3.3.

September 1, 2025

```python
# 2
def dot(v1, v2):
    return sum([x*y for x,y in zip(v1,v2)])

print(dot((1,2,3), (4,5,6)))  # 32
```

```
32
```

```python
#     2
from vectors import *
from math import acos, pi

def angle(v1, v2):
    return acos(dot(v1,v2) / (length(v1)*length(v2))) * 180 / pi

print(angle((1,0,0), (0,1,0)))  # 1.5707963267948966 (90 )
print(angle((3,4), (4,3)))
```

```
90.0
16.260204708311967
```

```python
#  3.12
v1 = (-1,-1,1)
v2 = (1,2,1)
print(dot(v1,v2))
print(angle(v1,v2))
```

```
-2
118.1255057020557
```

```python
#  3.16
from math import cos
v1_length = 3.61
v2_length = 1.44
print(v1_length * v2_length * cos(101.3 * pi / 180))
```

```
-1.0186064362303022
```

```
[10]:  #  3.17
       polar1 = to_polar((3,4))
       polar2 = to_polar((4,3))
       print(abs(polar1[1] - polar2[1]) * 180 / pi)
       print(angle((3,4), (4,3)))
```

```
16.260204708311957
16.260204708311967
```

```
[11]:  angle((1,1,1), (-1,-1,1))
```

```
[11]:  109.47122063449069
```