives the point B^{11} (6, -1). Coordinate of the point B is …

   A.(3, 2) B.(2, 3) C.(0, -7) D.(-7, 0) E.(1, 8)

2. Given the line K : 2x + 3y = 5. If the line K is translated by $\begin{pmatrix}4\\5\end{pmatrix}$ gives the line k^1, then the equation of the line k^1 is …

   A.2x = 3y = 12 B.2 = 3y = 16 C.2x = 3y = 24

   D.2x = 3y = 25 E.2x + 3y = 28

3. The point P (2, -4) is reflected to the line x = -3 gives the point p^1. Coordinate of the point p^1 is …

   A.(-6, -4) B.(-8, -4) C.(-10, -4) D.(-12, -4) E.(-15, -4)

4. The point Q (1, -6) is reflected to the line y = -5 gives the point Q^1. Coordinate of the point Q^1 is …

   A.(1, -10) B.(1, -16) C.(1, 16) D.(1, -4) E.(1, 4)

5. The point (-2, 4) is reflected to the line y = -x gives the point ...

A.(-4, 2) B.(-4, -2) C.(-, -2) D.(4, 2) E.(2, -4)

6. The point A is rotated through 90° gives the point A^1. If A (3, -5) and the rotation is counter clockwise, then coordinate of the point A^1 is ...

A.(5, -3) B.(5, 3) C.(-5, -3) D.(3, 5) E.(-3, 5)

7. A figure in XY plane is rotated through 45° clockwise then reflected to Y axis. The matrix that represents the result of the two transformations mentioned is ...

A. $\frac{1}{2}\sqrt{2}\begin{pmatrix} -1 & 1 \\ -1 & 1 \end{pmatrix}$ B. $\frac{1}{2}\sqrt{2}\begin{pmatrix} 1 & -1 \\ 1 & -1 \end{pmatrix}$ C. $\frac{1}{2}\sqrt{2}\begin{pmatrix} -1 & -1 \\ -1 & -1 \end{pmatrix}$

D. $\frac{1}{2}\sqrt{2}\begin{pmatrix} -1 & -1 \\ -1 & 1 \end{pmatrix}$ E. $\frac{1}{2}\sqrt{2}\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

8. A plane figure is rotated through 30 counterclockwise then is rotated again through 45° counterclockwise. The matrix that represents the two transformations mentioned is ...

A. $\frac{1}{4}\begin{pmatrix} \sqrt{6}-\sqrt{2} & -\sqrt{6}-\sqrt{2} \\ \sqrt{6}+\sqrt{2} & \sqrt{6}-\sqrt{2} \end{pmatrix}$ B. $\frac{1}{4}\begin{pmatrix} \sqrt{6}-\sqrt{2} & -\sqrt{2}+\sqrt{6} \\ \sqrt{6}+\sqrt{2} & \sqrt{6}-\sqrt{2} \end{pmatrix}$

C. $\frac{1}{4}\begin{pmatrix} \sqrt{6}-\sqrt{2} & -\sqrt{2}-\sqrt{6} \\ \sqrt{6}+\sqrt{2} & \sqrt{6}+\sqrt{2} \end{pmatrix}$ D. $\frac{1}{4}\begin{pmatrix} \sqrt{6}-\sqrt{2} & -\sqrt{2}-\sqrt{6} \\ \sqrt{6}-\sqrt{2} & \sqrt{6}+\sqrt{2} \end{pmatrix}$

E. $\frac{1}{4}\begin{pmatrix} \sqrt{6}+\sqrt{2} & -\sqrt{6}-\sqrt{2} \\ \sqrt{6}+\sqrt{2} & \sqrt{6}-\sqrt{2} \end{pmatrix}$

9. Give the points: A (3, 2), B (5, 6), C (7, 2). The triangle ABC then gets a dilatation of scale factor 4 to the center O. The area of dilatation result is ...

A.100 B.120 C.128 D.144 E.168

10. If the point (2, 3) is reflected to the line x + 4y + 5 = 0 then the image is ...

A.$(-\frac{2}{17}, 2\frac{3}{17})$ B.$(\frac{2}{17}, 2\frac{3}{17})$ C.$(-2\frac{2}{17}, -1\frac{1}{17})$

D.$(-2\frac{2}{17}, 1\frac{1}{17})$ E.$(-\frac{4}{17}, -5\frac{16}{17})$

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