*
https://www.wolframalpha.com/input/?i=eigenvector+%7B%7B1%2C2%7D%2C%7B2%2C1%7D%7D

WolframAlpha

eigenvector {{1,2},{2,1}}

Extended Keyboard   Upload

Input:

eigenvectors $\begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$

Results:

$v_1 = (1, 1)$

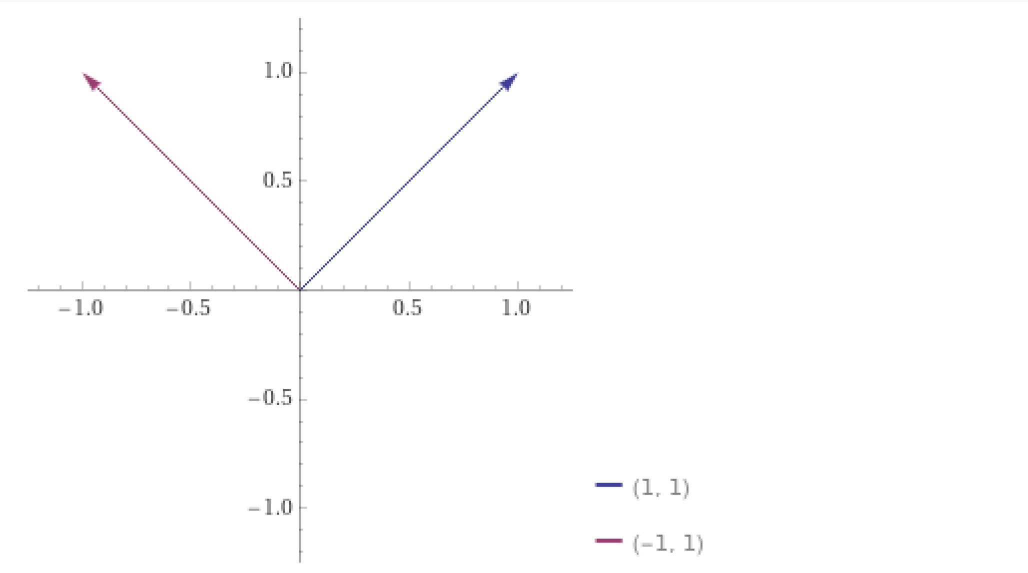
$v_2 = (-1, 1)$

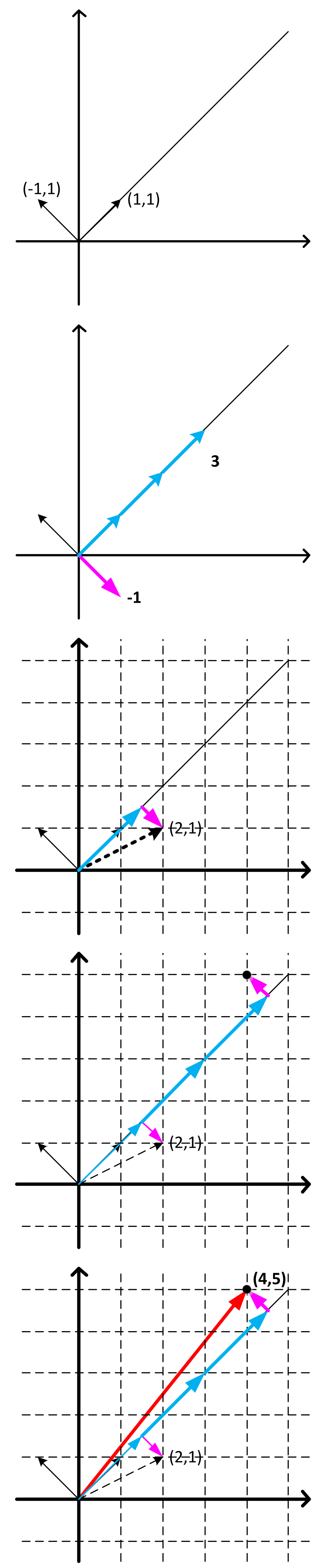
Corresponding eigenvalues:

$\lambda_1 = 3$

$\lambda_2 = -1$

Plot of eigenvectors:





$\vec{e} = (3, \ -1)$
$\vec{v} = (2, \ 1)$

$R R^{-1} \vec{v}$

$R^{-1} \vec{v}$
$\vec{v}' = Vector3.Scale(\vec{e}, R^{-1} \vec{v})$
$R \vec{v}'$

https://docs.unity3d.com/ScriptReference/Vector3.Scale.html

Vector3.Scale

public static Vector3 Scale(Vector3 a, Vector3 b);

Description

Multiplies two vectors component-wise.

Every component in the result is a component of a multiplied by the same component of b.

```
// Calculate the two vectors generating a result.
// This will compute Vector3(2, 6, 12)

using UnityEngine;
using System.Collections;

public class ExampleClass : MonoBehaviour
{
    void Example()
    {
        print(Vector3.Scale(new Vector3(1, 2, 3), new Vector3(2, 3, 4)));
    }
}
```

```
import numpy as np

M = np.array([[1,2],[2,1]])
M = np.mat(M)
a = np.array([[1, -1], [1, 1]])
R = np.mat(a) #eigenvector
print("eigenvector R = ",R)
#print("eigenvector.Inverse=",R.I)

e = np.array([[3],[-1]])
e = np.mat(e)
print("eigenvalue e = ",e)

# scale test for (2,1)
v = np.array([[2],[1]])
print("scale test for v=",v)
t = R.I @ v
#print("t=",t)
t2 = np.multiply(e,t)
#print("t2=",t2)
enew = R @ t2
print("enew eigenvector = ", enew)
```

$\begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$

$v_1 = (1, 1)$

$v_2 = (-1, 1)$

$\lambda_1 = 3$

$\lambda_2 = -1$

```
eigenvector R = [[ 1 -1]
 [ 1  1]]
eigenvalue e = [[ 3]
 [-1]]
scale test for v= [[2]
 [1]]
enew eigenvector = [[4.]
 [5.]]
```

```
# test
test = np.array([[2],[1]])
test = np.mat(test)
testResult = M @ test
print("testResult = ",testResult)
```

```
testResult = [[4]
 [5]]

Process finished with exit code 0
```

Torque

From Wikipedia, the free encyclopedia

For other uses, see Torque (disambiguation).

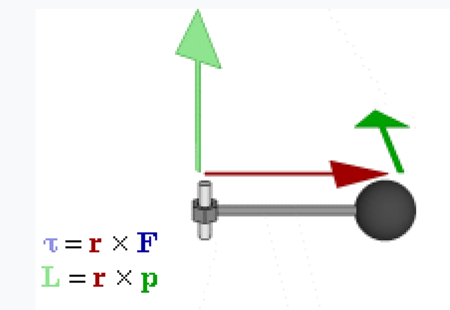
In physics and mechanics, **torque** is the rotational equivalent of linear force.[1] It is also referred to as the **moment**, **moment of force**, **rotational force** or **turning effect**, depending on the field of study. The concept originated with the studies by Archimedes of the usage of levers. Just as a linear force is a push or a pull, a torque can be thought of as a twist to an object around a specific axis. Another definition of torque is the product of the magnitude of the force and the perpendicular distance of the line of action of a force from the axis of rotation. The symbol for torque is typically $\boldsymbol{\tau}$, the lowercase Greek letter *tau*. When being referred to as moment of force, it is commonly denoted by M.

In three dimensions, the torque is a pseudovector; for point particles, it is given by the cross product of the position vector (distance vector) and the force vector. The magnitude of torque of a rigid body depends on three quantities: the force applied, the *lever arm vector*[2] connecting the point about which the torque is being measured to the point of force application, and the angle between the force and lever arm vectors. In symbols:

$$\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F}$$

$$\tau = \|\mathbf{r}\| \, \|\mathbf{F}\| \sin\theta$$

Torque



Relationship between force **F**, torque **τ**, linear momentum **p**, and angular momentum **L** in a system which has rotation constrained to only one plane (forces and moments due to gravity and friction not considered).

Common symbols	*τ*, *M*
SI unit	N·m
Other units	pound-force-feet, lbf·inch, ozf·in
In SI base units	kg·m^2·s^{-2}
Dimension	M L^{2}T^{-2}

The net torque on a body determines the rate of change of the body's angular momentum,

$$\boldsymbol{\tau} = \frac{\mathrm{d}\mathbf{L}}{\mathrm{d}t}$$

where **L** is the angular momentum vector and t is time.

For the motion of a point particle,

$$\mathbf{L} = I\boldsymbol{\omega},$$

where I is the moment of inertia and $\boldsymbol{\omega}$ is the orbital angular velocity pseudovector. It follows that

Moment of inertia

From Wikipedia, the free encyclopedia
(Redirected from Inertia tensor)

Moment of inertia may also refer to the Second Moment of Area. For inf
Second moment of area.

The **moment of inertia**, otherwise known as the **mass moment of inertia**, **angular mass** or **rotational inertia**, of a rigid body is a quantity that determines the torque needed for a desired angular acceleration about a rotational axis; similar to how mass determines the force needed

Definition [edit]

For a rigid object of N point masses m_k, the moment of inertia tensor is given by

$$\mathbf{I} = \begin{bmatrix} I_{11} & I_{12} & I_{13} \\ I_{21} & I_{22} & I_{23} \\ I_{31} & I_{32} & I_{33} \end{bmatrix}.$$

Derivation of the tensor components [edit]

The distance r of a particle at $\mathbf{x}$ from the axis of rotation passing through the origin in the $\hat{\mathbf{n}}$ direction is $|\mathbf{x} - (\mathbf{x} \cdot \hat{\mathbf{n}})\hat{\mathbf{n}}|$, where $\hat{\mathbf{n}}$ is unit vector. The moment of inertia on the axis is

$$I = mr^2 = m(\mathbf{x} - (\mathbf{x} \cdot \hat{\mathbf{n}})\hat{\mathbf{n}})^2 = m(\mathbf{x}^2 - 2\mathbf{x}(\mathbf{x} \cdot \hat{\mathbf{n}})\hat{\mathbf{n}} + (\mathbf{x} \cdot \hat{\mathbf{n}})^2 \hat{\mathbf{n}}^2) = m(\mathbf{x}^2 - (\mathbf{x} \cdot \hat{\mathbf{n}})^2).$$

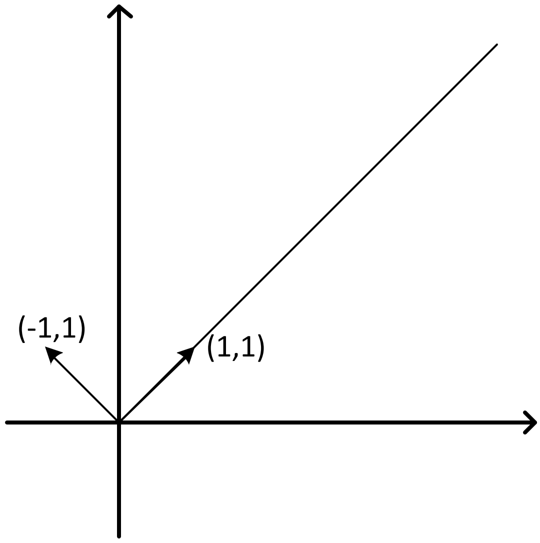
Rewrite the equation using matrix transpose:

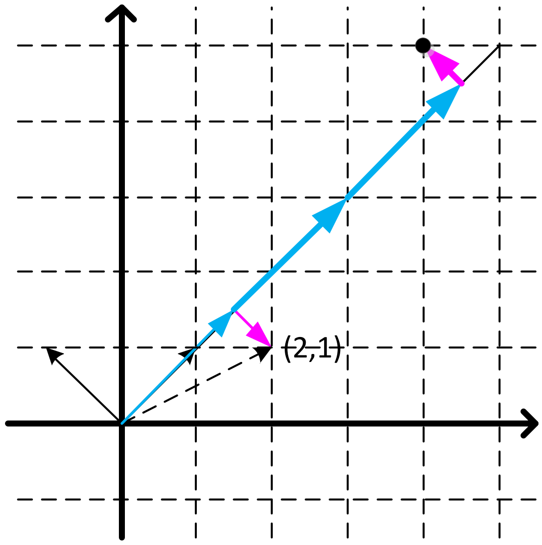
$$I = m(\mathbf{x}^T \mathbf{x} - \hat{\mathbf{n}}^T \mathbf{x} \mathbf{x}^T \hat{\mathbf{n}}) = m \cdot \hat{\mathbf{n}}^T (\mathbf{x}^T \mathbf{x} \cdot \mathbf{E_3} - \mathbf{x} \mathbf{x}^T) \hat{\mathbf{n}},$$

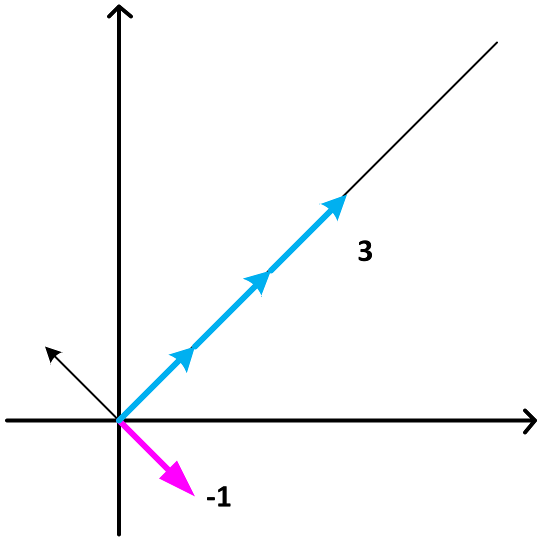
where $\mathbf{E}_3$ is the 3 × 3 identity matrix.

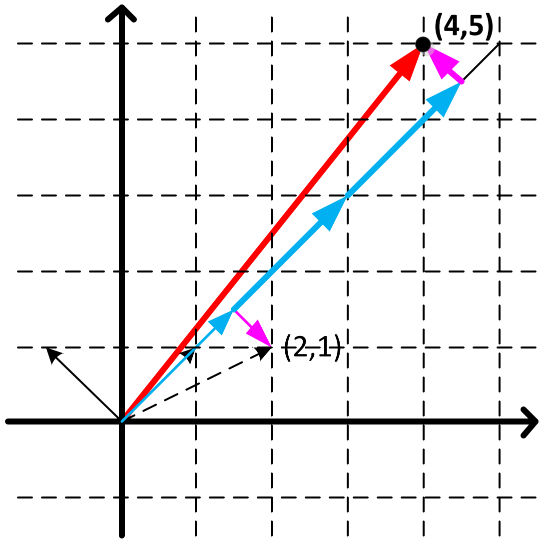
This leads to a tensor formula for the moment of inertia

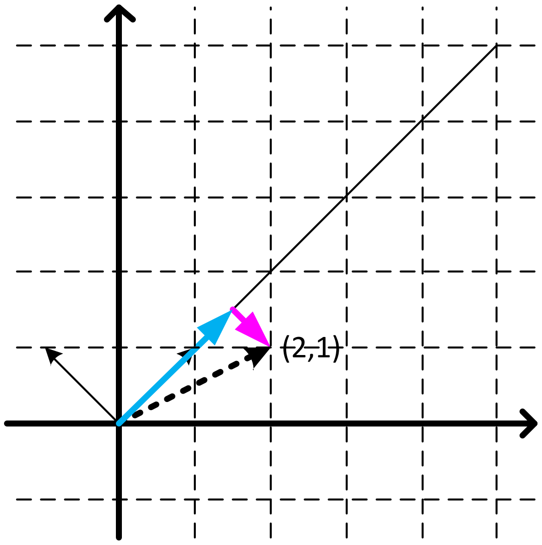
$$I = m[n_1, n_2, n_3] \begin{bmatrix} y^2 + z^2 & -xy & -xz \\ -yx & x^2 + z^2 & -yz \\ -zx & -zy & x^2 + y^2 \end{bmatrix} \begin{bmatrix} n_1 \\ n_2 \\ n_3 \end{bmatrix}.$$


(-1,1)
(1,1)


(2,1)


3
-1


(4,5)
(2,1)


(2,1)