**Harold’s Precalculus**

**Cheat Sheet**

24 February 2025

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|  | **Rectangular** | **Polar** | | | **Parametric** |
| **Point** | • | *or* | | | *Point (a,b) in Rectangular:*  *,*  *with 1 degree of freedom (df)* |
| *Polar 🡪 Rect.* | | *Rect. 🡪 Polar* |
| **Line** | *Slope-Intercept Form:*  *Point-Slope Form:*  *Intercept Form:*  *Normal Form:* | [http://upload.wikimedia.org/wikipedia/commons/thumb/7/78/Polar_to_cartesian.svg/250px-Polar_to_cartesian.svg.png](http://en.wikipedia.org/wiki/File:Polar_to_cartesian.svg) | | | *where* |
| **Plane** |  | *Vector Form:* | | |  |
| **Conics** | *General Equation for All Conics:*  *where*  *or*  *Note: If , square hyperbola*  *Rotation:*  *If B ≠ 0, then* [*rotate*](http://faculty.eicc.edu/bwood/ma155supplemental/supplemental31.htm) *the coordinate system:*  *New = (x’, y’), Old = (x, y)*  *rotates through angle from x-axis*  http://www.sensorsmag.com/files/sensor/nodes/2009/6475/Figure9.gif | A different shapes of geometric shapes  Description automatically generated with medium confidence  Image result for conics | | | |
| **Circle** | *Center:*  *Vertices: NA*  *Focus:*  Equation of a Circle | *Centered at Origin:*  *r = a (constant)* | | | *Center:*  *Focus:* |
| **Ellipse** | *Center:*  *Vertices:*  *Co-Vertices:*  *Foci:*  *Focus length, c, from center:*  http://newportaoit.org/tfuentes/ellipse2.gif | See the source image  ***Interesting Note:***  *The sum of the distances from each focus to a point on the curve is constant.* | | | *Center:*  *Rotated Ellipse:*  *= the angle between the x-axis and the major axis of the ellipse*  http://www.sensorsmag.com/files/sensor/nodes/2009/6475/Figure9.gif |
| **Hyperbola** | *Center:*  *Vertices:*  *Foci:*  *Focus length, c, from center:*  Hyperbola | *Diagram  Description automatically generated*  *Diagram  Description automatically generated*  ***Interesting Note:***  *The difference between the distances from each focus to a point on the curve is constant.* | | | *Left-Right Opening Hyperbola:*  *(h, k) = vertex of hyperbola*  *Up-Down Opening Hyperbola:*  *(h, k) = vertex of hyperbola*  *General Form:*  *where A and D have different signs* |
| **Parabola** | *Vertical Axis of Symmetry:*  *Vertex:*  *Focus:*  *Directrix:*  *Horizontal Axis of Symmetry:*  *Vertex:*  *Focus:*  *Directrix:*  Parabola | Image result for conics parabola rectum  *Vertical Axis of Symmetry:*  *where A and D have the same sign*  ***Interesting Note:***  *The distances from a point on the curve to the focus is the same as to the directrix.* | | | *Vertical Axis of Symmetry:*  *(opens upwards)* or  *(opens downwards)*  *Vertex:*  *Horizontal Axis of Symmetry:*  *(opens to the right)* or  *(opens to the left)*  *Vertex:*  *Projectile Motion:*  *feet*  *meters*  *General Form:*  *where A and D have the same sign* |
| **Inverse Functions** |  | *if*  *if*  *if*  *if*  *if*  *if* |  | | *or*  *or*  *or*  *or*  *or*  *or* |
| **Arc Length** | http://www.mathwarehouse.com/trigonometry/radians/images/picture-s=r-theta-circle.gif | *Circle:*  *Proof:* | | |  |
| **Perimeter** | *Square: P = 4s*  *Rectangle: P = 2l + 2w*  *Triangle: P = a + b + c* | *Circle: C = πd = 2πr*  *Ellipse:* | | |  |
| **Area** | *Square:* *A = s²*  *Rectangle:* *A = lw*  *Rhombus:* *A = ½ ab*  *Parallelogram:* *A = Bh*  *Trapezoid:*  *Kite:* | *Triangle:*  *A = ½ Bh*  *Triangle:*  *A = ½ ab sin(C)*  *Triangle using Heron’s Formula:*  *Equilateral Triangle:* | | | *Frustum:*  *Circle:* *A = πr²*  *Circular Sector:* *A = ½ r²*  *Ellipse:* *A = πab* |
| **Lateral Surface Area** | *Cylinder:* *SA = 2πrh*  *Cone:* *SA = πrl* |  | | |  |
| **Total Surface Area** | *Cube:* *SA = 6s²*  *Rectangular Box: SA = 2lw + 2wh + 2hl*  *Regular Tetrahedron:* *SA = 2bh*  *Cylinder:* *SA = 2πr (r + h)* | *Cone:* *SA = πr² + πrl = πr (r + l)*  *Sphere:* *SA = 4πr²*  *Ellipsoid:* *SA = (too complex)* | | |  |
| **Volume** | *Cube:* *V = s³*  *Rectangular Prism:* *V = lwh*  *Cylinder:* *V = πr²h*  *Triangular Prism:* *V= Bh*  *Tetrahedron:* *V= ⅓ Bh* | *Pyramid:* *V = ⅓ Bh*  *Cone:* *V = ⅓ bh = ⅓ πr²h*  *Sphere:*  *Ellipsoid:* *V = πabc* | | |  |