Coordinates and Distance

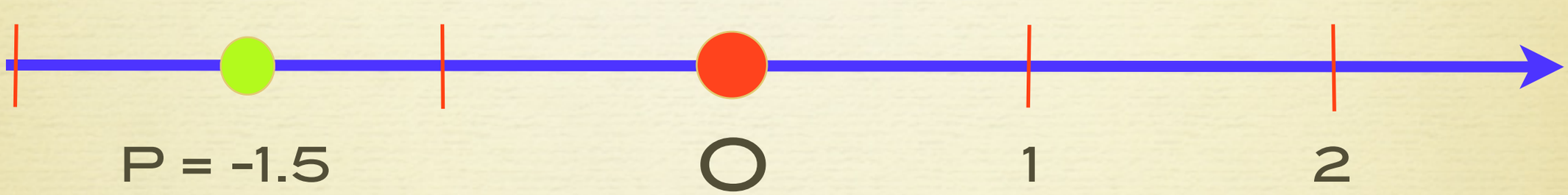
1. Coordinates
2. Distances
3. Objects
4. Completion of Square
5. Remarks

Oliver Knill, Math21a, Fall 2009

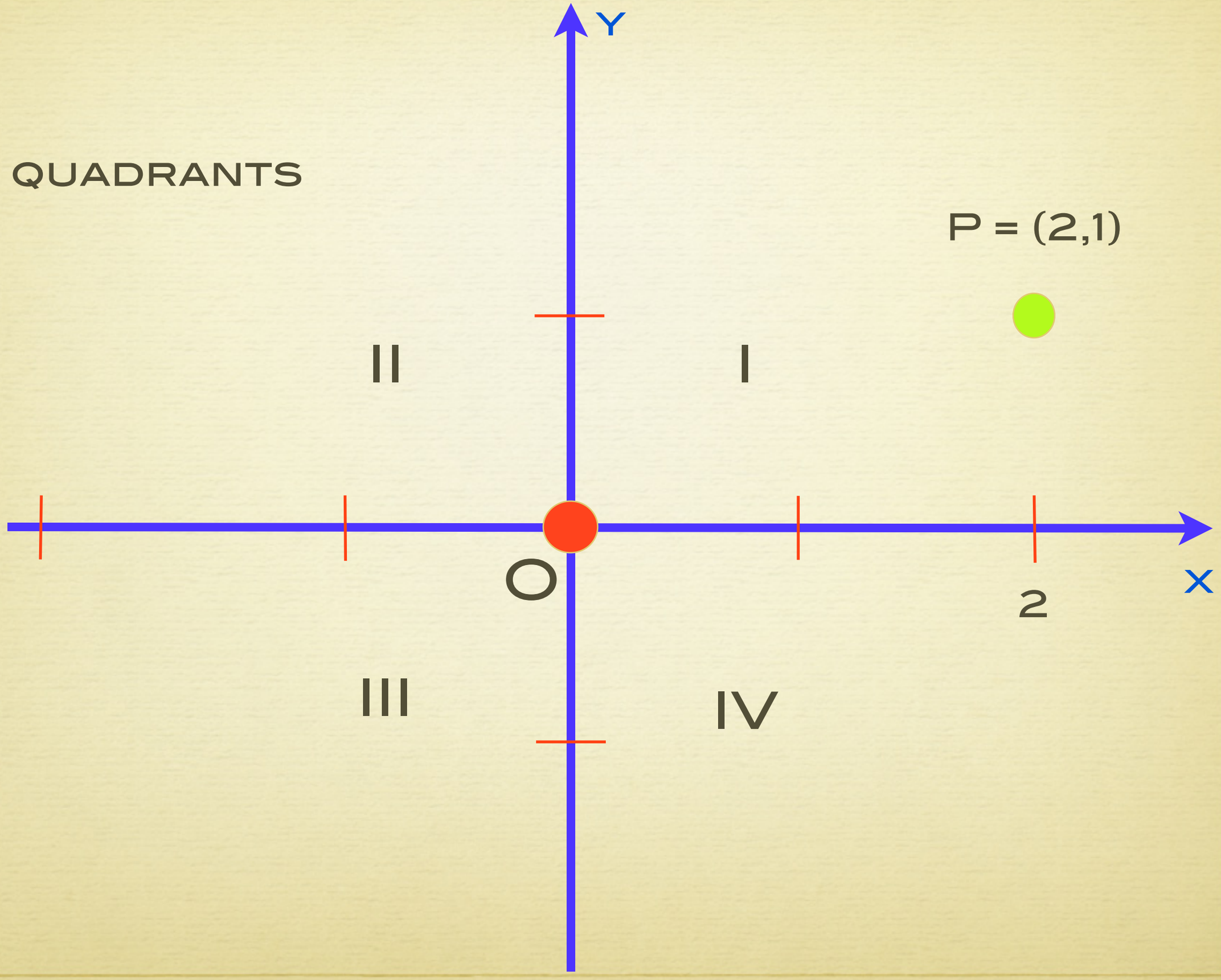
1. Coordinates

Negative
Real Axes

Positive
Real Axes

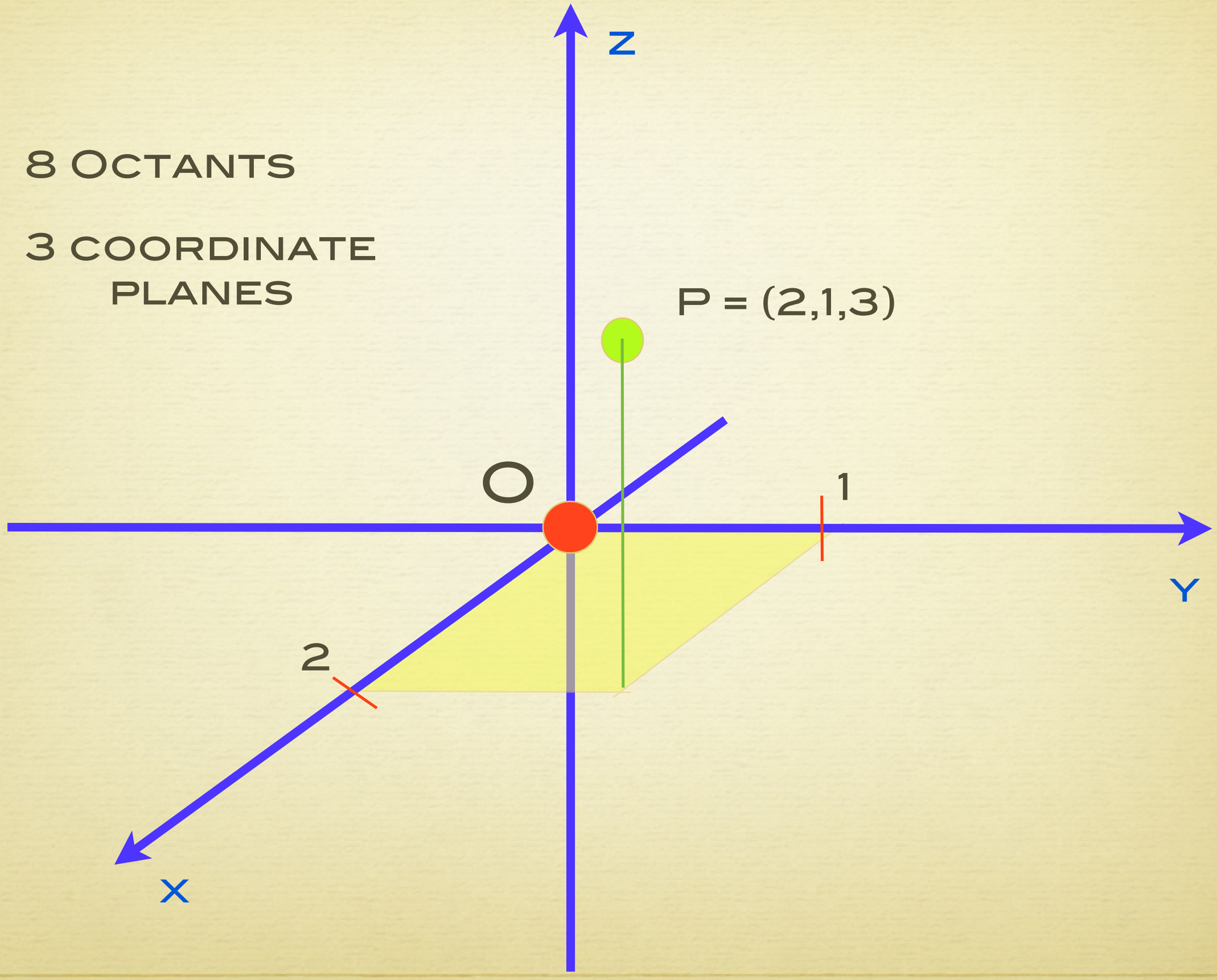


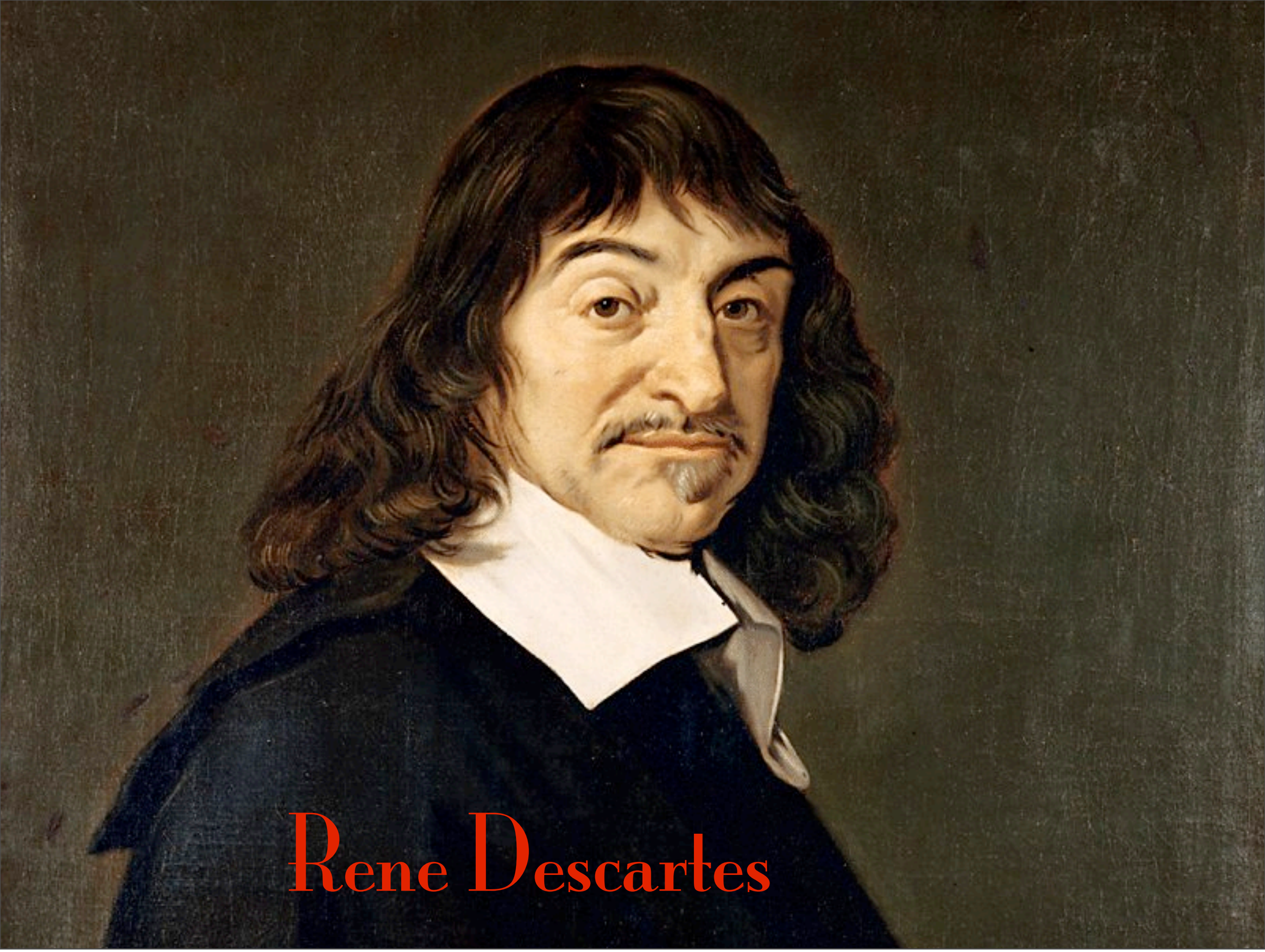
4 QUADRANTS



8 Octants

3 coordinate planes



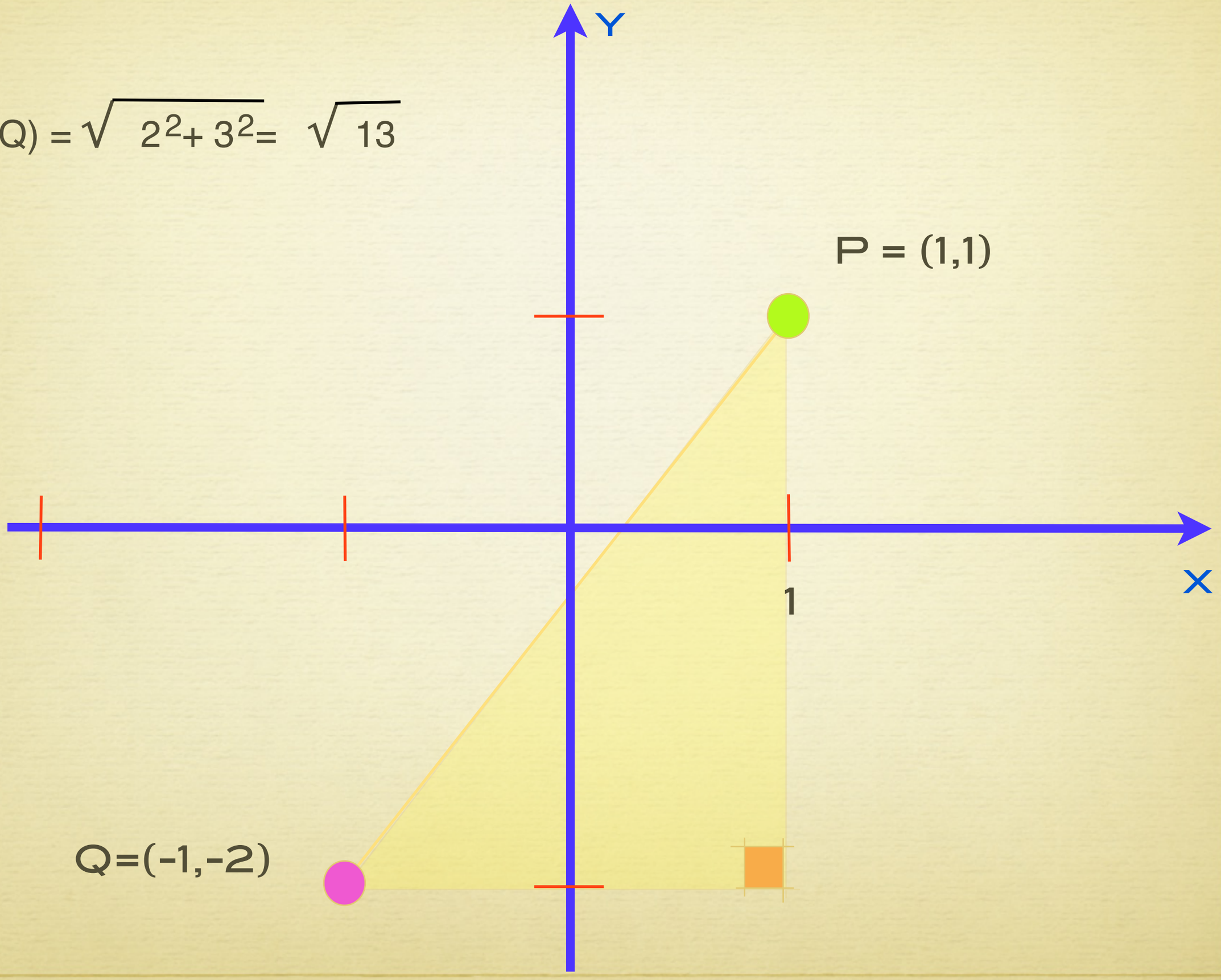

Rene Descartes

Descartes and Queen Christine

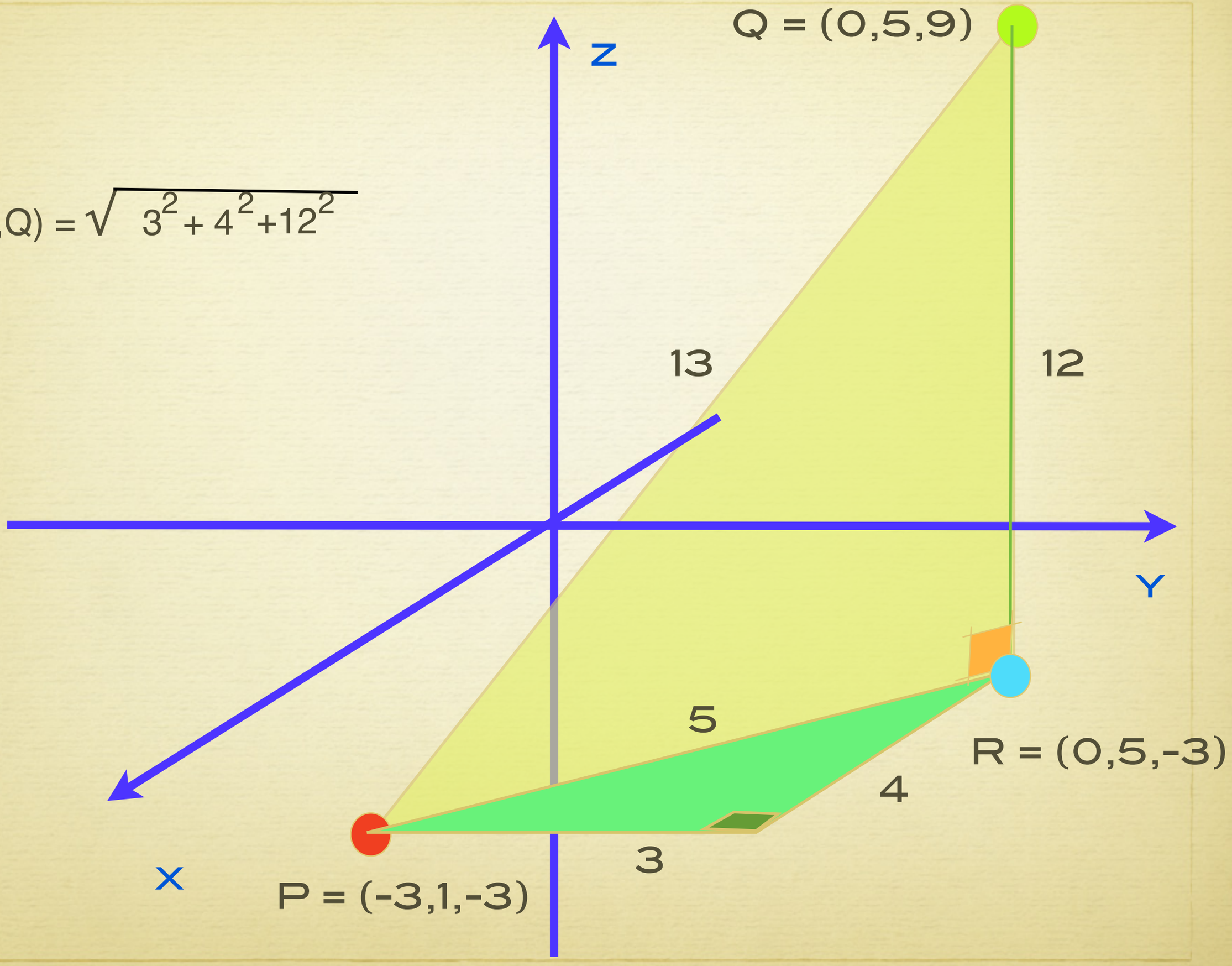

Princess Elizabeth

2. Distances

$$d(P,Q) = \sqrt{2^2 + 3^2} = \sqrt{13}$$

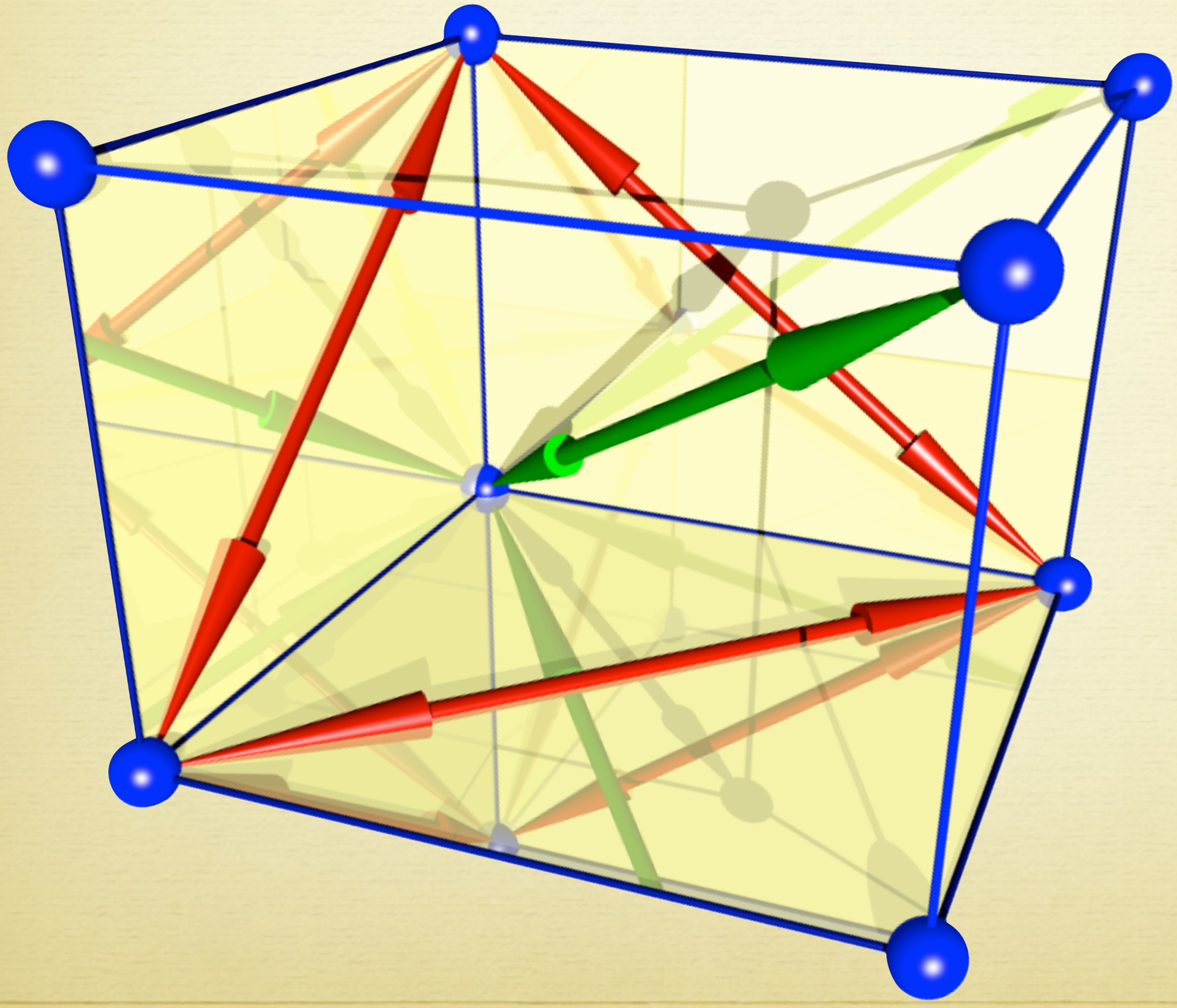


$$d(P,Q) = \sqrt{3^2 + 4^2 + 12^2}$$

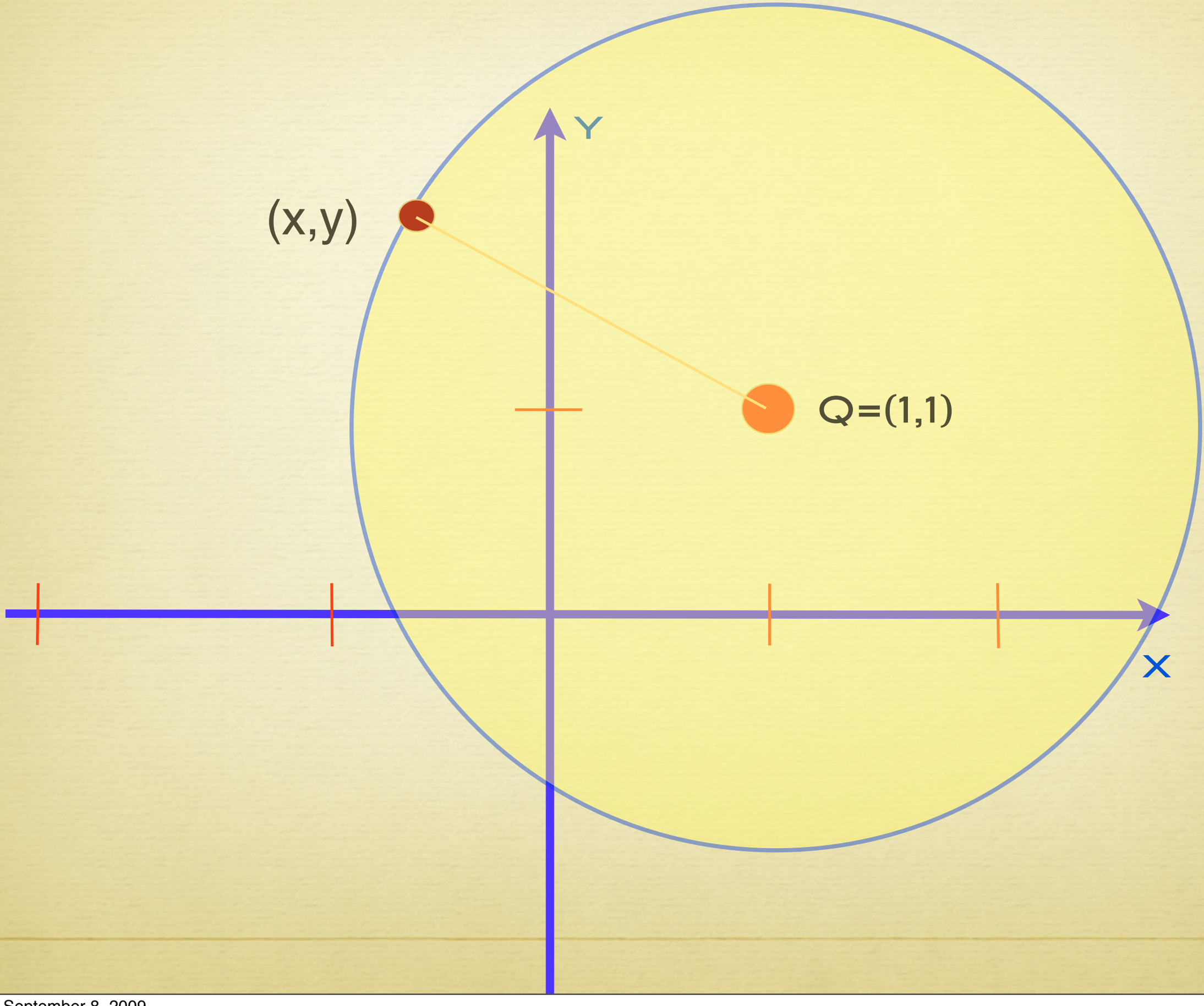


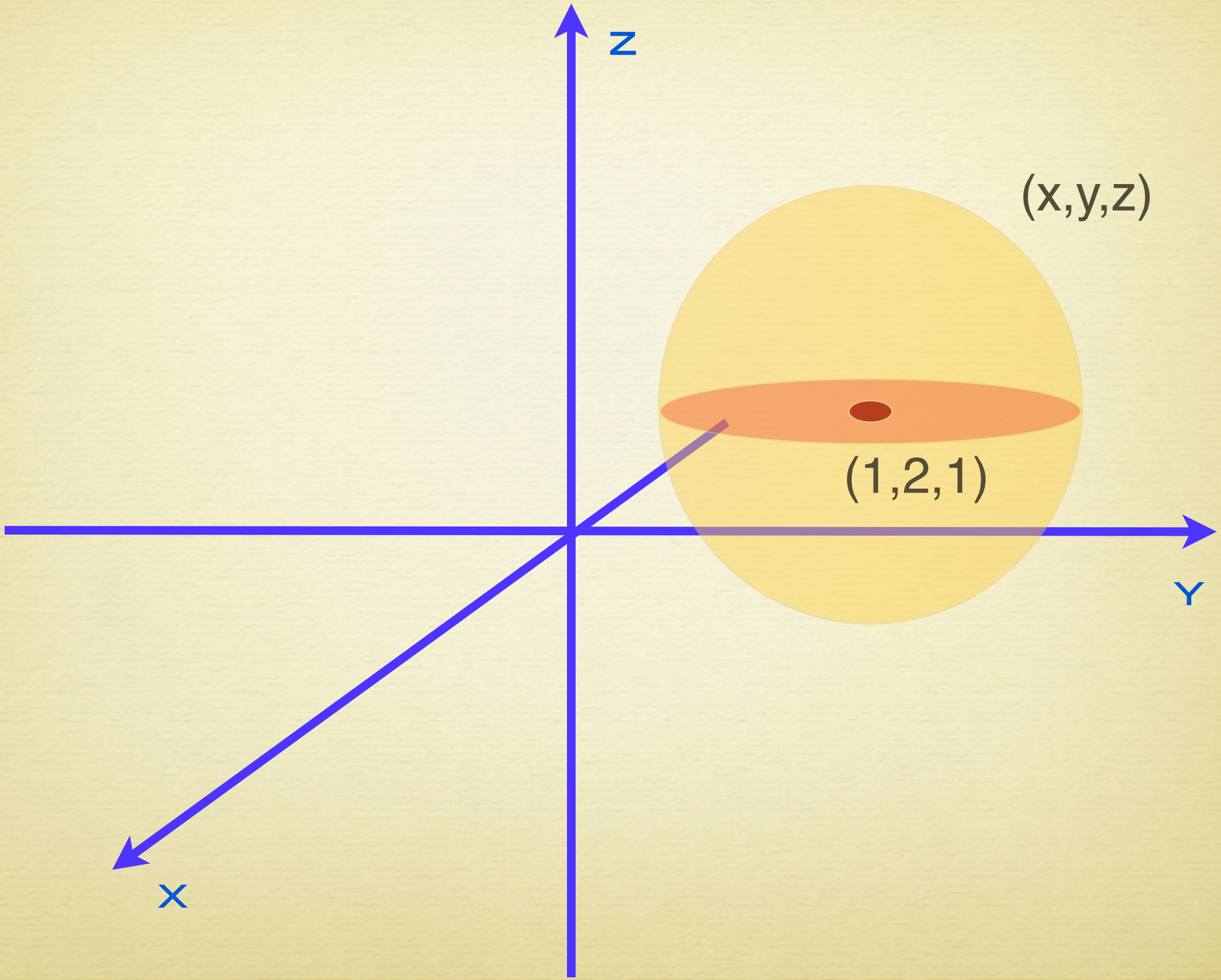
distances in "the Italian Job"

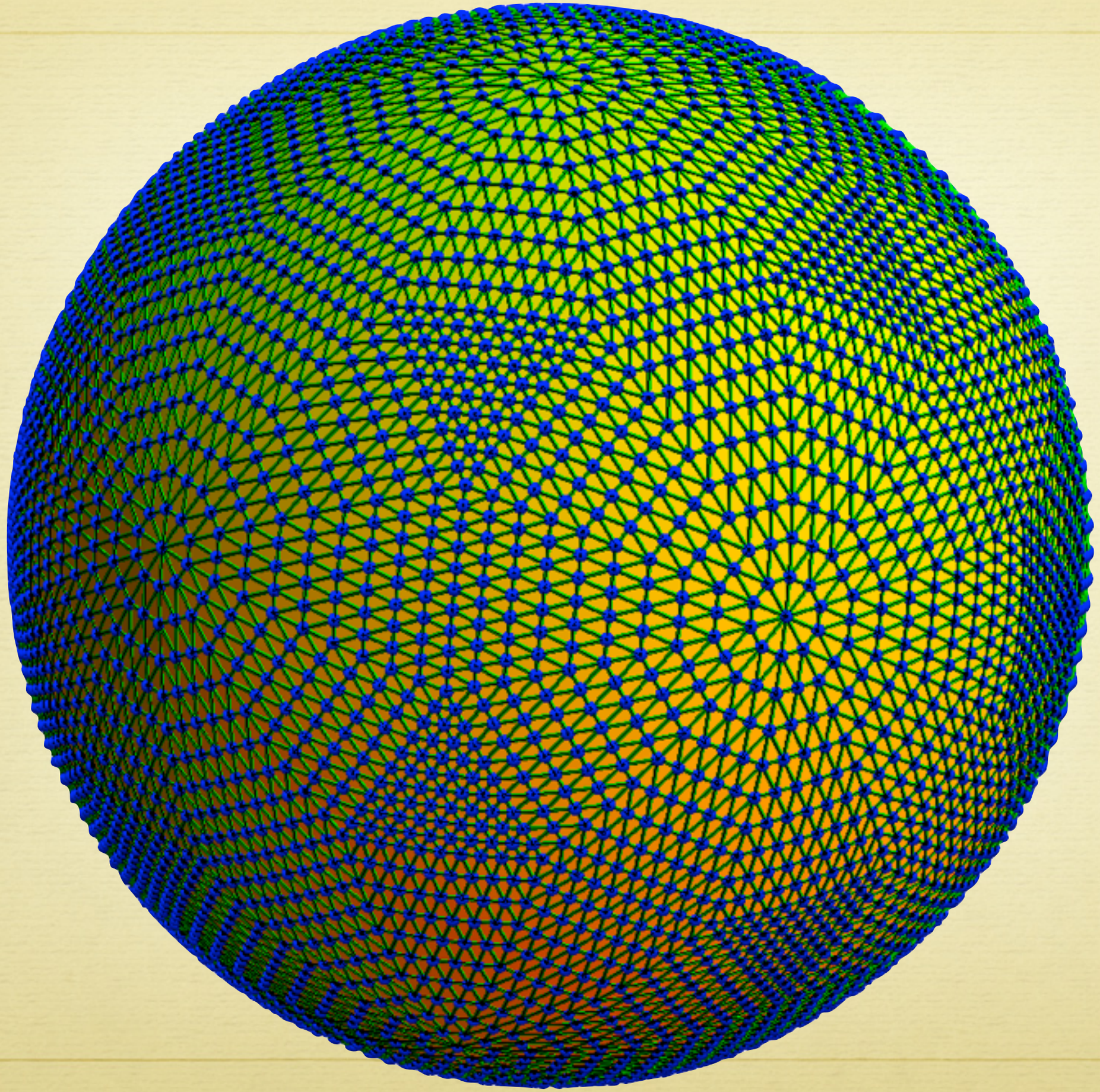
Euler bricks

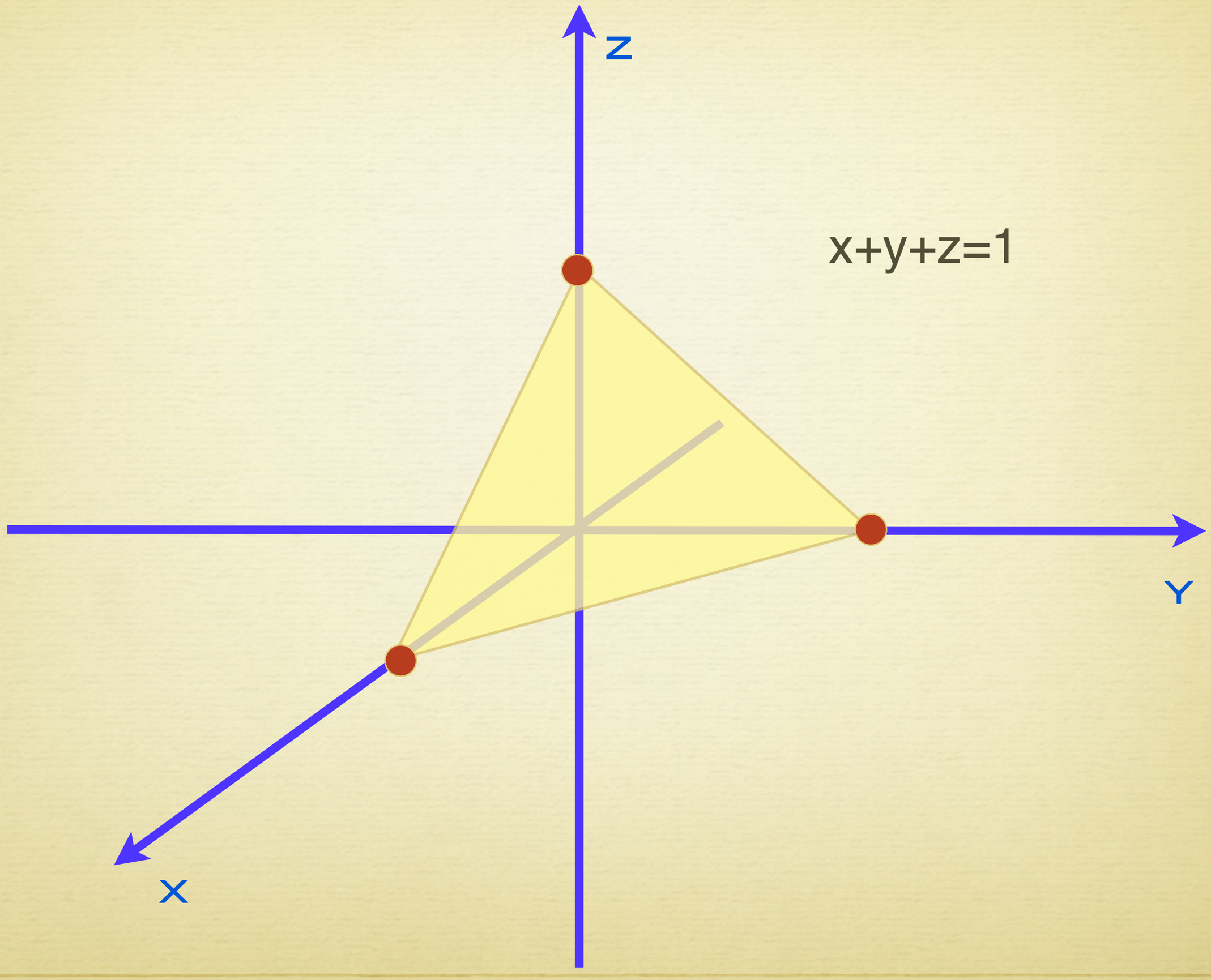


3. Objects

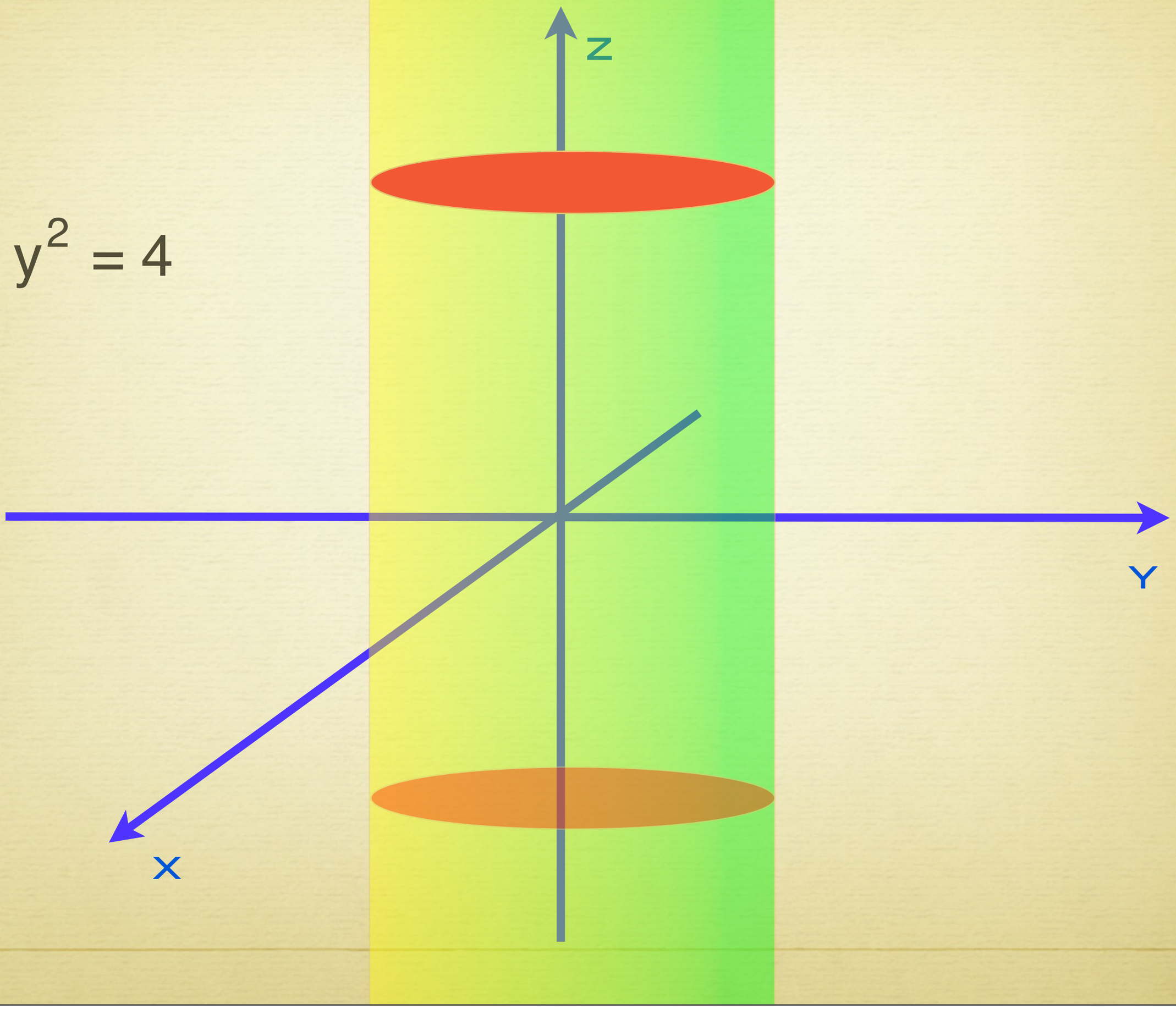

Y
(x,y)
Q=(1,1)
X

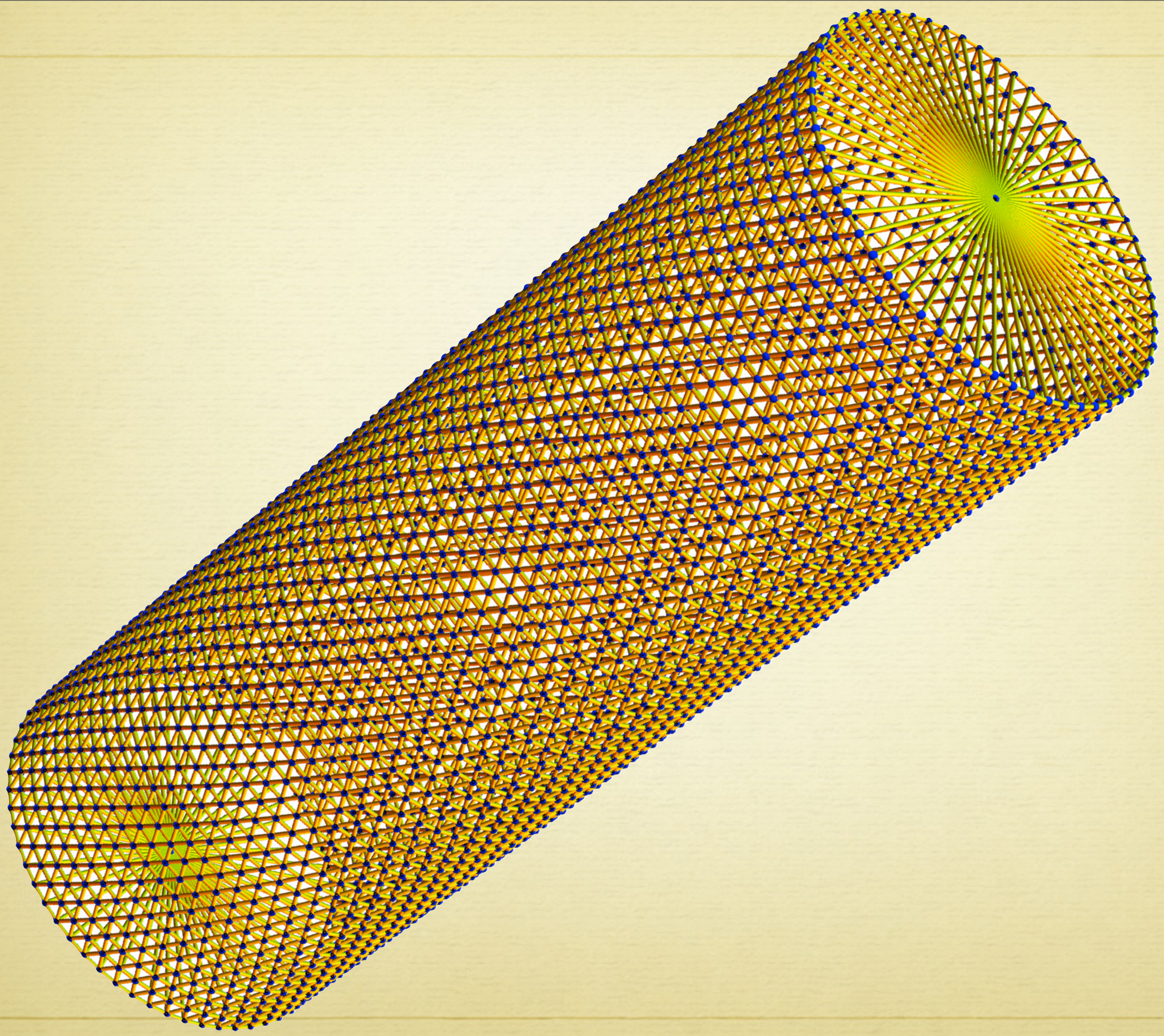

z
(x,y,z)
(1,2,1)
Y
X




z
x+y+z=1
Y
X

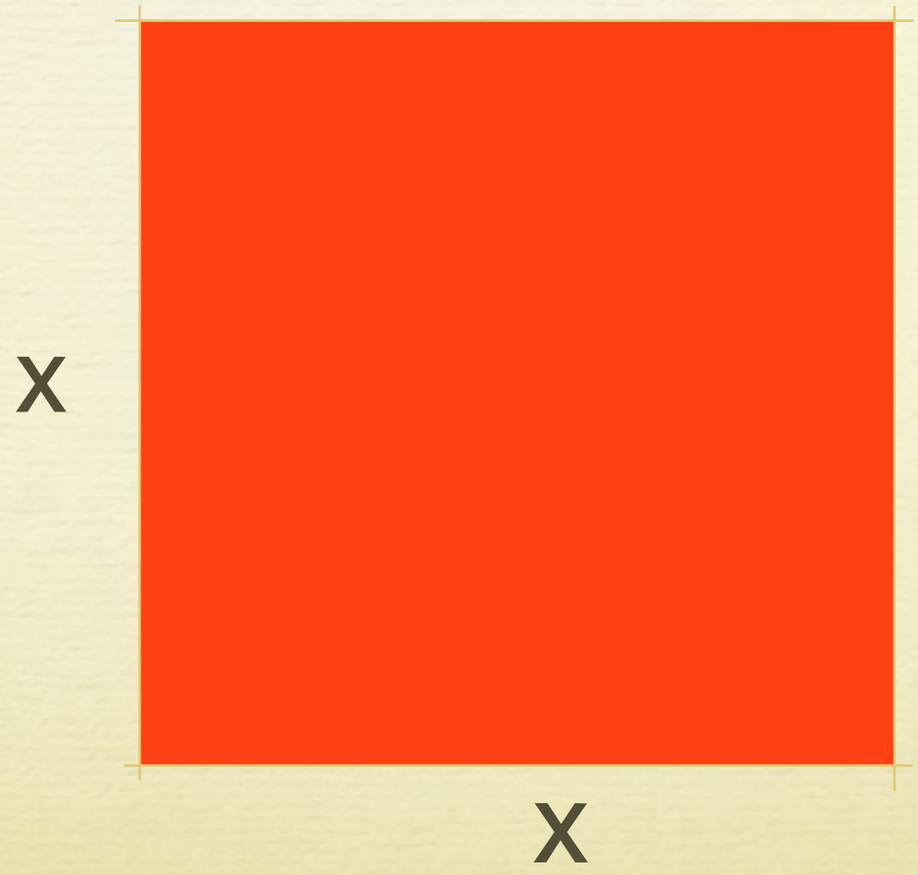
$x^2 + y^2 = 4$



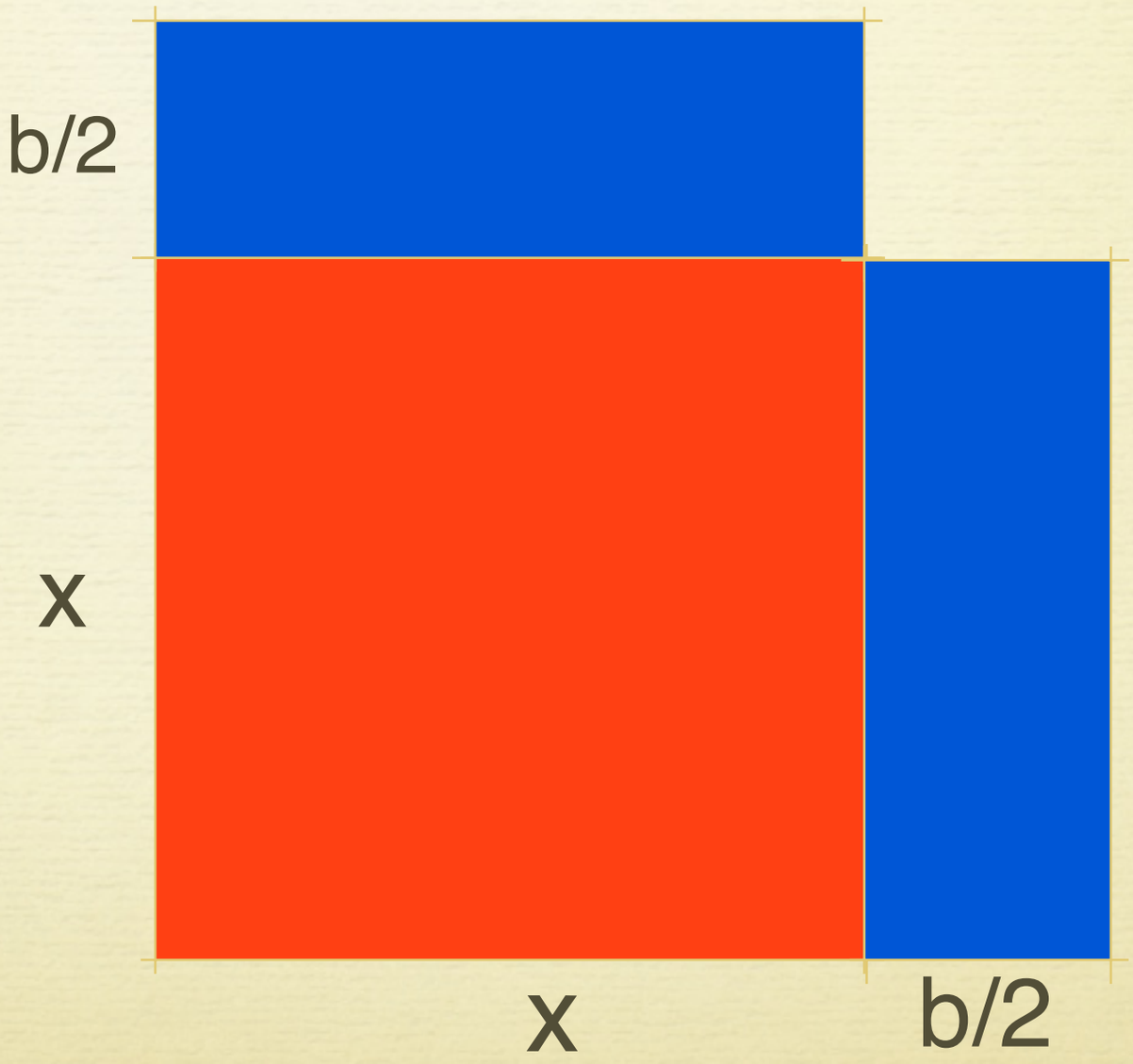


4. Completion of Square

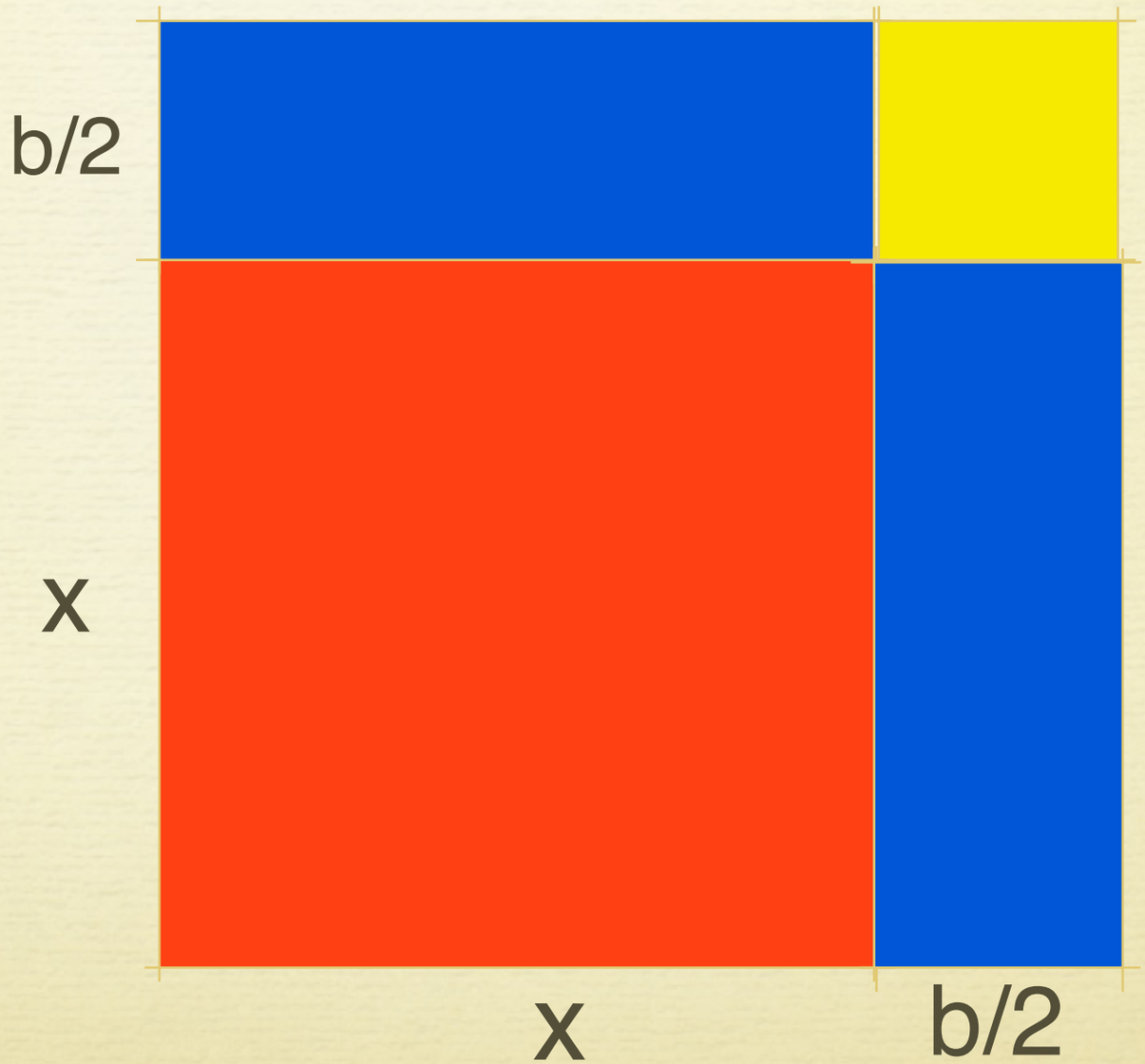
x^2



$x^2 + b\,x$

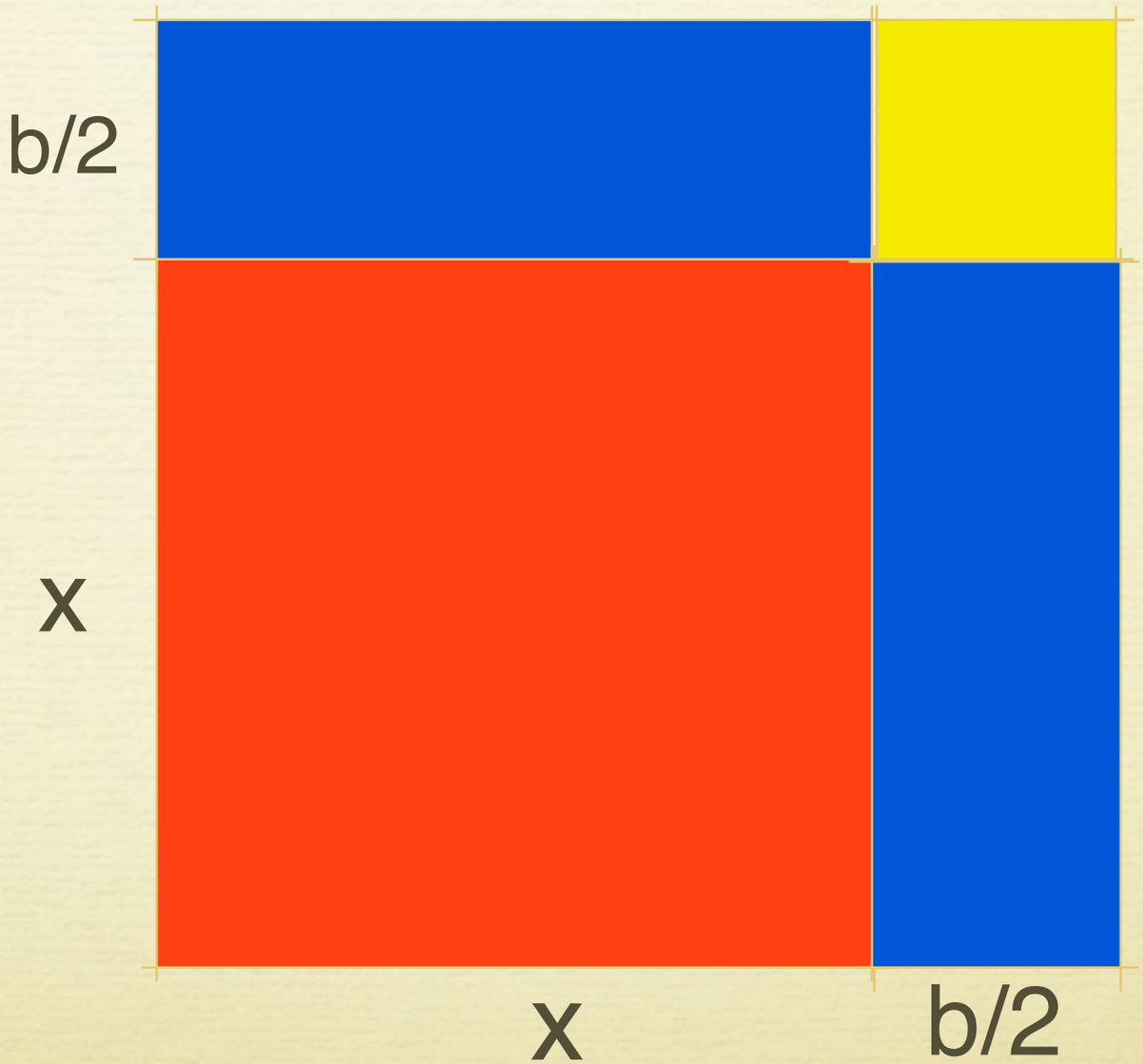


$x^2 + b\,x + b^2/4$



$x^2 + b\,x + b^2/4$

$= (x + b/2)^2$



Al Khwarizmi (780–847)

$$x^2 + 6x = 10$$

$$x = \sqrt{19} - 3$$

$$x^2 + 6x + 9 = 10 + 9$$

$$x = \sqrt{19} - 3$$

$$x^2 + 6x + 9 = 10 + 9$$

$$(x+3)^2 = 19$$

$$x = \sqrt{19} - 3$$

Problem: describe the set of points which satisfy

$$x^2+8x+y^2+2y=10$$

$$(x+4)^2+(y+1)^2=27$$

This is a cylinder of radius $\sqrt{27}$ with axes parallal to the z axes through the point (-4,-1)