



Computer Graphics

LECTURE 13

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Last Class

- ▶ Cross Product
- ▶ Plane
- ▶ Sphere
- ▶ Transformations

Today's Agenda

- ▶ Transformations
 - ▶ Translation

Example (Scaling)

Find the transformed point, P' , subject to scaling $P = (6, 2)$ through a vector $v = (a, b)$ where i) $a = b = 3$; ii) $a = 3, b = 4$; iii) $a = 1; b = -4$

Example (Rotation)

Find the transformed point, P' , caused by rotating $P = (6, 2)$ about the origin through an angle of 90°

Translation

- ▶ In **translation** all points in an object move to new position along the same straight-line path.
 - ▶ The path is called translation vector or shift vector

$$\begin{aligned}x' &= x + \alpha \\ y' &= y + \beta\end{aligned}$$

Example (Translation)

- Find the transformed point, P' , caused by translating $P = (6, 2)$ through a vector $v = (2, 4)$

Shear

$$\begin{aligned}x' &= x + h_x * y \\ y' &= y + h_y * x\end{aligned}$$

Reflection

- ▶ Special form of scaling
- ▶ Scaling by -1
- ▶ Scaling Matrix $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$
- ▶ $a = -1, b = 1$
- ▶ $a = 1, b = -1$
- ▶ $a = -1, b = -1$

Reflection



Combining Transforms

- ▶ General transformation of a point:
 - ▶ $P' = N \cdot P + A$
- ▶ Scaling or rotation,
- ▶ Translate, we set A, and N is the multiplicative identity.

Summary

- ▶ Translation
- ▶ Shear
- ▶ Reflection
- ▶ Combining Transforms

References

- ▶ Fundamentals of Computer Graphics Third Edition by Peter Shirley and Steve Marschner
- ▶ Interactive Computer Graphics, A Top-down Approach with OpenGL (Sixth Edition) by Edward Angel.