mat214HWK1

Dot and Cross Products

You need to define the variables that you will be using with "var".

Specify the vector by giving its coordinates. The coordinates may contain variables.

```python
var ( 'a,b,c,u,v,w,s,t' )
a = vector([1,-1/3,s])
b = vector([-1,s,1])
```

Now a and b are defined as vectors with the coordinates given above.

There are many methods for vectors. Just type the vector name like "a"

followed by a dot "." and hit "tab" to see a list of available methods for vectors.

Type "a.dot<tab>" and it completes the name.

```python
a.dot_product(b)
2/3*s - 1
```

```python
a.cross_product(b)
(-s^2 - 1/3, -s - 1, s - 1/3)
```

```python
b.cross_product(a)
(s^2 + 1/3, s + 1, -s + 1/3)
```

```python
a.norm()
\sqrt{|s|^2 + \frac{10}{9}}
```

```python
ab = b-a
ab
(-2, s + \frac{1}{3}, -s + 1)
```

```python
ab.norm()
\sqrt{|-s+1|^2 + |s+\frac{1}{3}|^2 + 4}
```

```python
t*a
(t, -\frac{1}{3} t, st)
```

```python
((t*a).norm() - abs(t)*a.norm()).full_simplify()
```
\[
\left( \frac{a}{a \cdot \text{norm}(a)} \right) \cdot \text{norm}(a) \cdot \text{full\_simplify()}
\]

\[
1
\]

\[
\text{var} \left( 'a1, a2, a3, b1, b2, b3' \right)
\]

\[
a = \text{vector}([a1, a2, a3])
\]

\[
b = \text{vector}([b1, b2, b3])
\]

\[
aXb = a \cdot \text{cross\_product}(b)
\]

\[
aXb
\]

\[
(a_2 b_3 - a_3 b_2, -a_1 b_3 + a_3 b_1, a_1 b_2 - a_2 b_1)
\]

\[
a = \text{vector}([-1, 0, 2])
\]

\[
b = \text{vector}([2, 1, 1])
\]

\[
a - b
\]

\[
(-3, -1, 1)
\]

\[
\text{adotb} = a \cdot \text{dot\_product}(b)
\]

\[
\text{adotb}
\]

\[
0
\]

\[
ahat = a / a \cdot \text{norm}(a)
\]

\[
bhat = b / b \cdot \text{norm}(b)
\]

\[
ahat \cdot \text{norm}(a)
\]

\[
1
\]

\[
\text{angleab} = \text{acos}(ahat \cdot \text{dot\_product}(bhat))
\]

\[
\text{angleab}
\]

\[
\frac{1}{2} \pi
\]

\[
v = \text{vector}([-1, 5, -2])
\]

\[
w = \text{vector}([3, 1, 1])
\]

\[
vw = (v - w) \cdot \text{norm}()
\]

\[
vwm = v \cdot \text{norm}() - w \cdot \text{norm}()
\]

\[
(vwm - vw) \cdot \text{N}()
\]

\[
-4.24252345273659
\]