Mathematics

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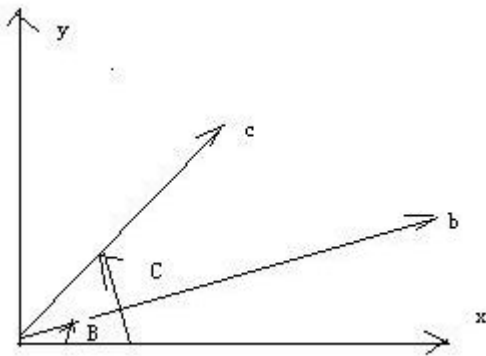1.What is the difference between a point and a vector?

  The difference is precisely that between *location* and *displacement*.

- Points are **locations in space**.

- Vectors are **displacements in space**.

2.What is a right handed coordinate system?

   On the same plane perpendicular to each other and the two axes of the origin of public coordinate system, referred to as the Cartesian coordinate system

3.How do you compute the dot product of two vectors? Informally, what does the dot product do? Give an example where we need the dot product for Computer Graphics applications.
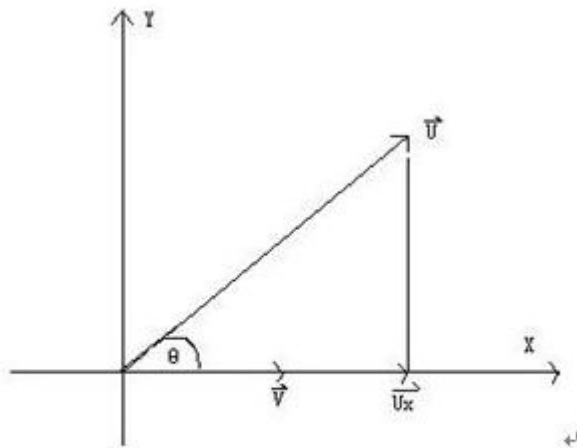

b = (|b| cosB, |b| sinB)
c = (|c| cosC, |c| sinC)
b.c = |b| |c| cosB cosC + |b| |c| sinB sinC
b.c = |b| |c| cos(B-C)
b.c = |b| |c| cos(@) (@ is the angle between B and C.)
con(@) = b.c / (|b| |c|)

4.How do you compute the projection of one vector onto another?

$$\vec{u} \cdot \vec{v} = |\vec{u}| * |\vec{v}| * cos(\theta)$$

$$|\vec{u_x}| = |\vec{u}| * cos(\theta) = \frac{\vec{u} \cdot \vec{v}}{|\vec{v}|} \quad \vec{u_x} = |\vec{u_x}| * \frac{\vec{v}}{|\vec{v}|} = \frac{(\vec{u} \cdot \vec{v}) * \vec{v}}{|\vec{v}| * |\vec{v}|}$$

5.What are the implicit and parametric forms of a line? Why are they named implicit and parametric?

Parametric: x=x'+t*cos a y=y'+t*sin a

Implicit:$(x-x_1)/(x_2-x_1)=(y-y_1)/(y_2-y_1)$

6.What is the implicit form of a circle centered at (x_c, y_c) with radius r?

$(x-x_c)^2+(y-y_c)^2=r^2$

7.Write an implicit equation for a line given two points.
$(x-x_1)/(x_2-x_1)=(y-y_1)/(y_2-y_1)$

8.Write a parametric equation for a line given two points.
t is parametric, a is Inclination angle
$(x-x_0,y-y_0)=t(cos\ a,sin\ a)$
x=x_0 + t * cos a
y=y_0 + t * sin a

9.Suppose you are given a parametric equation for a line. Convert from this representation to an implicit equation for that same line.
y=b*cos(t)
x=a*sin(t)

$(y/b)^2=cos^2(t)$
$(x/a)^2=sin^2(t)$

$y^2/b^2 + x^2/a^2 = \cos(t)^2 + \sin(t)^2 = 1$

10.Given an implicit equation for a line, convert it to a parametric representation.

If $y=k*x+b$, $k=\tan a=m/n$,a is Inclination angle ,$M(x_1$,y_1)is any point in a straight line.

Parametric equation:

$x=x_1$ +$t*\cos a$

$y=y_1$ +$t*\sin a$

11. Given a slope / intercept equation for a line, convert it to parametric and implicit representations.

$y=k*x+b$

Let $y=t$

$k*x+b=t$

$x=(t-b)/k$

Parametric equation is: $y=t$

$\qquad\qquad\qquad x=(t-b)/k$