How to use Vectors Calculator

http://www.la-citadelle.com/mathematics/vectors_calculator

Note: Copy and Paste into the Input TextArea what is written after each example in Courier New Font *or just click on the* ***Show Me!*** *Link.*

Magnitude

Find the magnitude of the vector $\vec{a}=(1,-2,3)$. ***Show Me!***

```
a=(1,-2,3)
m=magnitude(a)
```

Dot Product

Find the dot product of the vectors $\vec{a}=(0,-2,3)$ *and* $\vec{b}=(1,2,-5)$. ***Show Me!***

```
a=(0,-2,3)
b=(1,2,-5)
d=a.b
```

Cross Product

Find the cross product of the vectors $\vec{a}=(0,-2,3)$ *and* $\vec{b}=(1,2,-5)$. ***Show Me!***

```
a=(0,-2,3)
b=(1,2,-5)
c=a^b
```

Mixed Product

Given $\vec{a}=(0,-2,3)$, $\vec{b}=(1,2,-5)$, *and* $\vec{c}=(-2,1,3)$, *find* $\vec{a}\cdot(\vec{b}\times\vec{c})$. ***Show Me!***

```
a=(0,-2,3)
b=(1,2,-5)
c=(-2,1,3)
d=a.(b^c)
```

Double Cross Product

Given $\vec{a}=(0,-2,3)$, $\vec{b}=(1,2,-5)$, *and* $\vec{c}=(-2,1,3)$, *find* $\vec{a}\times(\vec{b}\times\vec{c})$. ***Show Me!***

```
a=(0,-2,3)
b=(1,2,-5)
c=(-2,1,3)
d=a^(b^c)
```

Linear Algebra Expression

Given $\vec{a}=(0,-2,3)$, $\vec{b}=(1,2,-5)$, *and* $\vec{c}=(-2,1,3)$, *find* $(\vec{a}\cdot\vec{b})(\vec{a}\times\vec{b})+2\vec{b}\times\vec{c}-3(\vec{c}\times\vec{a})\times\vec{b}$. ***Show Me!***

```
a=(0,-2,3)
b=(1,2,-5)
c=(-2,1,3)
d=(a.b)*(a^b)+2*(b^c)-3*((c^a)^b)
```

Area

(Vector-Vector) Find the area of the parallelogram defined by the vectors $\vec{a}=(0,-2,3)$ *and* $\vec{b}=(1,2,-5)$. ***Show Me!***

```
a=(0,-2,3)
b=(1,2,-5)
c=area(a,b)
```

Volume

(Vector-Vector-Vector) Find the volume of the parallelepiped defined by the vectors $\vec{a}=(0,-2,3)$, $\vec{b}=(1,2,-5)$ *and* $\vec{c}=(-2,4,7)$. **Show Me!**

```
a=(0,-2,3)
b=(1,2,-5)
c=(-2,4,7)
V=volume(a,b,c)
```

Angles

(Vector-Vector) Find the angle between the vectors $\vec{a}=(0,-2,3)$ *and* $\vec{b}=(1,2,-5)$. **Show Me!**

```
a=(0,-2,3)
b=(1,2,-5)
c=angle(a,b)
```

(Line-Line) Find the angle between the lines $L_1:\vec{r}=(1,2,3)+t(2,-1,4)$ *and* $L_2:\vec{r}=(0,-2,5)+t(1,0,2)$. **Show Me!**

```
L1=(1,2,3,2,-1,4)
L2=(0,-2,5,1,0,2)
a=angle(L1,L2)
```

(Plane-Plane) Find the angle between the planes $\pi_1:-x+y-2z+4=0$ *and* $\pi_2:2x+2y+4z-6=0$. **Show Me!**

```
p1=(-1,1,-2,4)
p2=(2,2,4,-6)
a=angle(p1,p2)
```

(Plane-Plane) Find the angle between the planes $\pi_1:\vec{r}=(0,-2,1)+s(0,-2,3)+t(0,0,1)$ *and* $\pi_2:2x+2y+4z-6=0$. **Show Me!**

```
p1=[0,-2,1,0,-2,3,0,0,1]
p2=(2,2,4,-6)
a=angle(p1,p2)
```

Distances

(Point-Point) Find the distance between the point $A(2,1,5)$ *and the point* $B(-5,-3,7)$. **Show Me!**

```
A=[2,1,5]
B=[-5,-3,7]
d=distance(A,B)
```

(Point-Line) Find the distance from the point $A(2,0,5)$ *to the line* $L:\vec{r}=(1,2,3)+t(2,-1,4)$. **Show Me!**

```
A=[2,0,5]
L=(1,2,3,2,-1,4)
d=distance(A,L)
```

(Point-Plane) Find the distance from the point $A(2,0,5)$ *to the plane* $\pi:x+2y+3z-6=0$. **Show Me!**

```
A=[2,0,5]
p=(1,2,3,-6)
d=distance(A,p)
```

(Point-Plane) Find the distance from the point $A(2,0,5)$ *to the plane* $\pi:\vec{r}=(0,-2,1)+s(0,-2,3)+t(0,0,1)$. **Show Me!**

```
A=[2,0,5]
p=[0,-2,1,0,-2,3,0,0,1]
d=distance(A,p)
```

(Line-Line) Find the distance between the line $L_1 : \vec{r} = (1,2,3) + t(2,-1,4)$ *and the line* $L_2 : \vec{r} = (0,-2,5) + t(1,0,2)$.

Show Me!

```
L1=(1,2,3,2,-1,4)
L2=(0,-2,5,1,0,2)
d=distance(L1,L2)
```

(Line-Plane) Find the distance from the line $L : \vec{r} = (1,2,3) + t(2,-1,4)$ *to the plane* $\pi : x + 2y + 3z - 6 = 0$.

Show Me!

```
L=(1,2,3,2,-1,0)
p=(1,2,3,-6)
d=distance(L,p)
```

(Line-Plane) Find the distance from the line $L : \vec{r} = (1,2,3) + t(2,-1,4)$ *to the plane* $\pi : \vec{r} = (0,-2,1) + s(2,-1,4) + t(0,0,1)$.

Show Me!

```
L=(1,2,3,2,-1,0)
p=[0,-2,1,2,-1,4,0,0,1]
d=distance(L,p)
```

(Plane-Plane) Find the distance between the planes $\pi_1 : -x + y - 2z + 4 = 0$ *and* $\pi_2 : 2x - 2y + 4z - 6 = 0$.

Show Me!

```
p1=(-1,1,-2,4)
p2=(2,-2,4,-6)
d=distance(p1,p2)
```

Intersections

(Line-Line) Find the intersection between the lines $L_1 : \vec{r} = (3,4,5) + t(1,1,1)$ *and* $L_2 : \vec{r} = (2,4,4) + t(1,2,1)$.

Show Me!

```
L1=(3,4,5,1,1,1)
L2=(2,4,4,1,2,1)
p=intersection(L1,L2)
```

(Line-Plane) Find the intersection between the line $L : \vec{r} = (1,2,3) + t(2,-1,4)$ *and the plane* $\pi : x + 2y + 3z - 6 = 0$.

Show Me!

```
L=(1,2,3,2,-1,4)
p=(1,2,3,-6)
A=intersection(L,p)
```

(Line-Plane) Find the intersection between the line $L : \vec{r} = (1,2,3) + t(2,1,4)$ *and the plane* $\pi : \vec{r} = (0,-2,1) + s(2,-1,4) + t(0,0,1)$.

Show Me!

```
L=(1,2,3,2,1,4)
p=[0,-2,1,2,-1,4,0,0,1]
A=intersection(L,p)
```

(Plane-Plane) Find the intersection between the planes $\pi_1 : -x + y - 2z + 4 = 0$ *and* $\pi_2 : 2x + 2y + 4z - 6 = 0$.

Show Me!

```
p1=(-1,1,-2,4)
p2=(2,2,4,-6)
c=intersection(p1,p2)
```

(Plane-Plane) Find the intersection between the planes $\pi_1 : -x + y - 2z + 4 = 0$ *and* $\pi_2 : \vec{r} = (0,-2,1) + s(2,-1,4) + t(0,0,1)$.

Show Me!

```
p1=(-1,1,-2,4)
p2=[0,-2,1,2,-1,4,0,0,1]
c=intersection(p1,p2)
```

(Plane-Plane-Plane) Find the intersection between the planes $\pi_1 : -x+y-2z+4=0$, $\pi_2 : 2x+2y+4z-6=0$, and $\pi_3 : x-y+z-3=0$. ***Show Me!***

```
p1=(-1,1,-2,4)
p2=(2,2,4,-6)
p3=(1,-1,1,-3)
L=intersection(p1,p2)
A=intersection(L,p3)
```

(Line-Coordinate Plane) Find the intersection between the line $L : \vec{r} = (1,2,3)+t(2,-1,4)$ *and the xy-plane.*

Show Me!

```
L=(1,2,3,2,-1,4)
A=intersection(L,xy)
```

(Plane-Coordinate Axis) Find the intersection between the plane $\pi : -x+y-2z+4=0$ *and the x-axis.*

Show Me!

```
p=(-1,1,-2,4)
A=intersection(p,x)
```

(Plane-Plane-Plane) Find the intersection between the planes $\pi_1 : \vec{r} = (0,1,2)+s(3,4,5)+t(6,7,8)$, $\pi_2 : \vec{r} = (0,-2,1)+s(2,-1,4)+t(0,0,1)$, and $\pi_3 : x-y+z-3=0$. ***Show Me!***

```
p1=[0,1,2,3,4,5,6,7,8]
p2=[0,-2,1,2,-1,4,0,0,1]
p3=(1,-1,1,-3)
L=intersection(p1,p2)
A=intersection(L,p3)
```

Perpendicular Lines

(Point-Line) Find the perpendicular line from the point $A(2,0,5)$ *to the line* $L : \vec{r} = (1,2,3)+t(2,-1,4)$. ***Show Me!***

```
A=[2,0,5]
L=(1,2,3,2,-1,4)
L2=pline(A,L)
```

(Point-Plane) Find the perpendicular line from the point $A(2,0,5)$ *to the plane* $\pi : x+2y+3z-6=0$.

Show Me!

```
A=[2,0,5]
p=(1,2,3,-6)
L=pline(A,p)
```

(Point-Plane) Find the perpendicular line from the point $A(2,0,5)$ *to the plane* $\pi : \vec{r} = (0,-2,1)+s(2,-1,4)+t(0,0,1)$.

Show Me!

```
A=[2,0,5]
p=[0,-2,1,2,-1,4,0,0,1]
L=pline(A,p)
```

(Line-Line) Find the perpendicular line to the lines $L_1 : \vec{r} = (1,2,3)+t(2,-1,4)$ *and* $L_2 : \vec{r} = (0,-2,5)+t(1,0,2)$.

Show Me!

```
L1=(1,2,3,2,-1,4)
L2=(0,-2,5,1,0,2)
L=pline(L1,L2)
```

Perpendicular Foot

(Point-Line) Find the foot of the perpendicular line from the point $A(2,0,5)$ *to the line* $L:\vec{r}=(1,2,3)+t(2,-1,4)$.

Show Me!

```
A=[2,0,5]
L=(1,2,3,2,-1,4)
P=foot(A,L)
```

(Point-Plane) Find the foot of the perpendicular line from the point $A(2,0,5)$ *to the plane* $\pi: x+2y+3z-6=0$.

Show Me!

```
A=[2,0,5]
p=(1,2,3,-6)
F=foot(A,p)
```

(Point-Plane) Find the foot of the perpendicular line from the point $A(2,0,5)$ *to the plane* $\pi:\vec{r}=(0,-2,1)+s(2,-1,4)+t(0,0,1)$.

Show Me!

```
A=[2,0,5]
p=[0,-2,1,2,-1,4,0,0,1]
F=foot(A,p)
```

(Line-Line) Find the foots of the perpendicular line to the lines $L_1:\vec{r}=(1,2,3)+t(2,-1,4)$ *and* $L_2:\vec{r}=(0,-2,5)+t(1,0,2)$.

Show Me!

```
L1=(1,2,3,2,-1,4)
L2=(0,-2,5,1,0,2)
A=foot(L1,L2)
B=foot(L2,L1)
```

Constructors

(Point-Point->Line) Find the equation of the line that passes through the points $A(2,0,5)$ *and* $B(0,-3,7)$.

Show Me!

```
A=[2,0,5]
B=[0,-3,7]
L=line(A,B)
```

(Point-Direction Vector->Line) Find the equation of the line that passes through the points $A(2,0,5)$ *and has a direction vector* $\vec{u}=(1,2,3)$.

Show Me!

```
A=[2,0,5]
u=(1,2,3)
L=line(A,u)
```

(Point-Point-Point->Plane) Find the equation of the plane that passes through the points $A(2,0,5)$, $B(0,-3,7)$, *and* $C(7,-5,10)$.

Show Me!

```
A=[2,0,5]
B=[0,-3,7]
C=[7,-5,10]
p=plane(A,B,C)
```

(Point-Point-Point->Triangle) Find the triangle with the vertices $A(2,0,5)$, $B(0,-3,7)$, *and* $C(7,-5,10)$.

Show Me!

```
A=[2,0,5]
B=[0,-3,7]
C=[7,-5,10]
p=triangle(A,B,C)
```

(Point-Point-Point-Point ->Pyramid) Find the pyramid with the vertices $A(2,-2,-2)$, $B(3,5,2)$, $C(-5,2,3)$, *and* $D(2,-1,7)$. ***Show Me!***

```
A=[2,-2,-2]
B=[3,5,2]
C=[-5,2,3]
D=[2,-1,7]
p=pyramid(A,B,C,D)
```

MidPoint and Centroid

(Midpoint) Find the mid point between the points $A(4,6,5)$, $B(0,-2,7)$. ***Show Me!***

```
A=[4,6,5]
B=[0,-2,7]
M=(A+B)/2
```

(Centroid) Find the centroid of the points $A(4,6,5)$, $B(0,-2,7)$, $C(-2,2,-2)$. ***Show Me!***

```
A=[4,6,5]
B=[0,-2,7]
C=[-2,2,-2]
M=(A+B+C)/3
```

Triangle

(Median Line) Consider the triangle with the vertices $A(4,6,5)$, $B(0,-2,7)$, $C(-2,2,-2)$. *Find the equation of the median line from the vertex* A. ***Show Me!***

```
A=[4,6,5]
B=[0,-2,7]
C=[-2,2,-2]
M=(B+C)/2
u=M-A
L=line(A,u)
```

(Bisector Line) Consider the triangle with the vertices $A(4,6,5)$, $B(0,-2,7)$, $C(-2,2,-2)$. *Find the equation of the bisector line from the vertex* A. ***Show Me!***

```
A=[4,6,5]
B=[0,-2,7]
C=[-2,2,-2]
AB=B-A
AC=C-A
u=AB/magnitude(AB)+AC/magnitude(AC)
L=line(A,u)
```

(Altitude Line) Consider the triangle with the vertices $A(4,6,5)$, $B(0,-2,7)$, $C(-2,2,-2)$. *Find the equation of the altitude line from the vertex* A. ***Show Me!***

```
A=[4,6,5]
B=[0,-2,7]
C=[-2,2,-2]
AB=B-A
AC=C-A
BC=C-B
n=AB^AC
u=n^BC
L=line(A,u)
```

(Perpendicular Bisector Line) Consider the triangle with the vertices $A(4,6,5)$, $B(0,-2,7)$, $C(-2,2,-2)$. *Find the equation of the perpendicular bisector to the side* BC. **Show Me!**

```
A=[4,6,5]
B=[0,-2,7]
C=[-2,2,-2]
AB=B-A
AC=C-A
BC=C-B
n=AB^AC
u=n^BC
M=(B+C)/2
L=line(M,u)
```

Descriptors

(Point or Vector) Describe the vector $\vec{a}=(0,-2,3)$. **Show Me!**

```
a=(0,-2,3)
d=describe(a)
```

(Line) Describe the line $L:\vec{r}=(1,2,3)+t(2,-1,4)$. **Show Me!**

```
L=(1,2,3,2,-1,4)
d=describe(L)
```

(Plane) Describe the plane $\pi:-x+y-2z+4=0$. **Show Me!**

```
p=(-1,1,-2,4)
d=describe(p)
```

(Plane) Describe the plane $\pi:\vec{r}=(0,-2,1)+s(2,-1,4)+t(0,0,1)$. **Show Me!**

```
p=[0,-2,1,2,-1,4,0,0,1]
d=describe(p)
```

(Triangle) Describe the triangle with the vertices $A(2,0,5)$, $B(0,-3,7)$, *and* $C(7,-5,10)$. **Show Me!**

```
A=[2,0,5]
B=[0,-3,7]
C=[7,-5,10]
p=triangle(A,B,C)
d=describe(p)
```

Predefined Elements

These elements are defined internally in the system. Do not redefined them or use with another purpose.

```
x=(0,0,0,1,0,0) //the x-axis
y=(0,0,0,0,1,0) //the y-axis
z=(0,0,0,0,0,1) //the y-axis
yz=(1,0,0,0) //the yz-plane
zy=(1,0,0,0) //the zy-plane
zx=(0,1,0,0) //the zx-plane
xz=(0,1,0,0) //the xz-plane
xy=(0,0,1,0) //the xy-plane
yx=(0,0,1,0) //the yx-plane
```