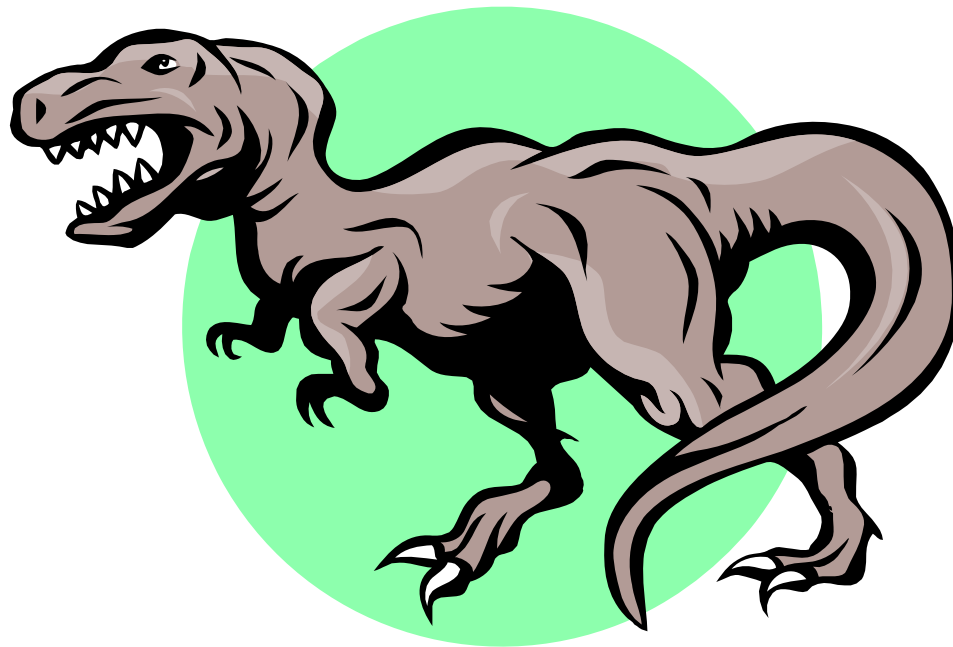
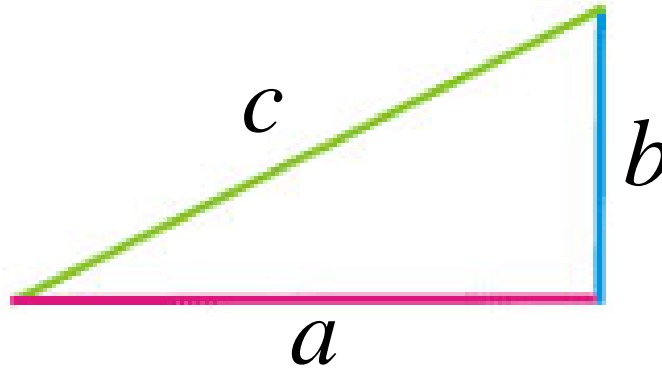


PRELIMINARIES

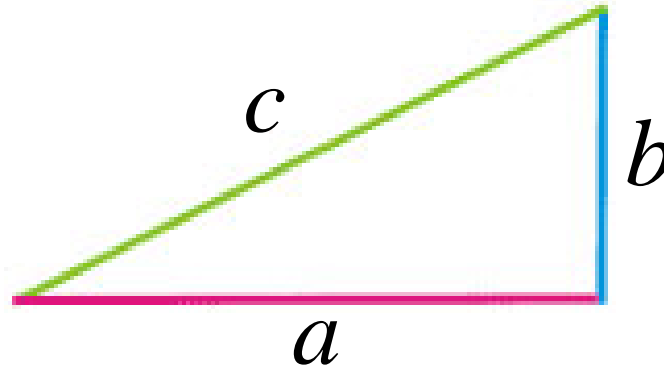


The Pythagorean Theorem



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

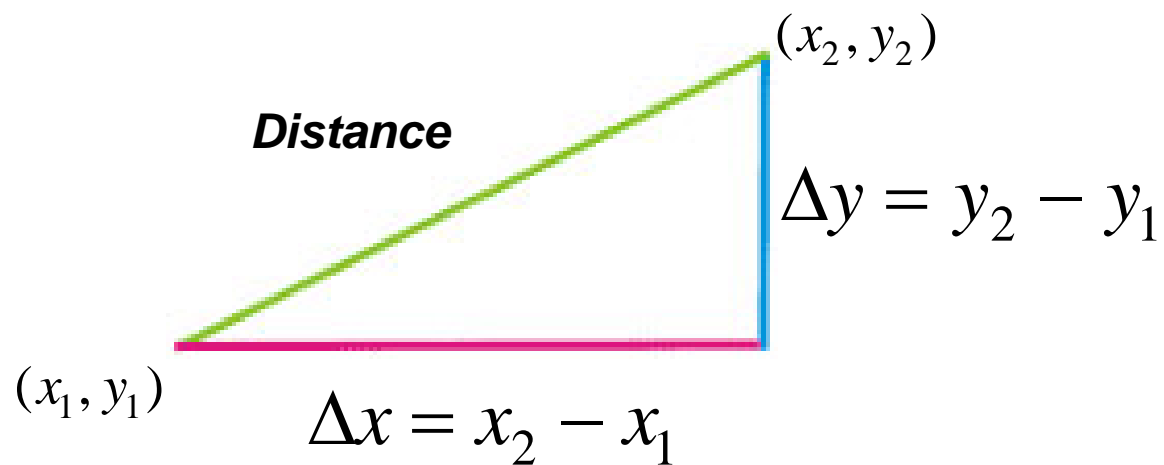
The Pythagorean Theorem



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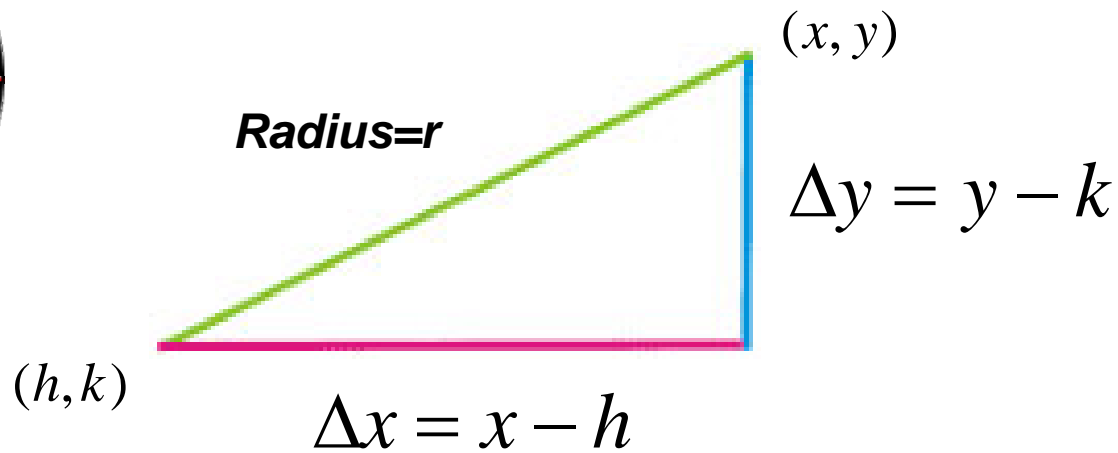
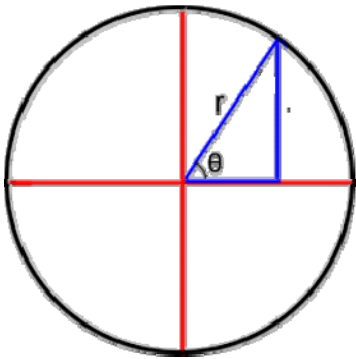
President James Garfield developed his own proof of the Pythagorean Theorem in *The Journal of Education* in 1876.

The Distance Formula



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

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:

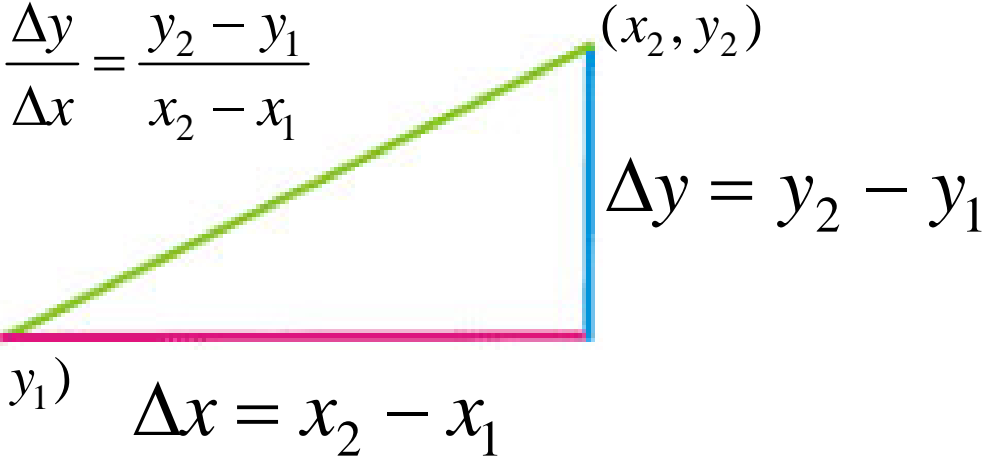
$$\left(\frac{2a}{2}\right)^2 = a^2$$

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

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


$(a, b) = (x_1, y_1)$ $\Delta x = x_2 - x_1$

(x_2, y_2) $\Delta y = y_2 - y_1$

slope-intercept form:

$$y = mx + b$$

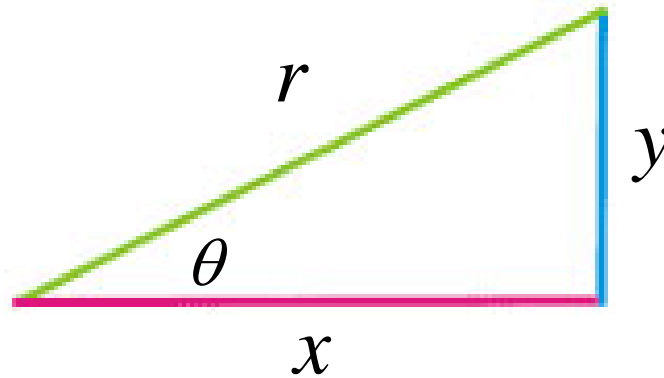
point-slope form:

$$y - b = m(x - a)$$

Benton's point-slope form:

$$y = m(x - a) + b$$

Trigonometric Functions



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

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

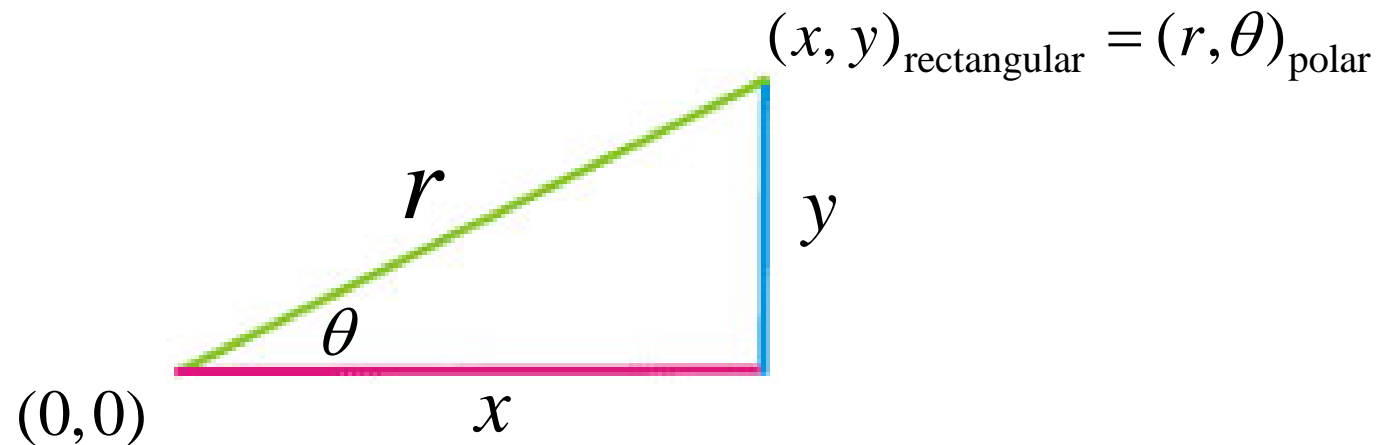
$$\cos \theta = \frac{x}{r}$$

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

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

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

Polar Coordinates



$$x = r \cos \theta$$

$$y = r \sin \theta$$

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

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

Multiplying Matrices

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

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

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

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

$$\text{Area of a circle} = \pi r^2$$

$$\text{Circumference of a circle} = \pi d = 2\pi r$$

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

$$\text{Area of a parallelogram} = bh$$

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

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

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