Notes on

Perimeter Projections

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March 2012

The two applets described here are intended to prompt students to *get to grips with graphs* while setting up the sine and cosine functions.

## Perimeter Projections

There are two modes: *projections* and *reconstructions*

### Projections

To start, a quadrilateral is visible, and when the animation is started, a point is seen traversing the perimeter, back and forth. Corresponding points are seen traversing the vertical and the horizontal axes. Work can be done so that everyone has their own succinct articulation of the relation between the axes-points and the perimeter-traversing point.

Pressing *S Pt* reveals a point moving in line with the perimeter-traversing point, but moving to the right and back again as well. Pressing *C Pt* reveals a point moving up and down in concert with the horizontal-axis point, and it too moves to the right and then back again.

Pressing *Axes* shows pertinent points on the horizontal axis. The red point appears to co-ordinate the *S* *Pt* and the *C Pt*. Again this needs to become entirely familiar before it is worth moving on. A menu of familiar quadrilaterals can be obtained by pressing *SP Polygon*. However the points of the quadrilateral can also be moved about.

Pressing *Rotate* displays a point that can be used to rotate the polygon about its centre of mass.

Pressing *Translate* selects all the vertices of the quadrilateral so that it can be translated to a better position if for some reason it moves off the screen.

The principal challenge is, given a quadrilateral, predict the *S* and *C* graphs. Moving one hand up and down and the other back and forth in line with the perimeter-traversing point is a good way to enrich an enactive sense of the projections.

### Reconstruction

The inverse problem is to reconstruct the quadrilateral given the two projection graphs. On changing mode, irrelevant buttons disappear. Six hollow points appear, and these can be varied to alter the vertices of the *S* and *C* graphs. Interesting questions arise if only the *S* graph is visible: what different polygons have the same *S* graph?

## Polygon Shadows