Congratulations! You passed!

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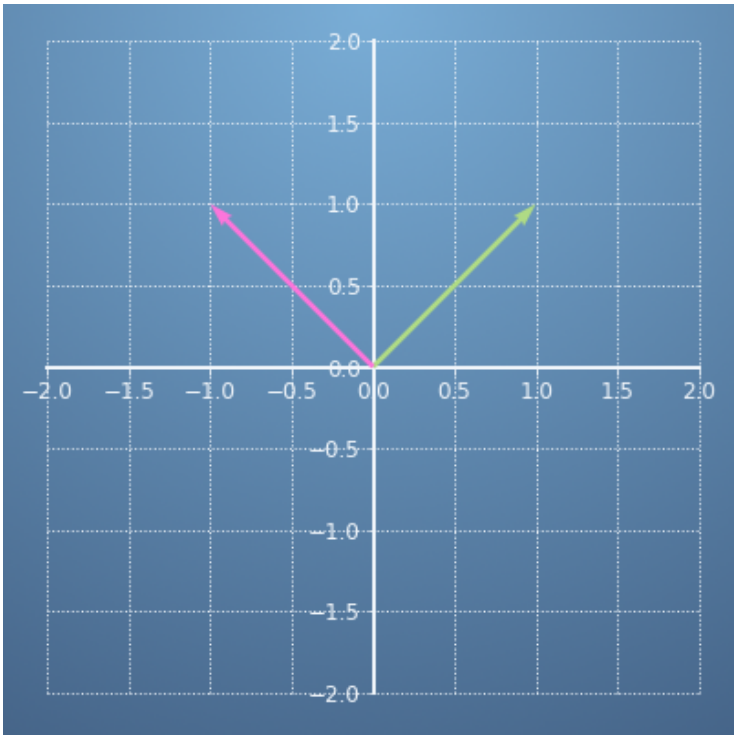
Go to next item

1. **1 / 1 point**



Compute the angle between

$$\begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$\mathbf{x} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$ using the inner product defined by

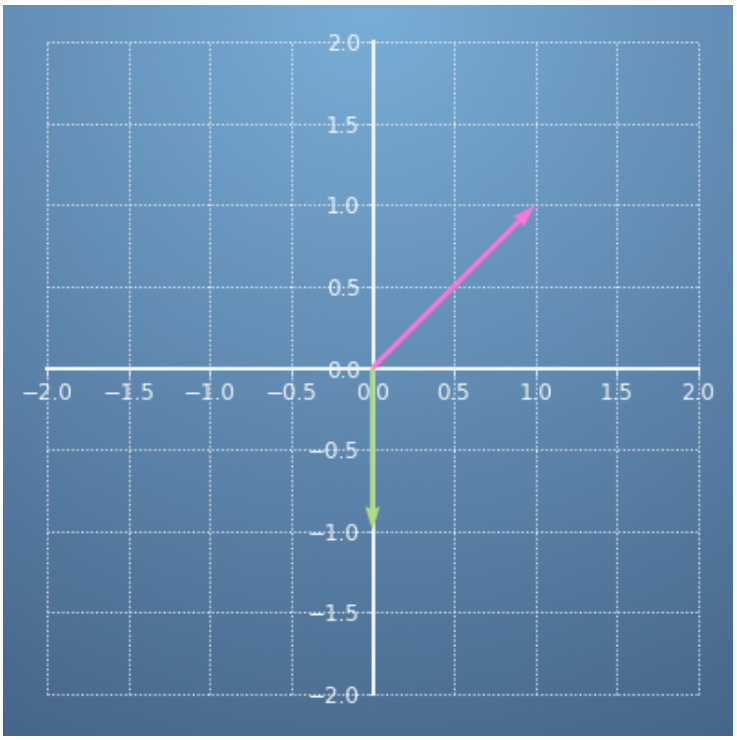
$$\begin{bmatrix} 2 & -1 \\ -1 & 4 \end{bmatrix}$$

$\mathbf{\mathbf{y}\langle x, y\rangle} = \mathbf{x}^T \begin{bmatrix} 2 & -1 \\ -1 & 4 \end{bmatrix} \mathbf{y}$

- 1.57 rad (90°)
- 0.35 rad (20°)
- 1.2 rad (69°)

Correct
Absolutely right!

2. **1 / 1 p**



Compute the angle between

$$\begin{bmatrix} 0 \\ -1 \end{bmatrix}$$

$\mathbf{x} = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ using the inner product defined by

$$\begin{bmatrix} 1 & -\frac{1}{2} \\ -\frac{1}{2} & 5 \end{bmatrix}$$

$\mathbf{y}\rangle = \mathbf{x}^T \begin{bmatrix} 1 & -\frac{1}{2} \\ -\frac{1}{2} & 5 \end{bmatrix} \mathbf{y}$.

To aid in computing this angle and the next ones in this quiz, let's write an expression in Python for the angle between two vectors using a non-standard inner product.

Remember $\cos\alpha = \frac{\langle x,y\rangle}{\|x\|\cdot\|y\|} = \frac{\langle x,y\rangle}{\sqrt{\langle x,x\rangle}\cdot\sqrt{\langle y,y\rangle}}$

Complete the expressions for norm_x and norm_y and then run the code. You might find the NumPy function np.sqrt useful.

```
# the matrix A defines the inner product
A = np.array([[1, -1/2],[-1/2,5]])
x = np.array([0,-1])
y = np.array([1,1])

def find_angle(A, x, y):
    """Compute the angle"""
    inner_prod = x.T @ A @ y
    # Fill in the expression for norm_x and norm_y below
    norm_x = np.linalg.norm(x)
    norm_y = np.linalg.norm(y)
    alpha = inner_prod/(norm_x*norm_y)
    print("alpha: ", alpha)
    angle = np.arccos(alpha)
    return np.round(angle,2)

find_angle(A, x, y)
```

Run

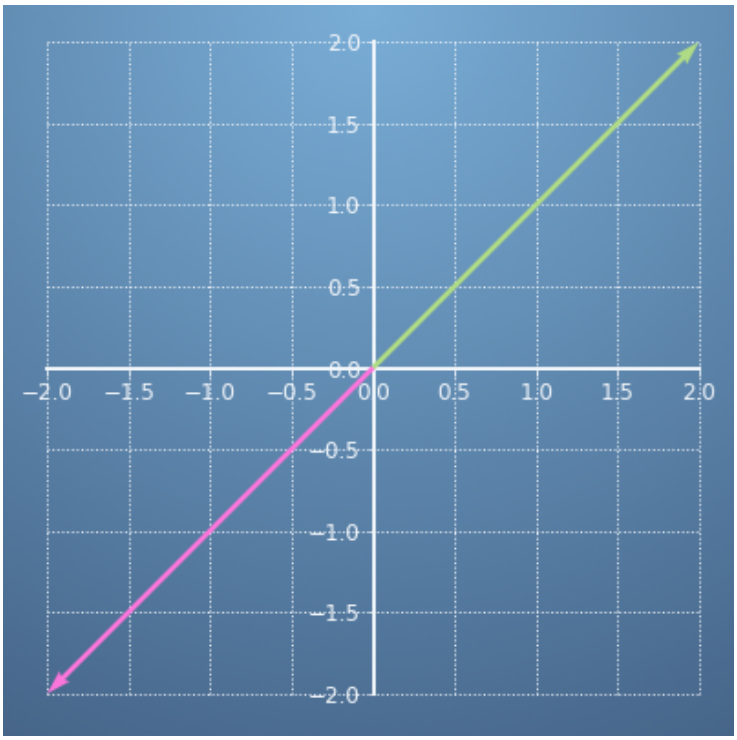
Reset

```
alpha:  -3.18198051534
alpha:  -3.18198051534
nan
```

- 2.35 rad (135°)
- -0.9 rad (-52°)
- 2.69 rad (154°)

Correct
Well done!

3. **1 / 1 point**



Compute the angle between

$$\begin{bmatrix} 2 \\ 2 \end{bmatrix}$$

$\mathbf{x} = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} -2 \\ -2 \end{bmatrix}$ using the inner product defined by

$$\begin{bmatrix} 2 & 1 \\ 1 & 4 \end{bmatrix}$$

\mathbf{y}\langle \mathbf{x}, \mathbf{y} \rangle = $\mathbf{x}^T \begin{bmatrix} 2 & 1 \\ 1 & 4 \end{bmatrix} \mathbf{y}$

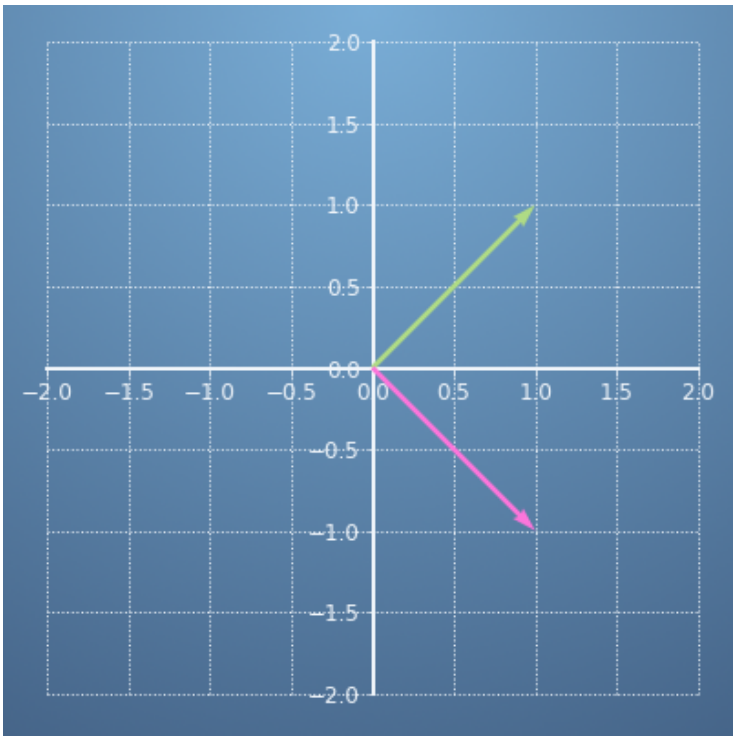
Using this inner product, are the vectors...

- ○ Parallel
- ◉ Antiparallel

Correct

Well done! The angle between the vectors is $\pi \approx 3.14$.

4. **1 / 1 p**



Compute the angle between

$$\begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$\mathbf{x} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ using the inner product defined by

$$\begin{bmatrix} 1 & 0 \\ 0 & 5 \end{bmatrix}$$

$\mathbf{y}\langle \mathbf{x}, \mathbf{y} \rangle = \mathbf{x}^T \begin{bmatrix} 1 & 0 \\ 0 & 5 \end{bmatrix} \mathbf{y}$

```
1   # Fill in the arrays and use the function `find_angle` defined for you to aid in your c
2   A = np.array([[1,0],[0,5]])
3   x = np.array([1,1])
4   y = np.array([1,1])
5
6   find_angle(A, x, y)
```

Run

Reset

nan

- ○ -1.57 rad (-90°)
- ○ -2.3 rad (-131°)
- ◉ 2.3 rad (131°)
- ○ 1.57 rad (90°)

✓ **Correct**
Good job.

5. Compute the angle between

1 / 1 p

$$\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$\mathbf{x} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} 2 \\ -1 \\ 0 \end{bmatrix}$ using the inner product defined by

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$$

$\mathbf{\mathbf{y}}\langle \mathbf{x}, \mathbf{y} \rangle = \mathbf{x}^T \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix} \mathbf{y}$

```
# Fill in the following arrays and use `find_angle` to aim your calculation.
A = np.array([[1,0,0], [0,2,-1], [0,-1,3]])
x = np.array([1,1,1])
y = np.array([2,-1,0])

find_angle(A, x, y)
```

Run

Reset

1.37

- ○ 0.2 rad (11°)
- ◉ 1.37 rad (78°)
- ○ 1.31 rad (75°)

✓ **Correct**

Well done!