Congratulations! You passed!

Grade received 100%
Latest Submission Grade 100%
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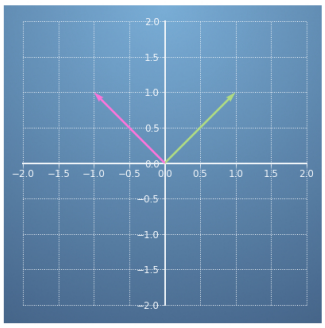
Go to next item

1. 1 / 1 point



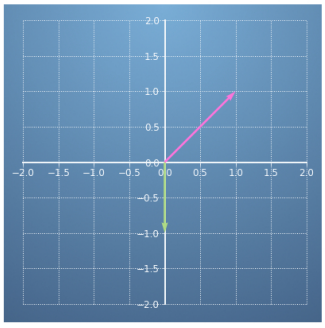
Compute the angle between $\mathbf{x} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$ using the inner product defined by

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

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

Correct
Absolutely right!

2. 1 / 1 point



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

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

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.

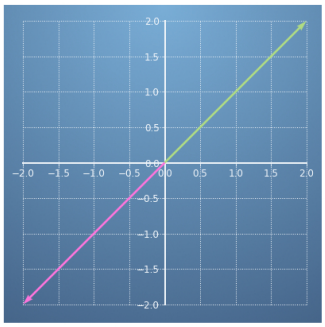
```
# the matrix A defines the inner product
A = np.array([[1, -1/2],[-1/2,5]])
x = np.array([0,-1])
y = np.array([1,1])


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.sqrt([x.T @ A @ x])
    norm_y = np.sqrt([y.T @ A @ y])
    alpha = inner_prod/(norm_x*norm_y)
    angle = np.arccos(alpha)
    return np.round(angle,2)

find_angle(A, x, y)
```

Run
Reset

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

Correct
Well done!

3. 1 / 1 point



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

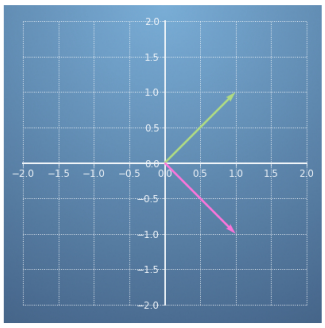
$$\langle \mathbf{x}, \mathbf{y} \rangle = \mathbf{x}^T \begin{bmatrix} 2 & 1 \\ 1 & 4 \end{bmatrix} \mathbf{y}$$

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 point



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

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

```
# Fill in the arrays and use the function `find_angle` defined for you to aid i

A = np.array([[1, 0],[0,5]])
x = np.array([1,1])
y = np.array([1,-1])

find_angle(A, x, y)
```

Run
Reset

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

Correct
Good job.

5. 1 / 1 point

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

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

```
# 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

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

Correct
Well done!