

Computer Programming and the Arts

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Art 101, UCSC
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Week #5, Thursday

- Transformations in 2D
 - Affine isomorphisms
 - Translation
 - Rotation
 - Scale
 - Shear
 - Default coordinates

Affine Isomorphisms

$$\begin{aligned}x\text{-new} &= ax + by + c \\ y\text{ new} &= dx + ey + f\end{aligned}$$

$$\text{matrix: } \begin{pmatrix} a & b \\ d & e \end{pmatrix}$$

$$\text{vector: } \begin{pmatrix} c \\ f \end{pmatrix}$$

$$\det = ae - db \neq 0$$

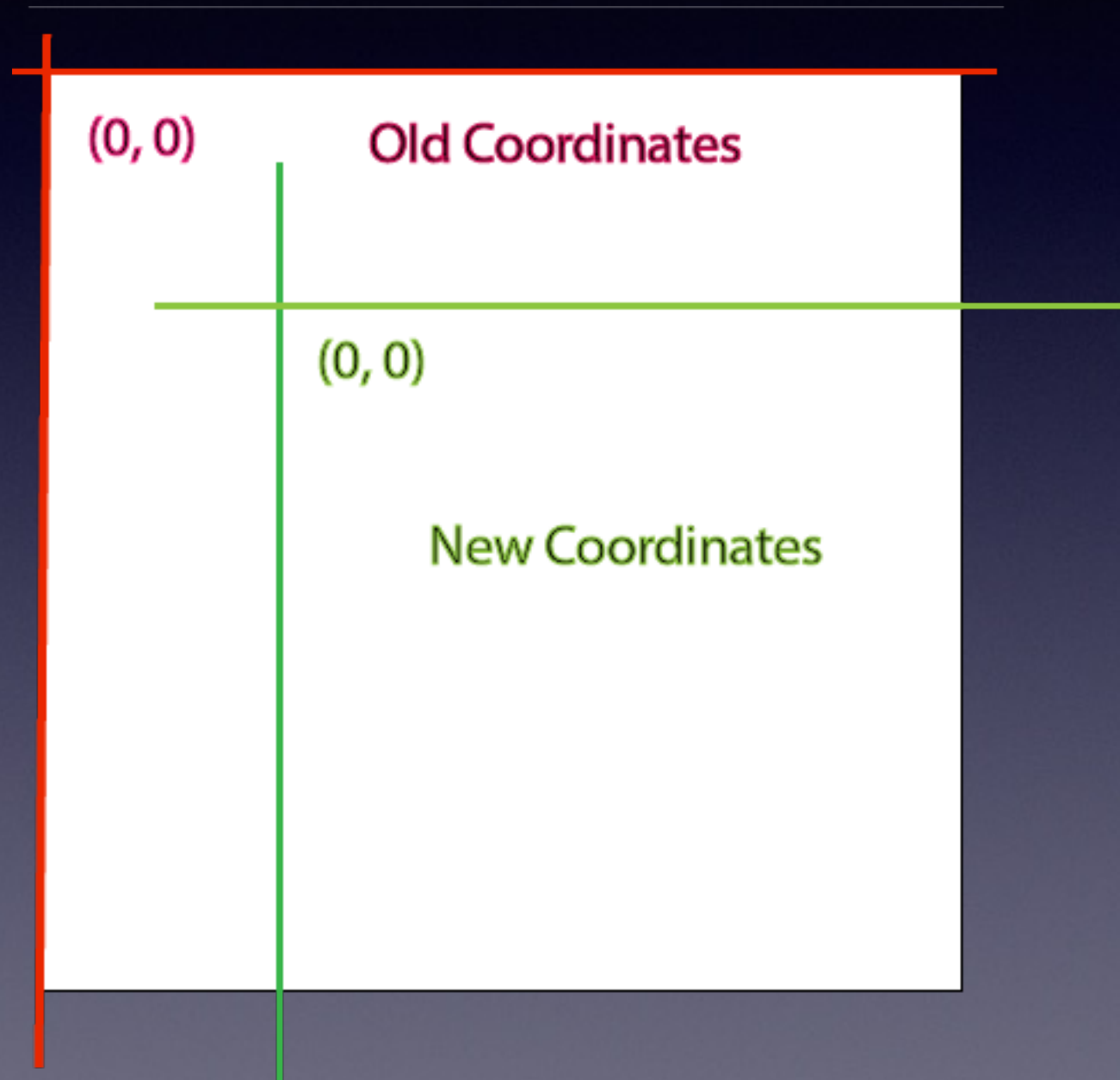
Affine Isomorphisms

$$x\text{-new} = ax + by + e$$

$$y\text{ new} = cx + dy + f$$

// in HTML5 CANVAS
transform(a, b, c, d, e, f);

Translation

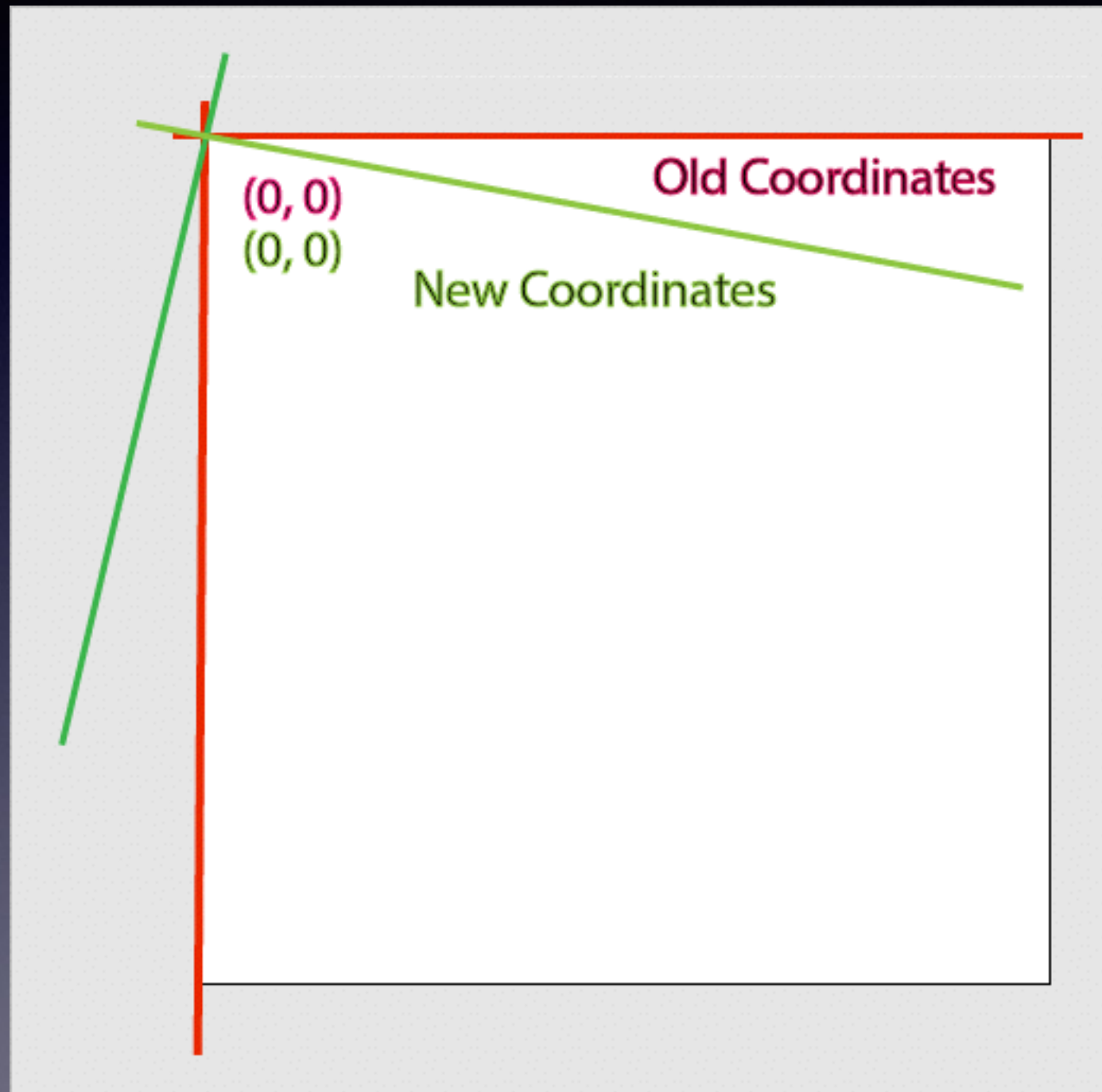


Translation

$$\begin{aligned}x_{\text{new}} &= x + 0y + e \\ y_{\text{new}} &= 0x + y + f\end{aligned}$$

```
// in HTML5 CANVAS  
transform(1, 0, 0, 1, e, f);  
// or  
translate(e, f);
```

Rotation



Rotation

$$x\text{-new} = c x + s y + 0$$

$$y\text{ new} = -s x + c y + 0$$

$$c = \cos A, s = \sin A$$

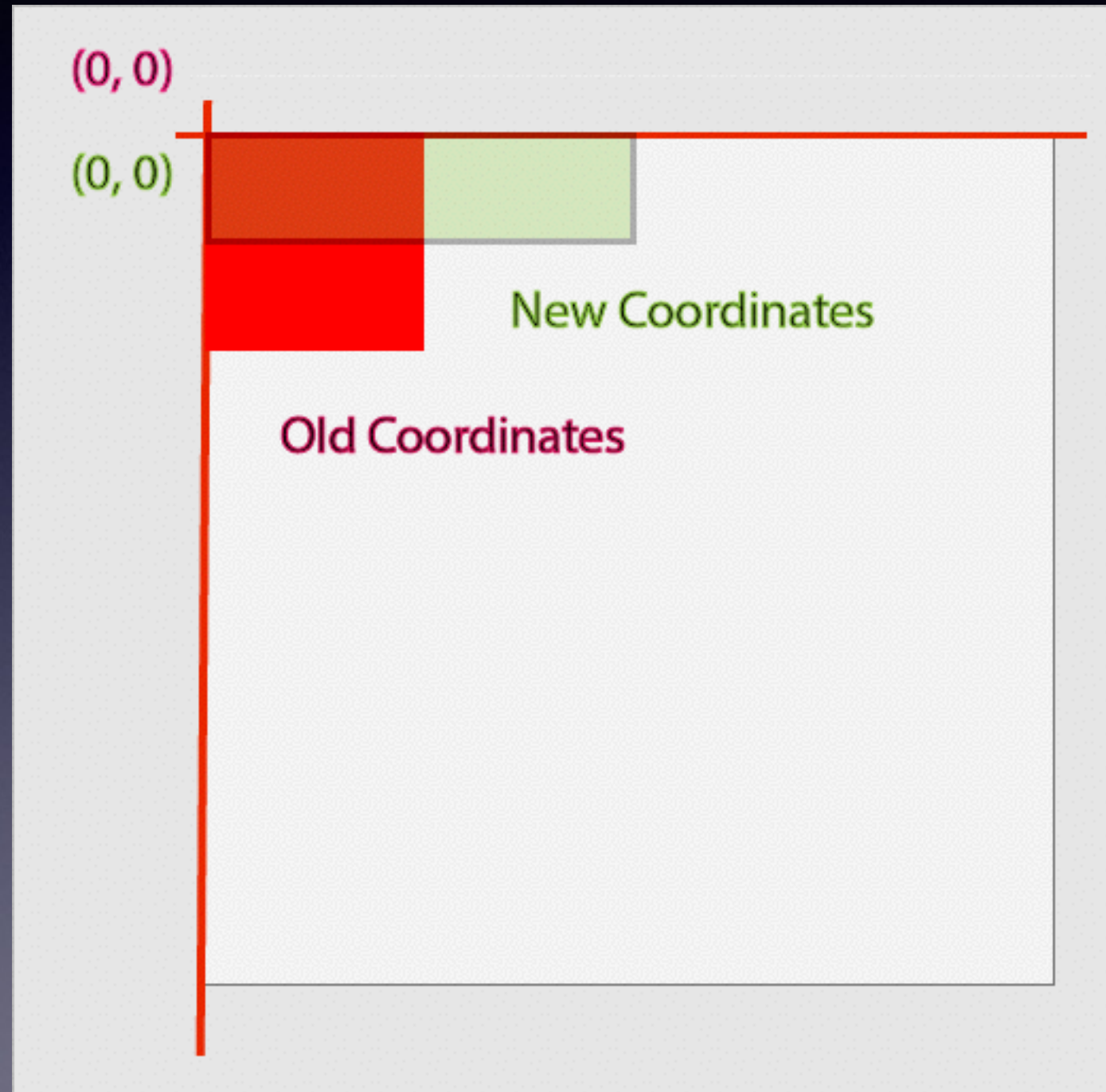
// in HTML5 CANVAS

transform(c, s, -s, c, 0, 0);

// or

rotate(A);

Scale



Scale

$$\begin{aligned}x_{\text{new}} &= ax + 0y + 0 \\ y_{\text{new}} &= 0x + dy + 0\end{aligned}$$

```
// in HTML5 CANVAS  
transform(a, 0, 0, d, 0, 0);  
// or  
scale(a,d);
```

Shear

$$\begin{aligned}x_{\text{new}} &= x + by \\ y_{\text{new}} &= dx + y\end{aligned}$$

```
// in HTML5 CANVAS  
transform(1, b, d, 1, 0, 0);
```

Default Coordinates

```
// in HTML5 CANVAS  
transform(1, 0, 0, 1, 0, 0);
```

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The END