**Polygon mesh shapes examples**

**Using two basic methods: extrusion and rotation**

*Fixed:* cube, tetrahedron, barn

*Extruded:* prism. Start with points in x,z plane, and extrude up.

  Given: polyline $p[i] = <x_i, 0, z_i>$ for $i$ in 0 to n-1 (n points)
  Create: polyline $p[i] = <x_i, h, z_i>$ for $i$ in n to 2n-1 (n points)

*Discrete surface of revolution:* Start with polyline in x,y plane, sweep around y-axis

  Given: polyline $p[i] = <x_i, y_i, 0>$
  Create: grid $g[i,t] = <x_i \cos t, y_i, x_i \sin t>$ for $t$ in range $[0,2\pi)$ with $dt$

*Parametric surface of revolution:* Start with parametric curve in x,y plane, sweep!

  Given: curve $p(u) = <px(u), py(u), 0>$ for $s$ in $[0,2\pi)$
  Create: surface $p(u,v) = <px(u) \cos(v), py(u), px(u) \sin(v)>$ for $t$ in $[0,2\pi)$

*Sphere:* Start with parametric circle in x,y plane, sweep around y-axis

  Given: curve $p(u) = < R \cos(u), R \sin(u), 0>$
  Create: surface $p(u,v) = < R \cos(u) \cos(v), R \sin(u), R \cos(u) \sin(v)>$

*Cylinder:* Start with parametric line in x,y plane, sweep around y-axis

  Given: curve $p(u) = < W, uH, 0 >$ u in $[0,1]$
  Create: surface $p(u,v) = < W \cos(v), uH, W \sin(v)>$

*Cone:* Start with tilted parametric line in x,y plane, sweep around y-axis

  Given: curve $p(u) = < (1-u)W, uH, 0 >$ u in $[0,1]$
  Create: surface $p(u,v) = < W(1-u)\cos(v), uH, W(1-u)\sin(v)>$

*Bilinear patch:* Start with line in 3D space, sweep along a second line

  Given: four points in 3D, $p0, p1, p2, p3$
  Create: $P1(t) = (1-t)p0+t p1$ and $P2(t) = (1-t)p3+t p2$
  Blend: $P(s,t) = (1-s)P1(t) + sP2(t)$

*Parametric patch:* Start with two parametric curves in 3D space, sweep along line

  Given: two curves in 3D, $P1(t)$ and $P2(t)$, blend them
  Create: $P(s,t) = (1-s)P1(t) + sP2(t)$