For 3D math,

What is the term for
a generalized
cross product?

3D Math

Given vectors $\boldsymbol{a}$ and $\boldsymbol{b}$
what is the return of
their cross product,
$\boldsymbol{a}\times\boldsymbol{b}$?

3D Math

Given vectors $\boldsymbol{a}$ and $\boldsymbol{b}$
what operation calculates
a new vector **perpendicular**
to both $\boldsymbol{a}$ and $\boldsymbol{b}$?

3D Math

Given the 3D vectors
$\boldsymbol{u}$ and $\boldsymbol{v}$,
what does the equation
below return?

$$\cos^{-1}\left(\frac{\boldsymbol{u}\bullet\boldsymbol{v}}{|\boldsymbol{u}|\ |\boldsymbol{v}|}\right)$$

3D Math

Given the 3D vectors
$\boldsymbol{v}$ and $\boldsymbol{u}$,
what does the equation
below return?

$$\cos^{-1}(\|\boldsymbol{u}\|\bullet\|\boldsymbol{v}\|)$$

3D Math

Given the 3D vectors
$\boldsymbol{u}$ and $\boldsymbol{v}$,
what formula calculates
the angle between them?

3D Math

Given 3D vectors $\boldsymbol{a}$ and $\boldsymbol{b}$,
each with elements x, y, z,
formulate the dot product
between them.

3D Math

For 3D math,

Given the dot product:
$\mathbf{a} \bullet \mathbf{b}$
What is the **magnitude**
of the value returned?

3D Math

Given the 3D vectors $\boldsymbol{v}$,
what's the value from
dot producting it with
a perpendicular vector?

$$\boldsymbol{u}\bullet\perp\boldsymbol{u}$$

3D Math

For 3D math,

What is another term
for
projection product?

3D Math

$$\boldsymbol{n}\ |\boldsymbol{a}|\ |\boldsymbol{b}|\ \sin\theta$$

Where θ is the angle between $\boldsymbol{a}$ and $\boldsymbol{b}$.
Where n is an angle perpedicular to $\boldsymbol{a}$ and $\boldsymbol{b}$.
$\boldsymbol{n} = \perp(\|\boldsymbol{a}\|\ \|\boldsymbol{b}\|)$

A wedge product.

The angle between
$\boldsymbol{u}$ and $\boldsymbol{v}$.

The angle will be in radians

Cross Product

With the notation: $\boldsymbol{a} \times \boldsymbol{b}$

$$\cos^{-1}(\|\boldsymbol{u}\| \bullet \|\boldsymbol{v}\|)$$

OR

$$\cos^{-1}\left(\frac{\boldsymbol{u} \bullet \boldsymbol{v}}{|\boldsymbol{u}|\ |\boldsymbol{v}|}\right)$$

The angle will be in radians.

The angle between
$\boldsymbol{u}$ and $\boldsymbol{v}$.

The angle will be in radians

$$\|\mathbf{a}\|\ \|\mathbf{b}\|\ \cos\theta$$

Their magnitudes multiplied, scaled by the cos of the angle between the vectors.

$$\boldsymbol{a}_x\boldsymbol{b}_x + \boldsymbol{a}_y\boldsymbol{b}_y + \boldsymbol{a}_z\boldsymbol{b}_z$$

- Dot Product, or
- Inner Product, or
- Scalar Product

0

For 3D math,

What is another term
for
dot product?

3D Math

For 3D math,

What is another term
for
inner product?

3D Math

For 3D math,

What is another term
for
scalar product?

3D Math

For 3D math,

What is the **generalized**
form of the
dot product equation
called?

3D Math

Given the 3D vectors $\boldsymbol{v}$,
whats the value from
dot-producting
its normal with its normal?

$\|\boldsymbol{u}\| \bullet \|\boldsymbol{u}\|$

3D Math

Given the 3D vectors $\boldsymbol{v}$,
whats the value from
dot-producting
its normal with
its negated normal?
$||\boldsymbol{u}|| \bullet - ||\boldsymbol{u}||$

3D Math

Given vectors $\boldsymbol{v}_1$ and $\boldsymbol{v}_2$,
and value t between [0,1],
What is the **formula**
for **linear interpolation**?

3D Math

For Linear Algebra,

What does the term
lerp
stand for?

3D Math

What does the
determinant of a matrix
represent?

3D Math

When **inverting** a **matrix**,
what happens if
its **determinant** is **zero**?

3D Math

- Dot Product, or
- Projection Product, or
- Scalar Product

- Projection Product, or
- Inner Product, or
- Scalar Product

Inner Product

- Dot Product, or
- Projection Product, or
- Inner Product

-1

1

Linear interpolation.

$$\boldsymbol{v}_1 + (\boldsymbol{v}_2 - \boldsymbol{v}_1) * t$$

OR

$$\boldsymbol{v}_1 * (1-t) + \boldsymbol{v}_2 * t$$

A zero determinant means the matrix cannot be inverted.

The volume inside the matrix.

If each colum represented a vector that represented an edge of a box/(hyper)cube, it represents what the volume of that cube would be.

(For matrices representing more than 3 dimensions, technically it's the *hyper*-volume)

What does the determinant of a matrix represent?

3D Math

If a **matrix** has either **all zeros** for any **column** or **all zeros** for any **row**, What does that tell you about its **determinant**?

3D Math

Given a 1D matrix $\mathbf{A}$, with members:

$$\begin{bmatrix} a_1 \end{bmatrix}$$

what is its **determinant**?

3D Math

Given a 2D matrix $\mathbf{A}$, with members:

$$\begin{bmatrix} u_1 & v_1 \\ u_2 & v_2 \end{bmatrix}$$

what is its determinant?

3D Math

Given a 2D matrix $\mathbf{A}$, with members:

$$\begin{bmatrix} u_1 & v_1 & w_1 \\ u_2 & v_2 & w_2 \\ u_3 & v_3 & w_3 \end{bmatrix}$$

what is its determinant?

3D Math

Given a matrix $\mathbf{A}$, what does the **notation** $|\boldsymbol{A}|$ mean?

3D Math

Given a matrix $\mathbf{A}$, what does the notation $\det(\mathbf{A})$ mean?

3D Math

Given a matrix $\mathbf{A}$ of size $m \times n$, how many **columns** and **rows** does the matrix have?

3D Math

Given a matrix $\mathbf{A}$ of size $m \times n$, how many **rows** and **columns** does the matrix have?

3D Math

Given a matrix $\mathbf{A}$, what does the **notation** $\mathbf{A}^{-1}$ mean?

3D Math

The determinant
will be zero.

The volume inside the
matrix.

i.e., if each colum represented a vector that
represented an edge of a box/(hyper)cube,
it represents what the volume of that cube would be.

(For matrices representing more than
3 dimensions, technically it's the
hyper-volume)

u_1v_2 - u_2v_1

a_1

The determinant
of matrix $\mathbf{A}$.

$u_1(v_2v_3$ - $v_3w_2)$ +
$u_2(v_3w_1$ - $v_1w_3)$+
$u_3(v_1w_2$ - $v_2w_1)$

m rows
n columns

The determinant
of matrix $\mathbf{A}$.

The **inverse** of matrix $\mathbf{A}$.

m rows
n columns

Given a matrix $\mathbf{A}$,
what's the **notation**
to represent its **inverse**?

3D Math

Given a 2D matrix $\mathbf{A}$,
with members:

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

what is its **inverse**?

3D Math

Given a 3D matrix $\mathbf{A}$,
with members:

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

what is its **inverse**?

3D Math

For a 3D matrix,
what does it mean if we
orthonormalize it?

3D Math

For a 3D matrix,
what does it mean if we
say it's skewed?

3D Math

Given a 2D matrix $\mathbf{A}$,
what does the notation
$\mathbf{A}^{\mathrm{T}}$
mean?

3D Math

Given a 2D matrix $\mathbf{A}$,
what's the notation
to represent its **transpose**?

3D Math

Given a value
x between `[0, 1]`,
give the formula for
a **7th order smoothstep**.

3D Math

Given a value
x between `[0, 1]`,
give the formula for
smootherstep.

AKA: A 5th order smoothstep.

3D Math

Given a value
x between `[0, 1]`,
give the formula for
smoothstep.

3D Math

$$\frac{1}{\det(\mathbf{A})}\begin{bmatrix} a_{22} & -a_{12} \\ -a_{21} & a_{11} \end{bmatrix}$$

$\mathbf{A}^{-1}$

The matrix will be "corrected" so that:

- all 3 orientation vectors are **perpendicular** to each other
- all 3 orientation vectors are **unit** length.

$$\frac{1}{\det(\mathbf{A})}\begin{bmatrix} a_{22}a_{33}-a_{23}a_{32} & a_{13}a_{32}-a_{12}a_{33} & a_{12}a_{23}-a_{13}a_{22} \\ a_{23}a_{31}-a_{21}a_{33} & a_{11}a_{33}-a_{13}a_{31} & a_{13}a_{21}-a_{11}a_{23} \\ a_{21}a_{32}-a_{22}a_{31} & a_{12}a_{31}-a_{11}a_{32} & a_{11}a_{22}-a_{12}a_{21} \end{bmatrix}$$

(Note the pattern more than the actual values)

The **transpose** of matrix $\mathbf{A}$.

All 3 orientation vectors are not perpendicular to each other.

It can also be said the matrix is **not** *orthogonal*

$-20x^7 + 70x^6 - 84x^5 + 35x^4$

$\mathbf{A}^T$

$3x^2 - 2x^3$

$6x^5 - 15x^4 + 10x^3$

Given a value
x between `[0, 1]`,
give the formula for
the **inverse** of a **cubic smoothstep**.

3D Math

For Linear Algebra,

What term is the
generalization of
a **matrix**?

3D Math

For Linear Algebra,

What are other terms for:
1) A 1D tensor
2) A 2D tensor

3D Math

What does the term
cubic mean?

3D Math

What does the term
quadratic mean?

3D Math

Given **3D** vectors
$\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$,
what's the **difference**
between their **tripple product**
and the **determinant** of
a matrix made by those vectors?

3D Math

Given the 3D vectors
$\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$,
what does the
notation
$[\boldsymbol{a}\ \boldsymbol{b}\ \boldsymbol{c}]$
represent?

3D Math

Given the 3D vectors
$\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$,
what does the
scalar tripple product
$(\boldsymbol{a}\times\boldsymbol{b})\bullet\boldsymbol{c}$
represent?

3D Math

Given the 3D
vectors $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$, what is
the formula for the **volume** of
the **tetrahedron** they form?

3D Math

Given 3D vectors
$\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$,
what is the formula:
$(\boldsymbol{a}\times\boldsymbol{b})\bullet\boldsymbol{c}$
called?

3D Math

A tensor.

$1/2 - \sin(\mathrm{asin}(1-2x)/3)$

It involves a formula where a variable is raised to the **third power** - as the highest power.

1) A vector
2) A matrix

Nothing, they're equivalent.

It involves a formula where a variable is raised to the **second power** - as the highest power.

The volume of the parallelepiped formed by $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$.

Which is also their determinant

The volume of the parallelepiped formed by $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$.

Which is also their determinant
aka, The Tripple Product

Scalar tripple product.

$$\frac{(\boldsymbol{a}\times\boldsymbol{b})\bullet\boldsymbol{c}}{6}$$

Their scalar tripple product divided by 6

Given the 3D vectors $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$, what is the formula for the scalar tripple product?

3D Math

Given a 3D vector $\boldsymbol{v}$, with the elements x,y,z, what is the formula to calculate its **magnitude**?

3D Math

Given a 3D vector $\boldsymbol{v}$, with the elements x,y,z, what is the formula to calculate its **length**?

3D Math

Given a vector $\boldsymbol{v}$, what does the notation

$|\boldsymbol{v}|$

mean?

3D Math

Given a vector $\boldsymbol{v}$, what **notation** represents the **magnitude** of the vector?

3D Math

Given a vector $\boldsymbol{v}$, what does the dot-product

$\boldsymbol{v} \bullet \boldsymbol{v}$

give back?

In respect to $\boldsymbol{v}$

3D Math

Given a 3D vector $\boldsymbol{v}$, with the elements x,y,z, what is the **formula** to **normalize** it?

3D Math

Given a vector $\boldsymbol{v}$, what does the notation

$\|\boldsymbol{v}\|$

represent?

3D Math

Given a vector $\boldsymbol{v}$, what does the notation

$$\frac{\boldsymbol{v}}{|\boldsymbol{v}|}$$

represent?

3D Math

What does it mean if two **vectors** are **orthogonal** to each other?

3D Math

$$\sqrt{\boldsymbol{v}_x^2 + \boldsymbol{v}_y^2 + \boldsymbol{v}_z^2}$$

$$(\boldsymbol{a}\times\boldsymbol{b})\bullet\boldsymbol{c}$$

Operation is commutative,
order of vectors does not matter.

The magnitude
of the vector.

AKA: The Euclidean length

$$\sqrt{\boldsymbol{v}_x^2 + \boldsymbol{v}_y^2 + \boldsymbol{v}_z^2}$$

AKA: The vector magnitude formula

The
magnitude squared
of $\boldsymbol{v}$.

$$|\boldsymbol{v}|\ |\boldsymbol{v}|$$

AKA

$$|\boldsymbol{v}|^2$$

$$|\boldsymbol{v}|$$

The normalized value of $\boldsymbol{v}$.

AKA: The unit vector of $\boldsymbol{v}$.

$$\frac{\boldsymbol{v}}{\sqrt{\boldsymbol{v}_x^2 + \boldsymbol{v}_y^2 + \boldsymbol{v}_z^2}}$$

It means they are
perpendicular
to each other.

The normalized value of $\boldsymbol{v}$.

AKA: The unit vector of $\boldsymbol{v}$.

What value **multiplier** converts **degrees** to **radians**?

3D Math

How many units of pi (π) represents 360 degrees?

3D Math

What value multiplier converts **radian** to **degrees**?

3D Math

Given vectors $\boldsymbol{a}$ and $\boldsymbol{b}$ with elements x,y,z, give the formula for a **cross product**.

The result vector will be called $\boldsymbol{v}$.

3D Math

Given 3D vectors $\boldsymbol{a}$ and $\boldsymbol{b}$ what operation calculates the **area** a **triangle** with these vectors as the edges?

3D Math

When using the cross product,

if

$\boldsymbol{a} \times \boldsymbol{b} = \boldsymbol{v}$,

what is the value of

$\boldsymbol{b} \times \boldsymbol{a} = ?$

3D Math

Given vectors $\boldsymbol{a}$ and $\boldsymbol{b}$ what is the **identity** of the **magnitude** of their **cross product**?

3D Math

2

i.e., $2\pi = 360°$

$\pi/180$

$$\boldsymbol{v}_x = \boldsymbol{a}_y\boldsymbol{b}_z - \boldsymbol{a}_z\boldsymbol{b}_y$$
$$\boldsymbol{v}_y = \boldsymbol{b}_z\boldsymbol{a}_x - \boldsymbol{a}_x\boldsymbol{b}_z$$
$$\boldsymbol{v}_z = \boldsymbol{a}_x\boldsymbol{b}_y - \boldsymbol{a}_y\boldsymbol{b}_x$$

$180/\pi$

$-\boldsymbol{v}$

The cross product is not commutative.

$$\frac{|\boldsymbol{a}\times\boldsymbol{b}|}{2}$$

Where × is a cross product.
($|\boldsymbol{a}\times\boldsymbol{b}|$ returns the area of the parallelogram)

The area of the parallelpiped formed by $\boldsymbol{a}$ and $\boldsymbol{b}$.

OR

$$|\boldsymbol{a}|\ |\boldsymbol{b}|\ \sin\theta$$

(Where θ is the angle between $\boldsymbol{a}$ and $\boldsymbol{b}$.)