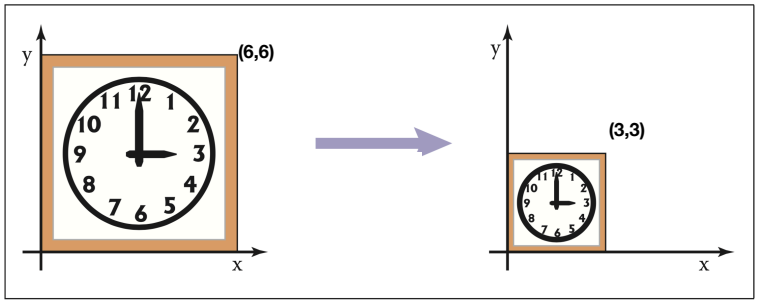
Lecture 03
Transformations in 2D
Short version

We will discuss transformation in 3D, and with full details, later in the course

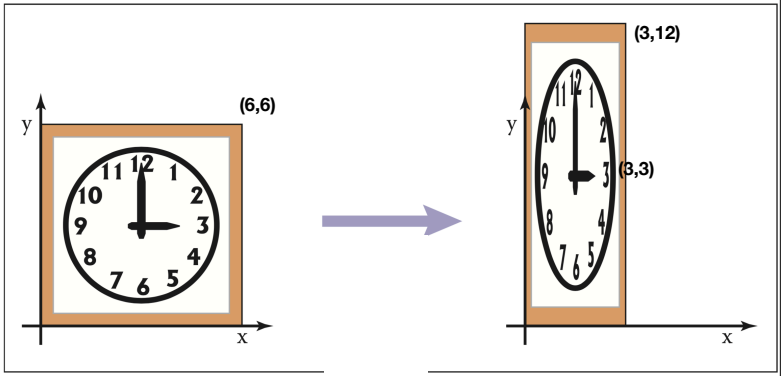
Scaling

- We can use different constants (s_x, s_y) for the x-axis vs. the y-axis. Then we shift each point (x,y) into the point
- $(x, y) \rightarrow (s_x \cdot x, \quad s_y \cdot y)$



Scaling

- Let s be a constant. If we move each point (x,y) into the point $(x, y) \rightarrow (s \cdot x, \quad s \cdot y)$ we scaled the image by s.



Scaling

- We might pick different constants to x and to y.
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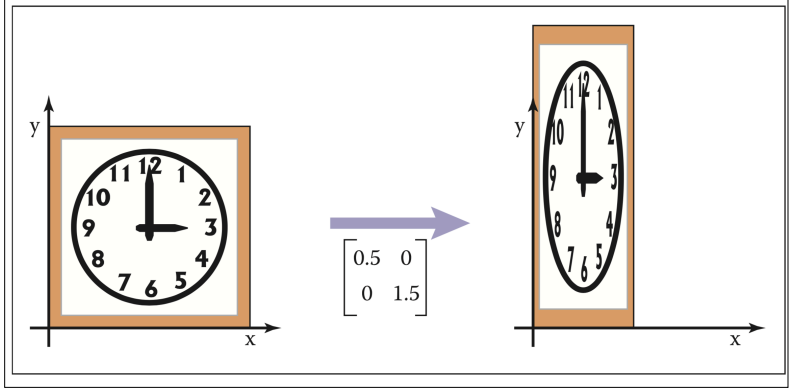
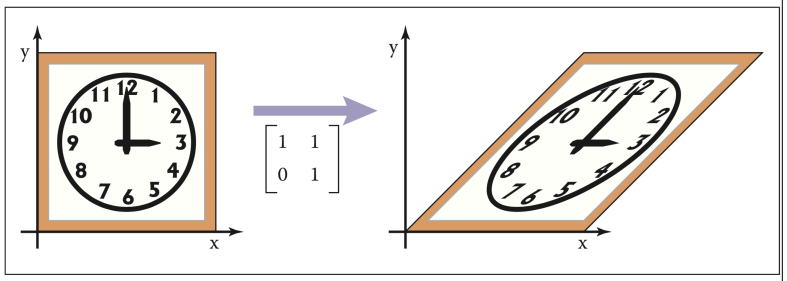


Shearing

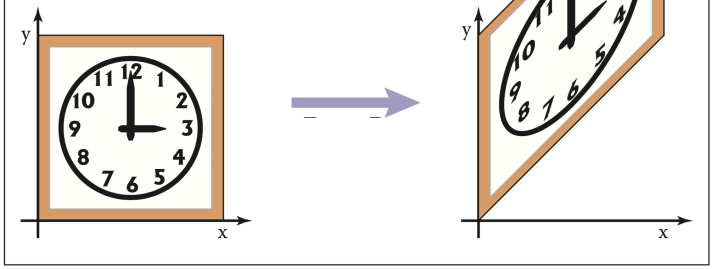
- If we move each point (x,y) into the point $(x, y) \rightarrow (x + y,\ y)$ we scaled the image by s.



Shearing

- Vertical shearing shifts each column based on the x value.

$$(x, y) \rightarrow (x,\ x + y)$$

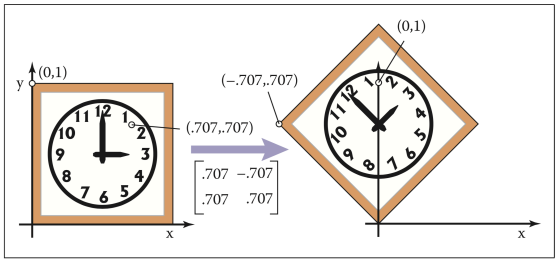


Rotation

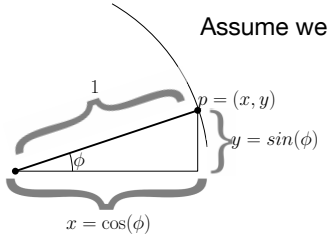
- Rotate counterclockwise by an angle ϕ about the origin.

$$(x, y) \rightarrow (x\cos\phi - y\sin\phi,\ \ x\sin\phi + y\cos\phi)$$

New *x* New *y*



Assume we rotate *p* by an angle θ CCW



$$\cos(\phi + \theta) =$$

$$\underbrace{\cos(\phi)\cos(\theta)}_{=x} - \underbrace{\sin(\phi)\sin(\theta)}_{=y}$$