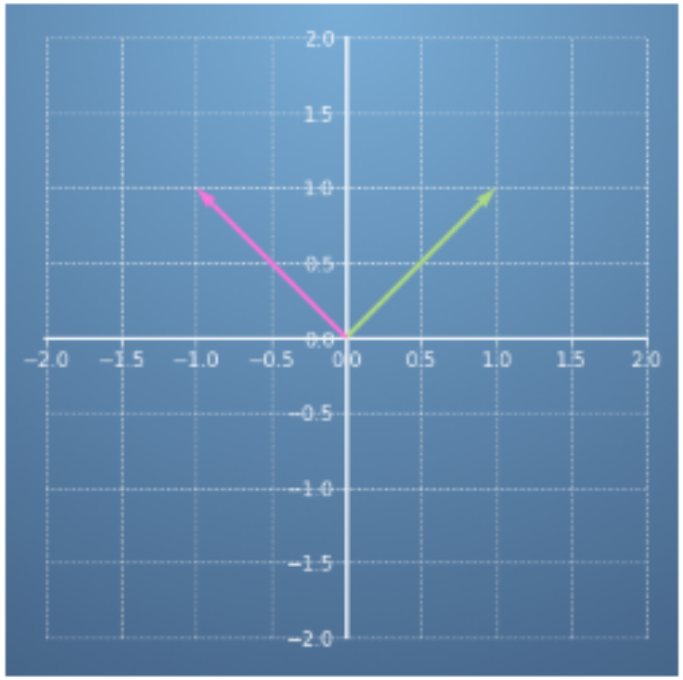
Your grade: 100%

Your latest: **100%** • Your highest: **100%** • To pass you need at least 80%. We keep your highest score.

Next item →

1 / 1 point

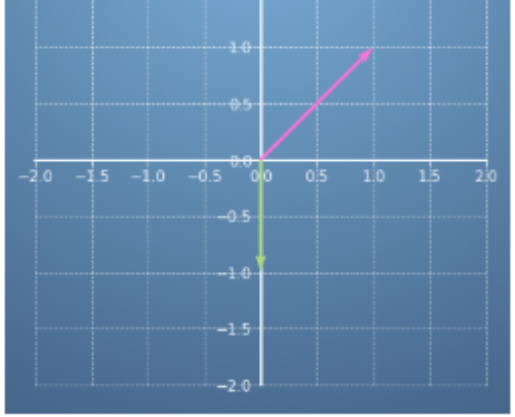


1. Compute the angle between $\mathbf{x} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$ using the inner product defined by

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

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

Correct
Absolutely right!



2. 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)
```

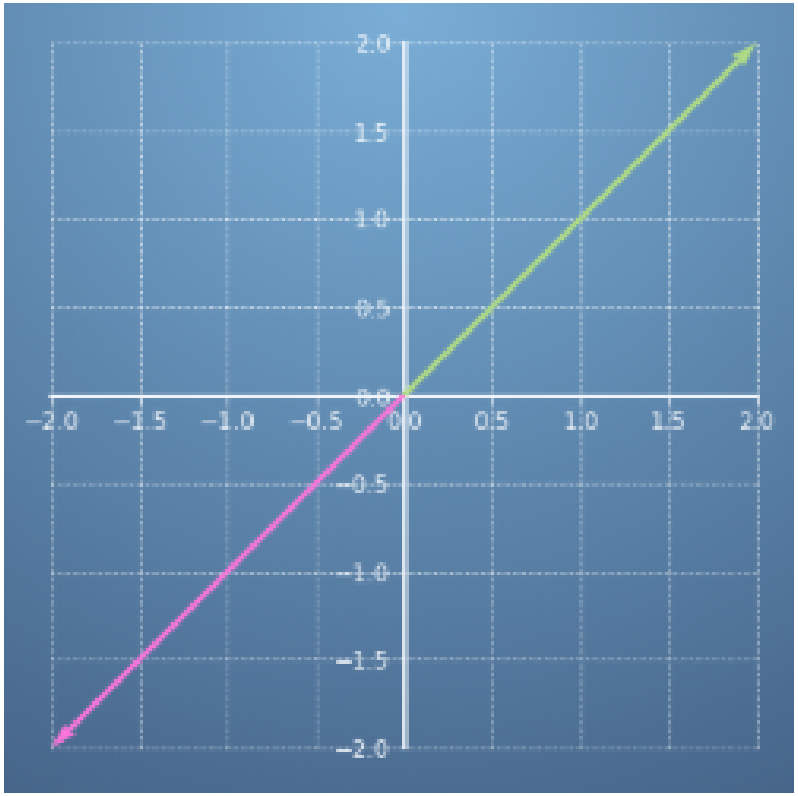
Run

Reset

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

Correct
Well done!

1 / 1 point



3. 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

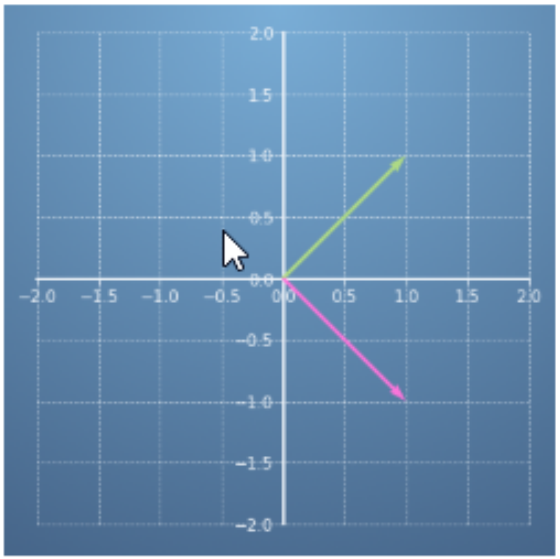
$$\langle \mathbf{x}, \mathbf{y} \rangle = \mathbf{x}^T \begin{bmatrix} 2 & 1 \\ 1 & 4 \end{bmatrix} \mathbf{y}$$

- ○ 0 rad (0°)
- ◉ 3.14 rad (180°)

Correct

Well done: $\pi \approx 3.14$ is the right answer.

1 / 1 point



4. 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

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

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

- (●) 2.3 rad (131°)
- ( ) -1.57 rad (-90°)
- ( ) 1.57 rad (90°)
- ( ) -2.3 rad (-131°)

Correct
Good job.

1 / 1 point

5. 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!