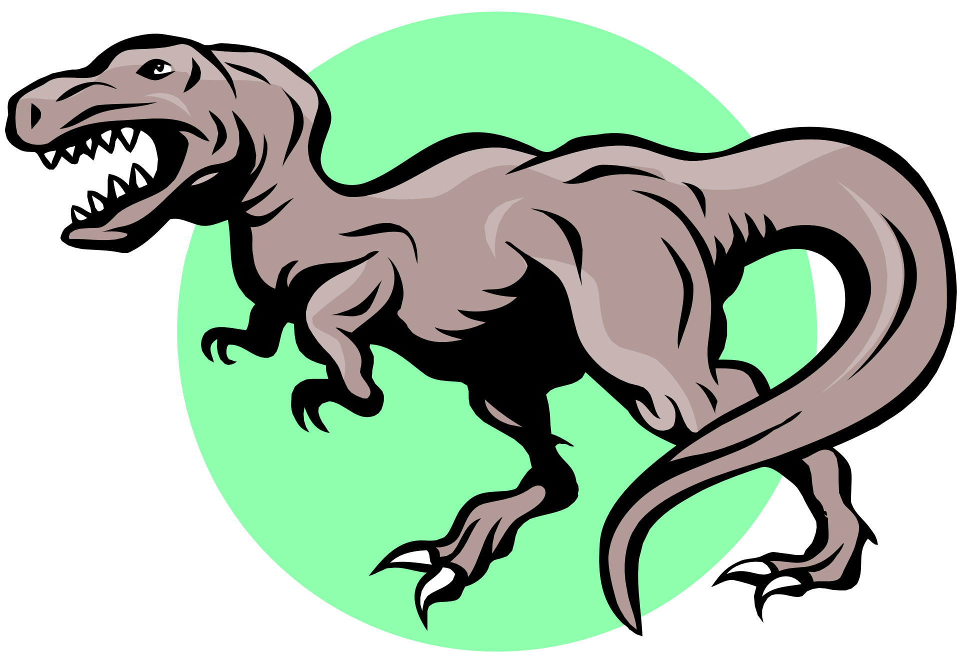
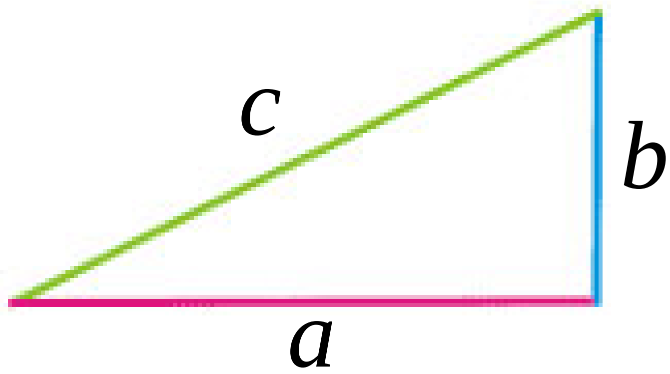
PRELIMINARIES

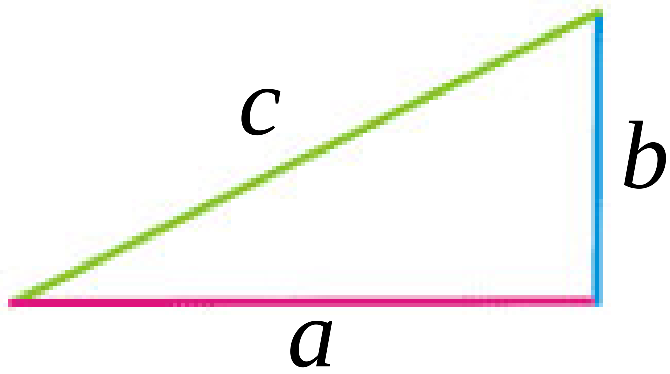


The Pythagorean Theorem



$$a^2 + b^2 = c^2$$

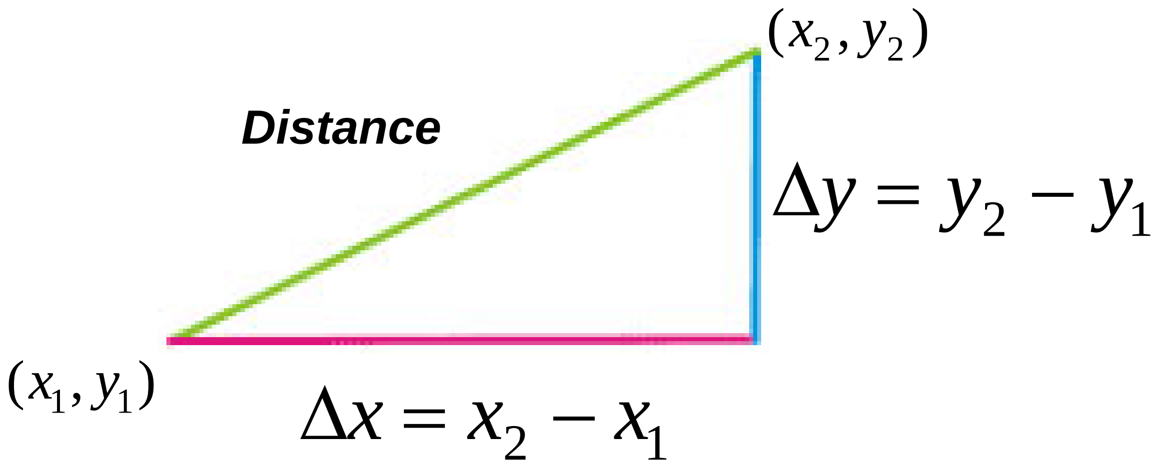
The Pythagorean Theorem



$$a^2 + b^2 = c^2$$

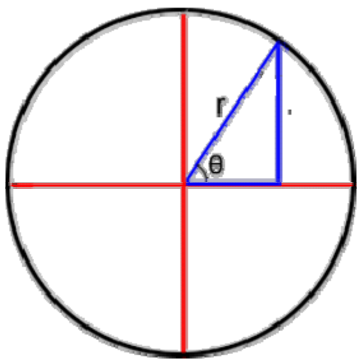
President James Garfield developed his own proof of the Pythagorean Theorem in *The Journal of Education* in 1876.

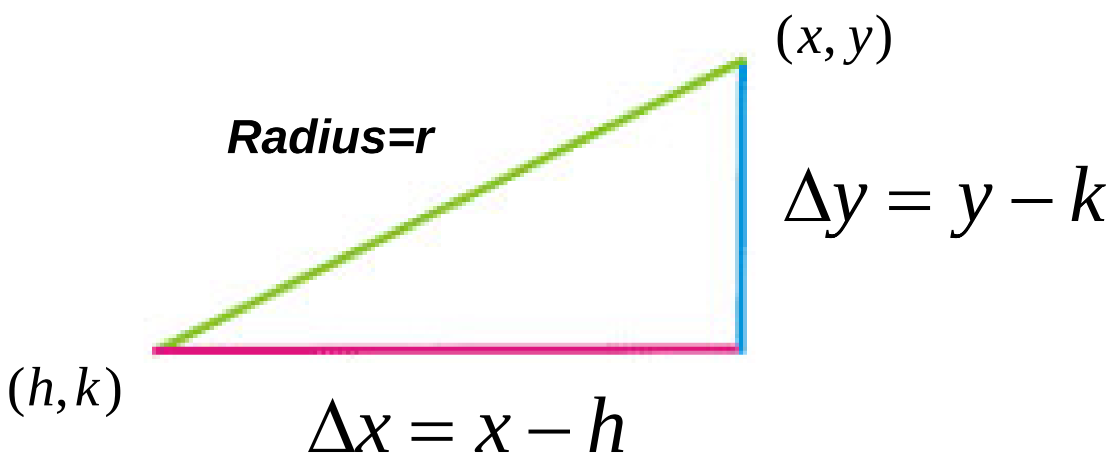
The Distance Formula



Distance = $\sqrt{\Delta x^2 + \Delta y^2} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Equation for a Circle





Center at (h,k)	$(x-h)^2 + (y-k)^2 = r^2$
Center at (0,0)	$x^2 + y^2 = r^2$
Unit Circle	$x^2 + y^2 = 1$

Completing the Square

$$(x+a)^2 = x^2 + 2ax + a^2$$

The relationship between the second and third terms is:

$$\left(\frac{2a}{2}\right)^2 = a^2$$

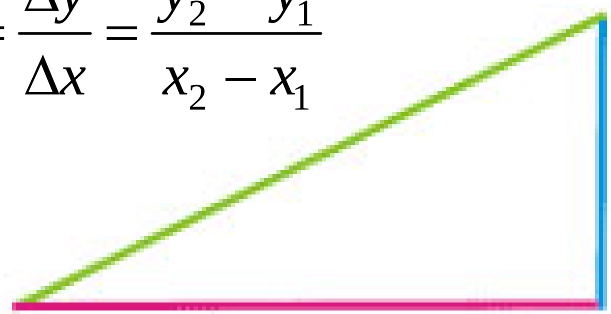
Example:

$$x^2 + 10x + ?$$

$$x^2 + 10x + \left(\frac{10}{2}\right)^2 = x^2 + 10x + 5^2 = (x+5)^2$$

Equations for a Line

$$slope = \frac{rise}{run} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

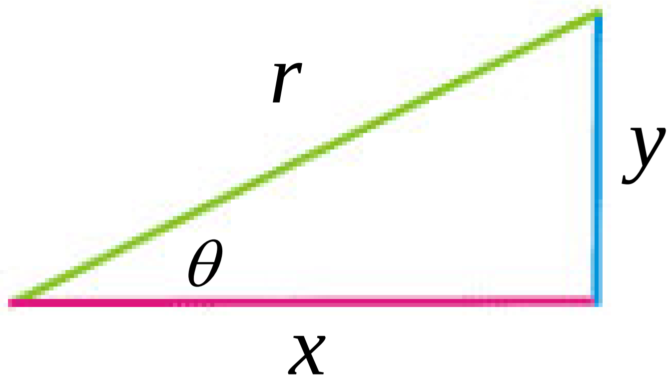


slope-intercept form: $y = mx + b$

point-slope form: $y - b = m(x - a)$

Benton's point-slope form: $y = m(x - a) + b$

Trigonometric Functions

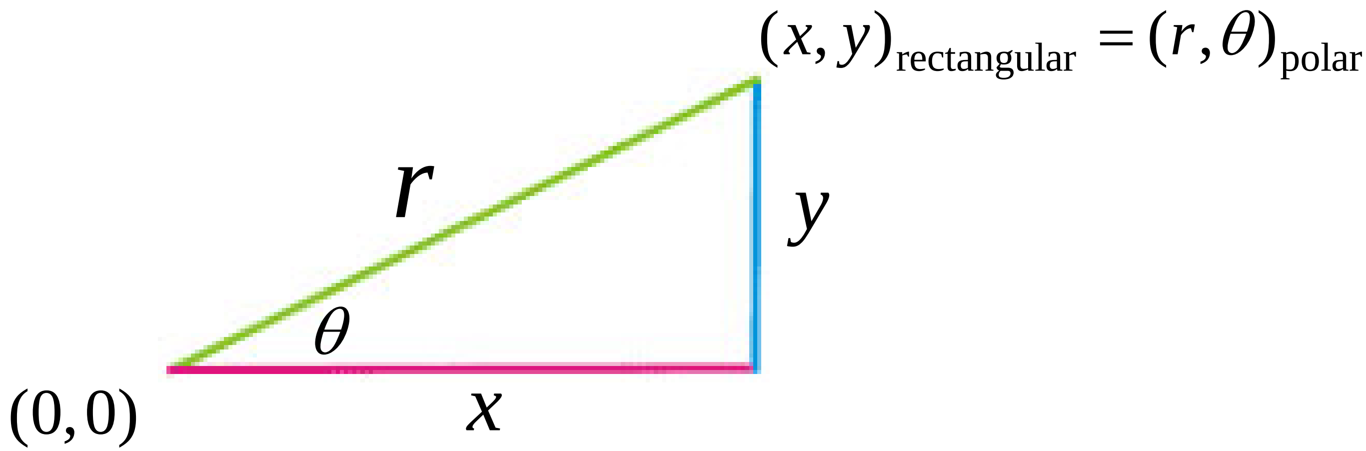


$$\sin\theta = \frac{y}{r} \qquad \csc\theta = \frac{r}{y}$$

$$\cos\theta = \frac{x}{r} \qquad \sec\theta = \frac{r}{x}$$

$$\tan\theta = \frac{y}{x} \qquad \cot\theta = \frac{x}{y}$$

Polar Coordinates



$$x = r\cos\theta$$

$$y = r\sin\theta$$

$$x^2 + y^2 = r^2$$

$$slope = \tan\theta = \frac{y}{x}$$

Multiplying Matrices

$$\begin{pmatrix}1 & 2 & 3\end{pmatrix}\begin{pmatrix}4\\5\\6\end{pmatrix}=\begin{pmatrix}1\cdot 4+2\cdot 5+3\cdot 6\end{pmatrix}=\begin{pmatrix}4+10+18\end{pmatrix}=\begin{pmatrix}32\end{pmatrix}$$

$$\begin{pmatrix}1 & 2\\3 & 4\end{pmatrix}\begin{pmatrix}5 & 6\\7 & 8\end{pmatrix}=\begin{pmatrix}1\cdot 5+2\cdot 7 & 1\cdot 6+2\cdot 8\\3\cdot 5+4\cdot 7 & 3\cdot 6+4\cdot 8\end{pmatrix}=\begin{pmatrix}19 & 22\\43 & 50\end{pmatrix}$$

$$\begin{pmatrix}4\\5\\6\end{pmatrix}\begin{pmatrix}1 & 2 & 3\end{pmatrix}=\begin{pmatrix}4 & 8 & 12\\5 & 10 & 15\\6 & 12 & 18\end{pmatrix}$$

Determinants of 2x2 Matrices

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix} = 1 \cdot 4 - 2 \cdot 3 = 4 - 6 = -2$$

$$\begin{vmatrix} 5 & 6 \\ 7 & 8 \end{vmatrix} = 5 \cdot 8 - 6 \cdot 7 = 40 - 42 = -2$$

Determinants of 3x3 Matrices

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = a\begin{vmatrix} e & f \\ h & i \end{vmatrix} - b\begin{vmatrix} d & f \\ g & i \end{vmatrix} + c\begin{vmatrix} d & e \\ g & h \end{vmatrix}$$

$$\begin{vmatrix} 1 & 2 & 3 \\ 3 & 2 & 4 \\ 2 & 5 & 1 \end{vmatrix} = 1\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} - 2\begin{vmatrix} 3 & 4 \\ 2 & 1 \end{vmatrix} + 3\begin{vmatrix} 3 & 2 \\ 2 & 5 \end{vmatrix}$$

$$= 1(-18) - 2(-5) + 3(11) = -18 + 10 + 33 = 25$$

Formulas

Area of a circle $= \pi r^2$

Circumference of a circle $= \pi d = 2\pi r$

Area of a triangle $= \frac{bh}{2}$

Area of a parallelogram $= bh$

Area of a trapezoid $= \frac{h(b_1 + b_2)}{2}$

Volume of a sphere $= \frac{4}{3}\pi r^3$

Surface area of a sphere $= 4\pi r^2$