

Precalculus Models and Curves

By the end of Math 120 you should know these curves well.

1. Lines:

- $y = m(x - x_1) + y_1$
- $y = mx + b$

Perpendicular lines have negative reciprocal slopes.

2. Circles:

- $(x - h)^2 + (y - k)^2 = r^2$
- Upper semicircle: $y = k + \sqrt{r^2 - (x - h)^2}$
- Lower semicircle: $y = k - \sqrt{r^2 - (x - h)^2}$

3. Parabolas:

- $y = ax^2 + bx + c$
- $y = a(x - h)^2 + k$

Vertex: $h = -b/(2a)$

4. Cubics and Higher Polynomials:

- $y = ax^3 + bx^2 + cx + d$

5. Rational Functions:

- $y = \frac{ax+b}{x+d}$

6. Exponential & Logarithmic:

- $y = a \cdot b^x$
- $x = \ln(y)$ is equivalent to $y = e^x$

7. Trigonometric Functions:

- $y = \sin(x), x = \sin^{-1}(y)$
- $y = \cos(x), x = \cos^{-1}(y)$
- $y = \tan(x), x = \tan^{-1}(y)$

8. Sinusoidal Model:

- $y = A \sin\left(\frac{2\pi}{B}(x - C)\right) + D$

9. Uniform Motion (Parametric):

- Linear: $x = a + bt, y = c + dt$
- Circular: $x = r \cos(\theta_0 \pm \omega t), y = r \sin(\theta_0 \pm \omega t)$

Problem-Solving Toolbox

By the end of Math 120 you should know these concepts well.

1. Unit Conversions:

- Length: inches $\leftrightarrow$ feet $\leftrightarrow$ miles, cm $\leftrightarrow$ meters $\leftrightarrow$ km
- Time: seconds $\leftrightarrow$ minutes $\leftrightarrow$ hours
- Angles: revolutions $\leftrightarrow$ radians $\leftrightarrow$ degrees

2. Areas and Volumes:

- Triangle: $\frac{1}{2}bh$
- Circle: πr^2
- Circular wedge: $\frac{1}{2}\theta r^2$
- Cone: $\frac{1}{3}\pi r^2 h$
- Cylinder: $\pi r^2 h$
- Sphere: $\frac{4}{3}\pi r^3$

3. Triangle Facts: Similar triangles, trig functions, Pythagorean theorem.

4. Visualization: Draw diagrams, label variables, write equations.

5. Linear Speed and Rates:

- rate = $\frac{\text{change in quantity}}{\text{change in time}}$
- linear speed = $\frac{\text{distance}}{\text{time}}$

6. Distance Between Points:

- $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

7. Angular Speed and Circular Motion:

- angular speed = $\omega = \frac{\text{angle}}{\text{time}}$
- arc length = $s = r\theta$ (θ in radians)
- linear speed = $v = \omega r$ (ω in radians/time)

8. Functions: Functional notation, composition, inverses, shifting, dilating, reflecting, multipart functions, graphing and analyzing.

9. Fitting a Model: Plug in data points to solve for constants.

10. Solving Equations:

- Isolate variable using inverses in the correct order.
- Quadratic $ax^2 + bx + c = 0$: factoring, completing the square, or quadratic formula