**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 | *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 confidenceImage 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* |  |