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Homework 1

Due Oct 21 at 2:59am   **Points** 100   **Questions** 10
Available until Oct 21 at 2:59am   **Time Limit** 60 Minutes
Allowed Attempts 3

Instructions

We use the conventions in the QBook101.

The default programming language for coding is Python. You may write pieces of code during this exercise.

Take the Quiz Again

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	60 minutes	0 out of 100

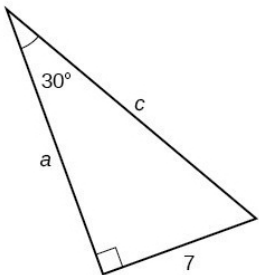> ⊘ **Correct answers are hidden.**

Score for this attempt: **0** out of 100
Submitted Sep 14 at 5:25pm
This attempt took 60 minutes.

Unanswered   **Question 1**   0 / 10 pts

Find the values of the sides a and c of the following right triangle:

- $a = 13.5 \,;\, c = 13.00$

- $a = 10.05 \,;\, c = 9.00$

- $a = 12.12 \,;\, c = 14.00$

- $a = 4.04 \,;\, c = 8.08$

Unanswered   **Question 2**   0 / 10 pts

Given the complex numbers $z = 3$... Find $z = 4.2$ ...

Last Attempt Details:

Time:	60 minutes
Current Score:	0 out of 100
Kept Score:	0 out of 100

2 More Attempts available

Take the Quiz Again

(Will keep the highest of all your scores)

Given the complex numbers $z_1 = 3 - $ and $z_2 = -4.2 - 0.$
what is the result of the operation $z_2 \, \bar{z}_1$?

- ○ $2.8 - 14.3i$
- ○ $-23.6 + 53.7i$
- ○ $-11.1 - 21.9\,i$
- ○ $-33.6 - 56.7i$

Question 3 0 / 10 pts

Given the matrix $\mathbf{A}$ and the vector $\vec{v}$, what is the result of
the operation $\vec{v}^T \mathbf{A}$?

$$\mathbf{A} = \begin{pmatrix} -1 & 3 & 1 \\ 5 & 2 & \\ 2 & 0 & 0 \end{pmatrix} \text{ and } \vec{v} = \begin{pmatrix} 2 \\ 1 \\ -2 \end{pmatrix}$$

where $\vec{v}^T$ is the transpose of the vector $\vec{v}$.

- ○ $\begin{pmatrix} 2 & -16 & -6 \end{pmatrix}$

- ○ $\begin{pmatrix} -1 \\ 8 \\ 3 \end{pmatrix}$

- ○ $\begin{pmatrix} -1 & 8 & 3 \end{pmatrix}$

- ○ $\begin{pmatrix} 21 \\ 26 \\ 22 \end{pmatrix}$

Question 4 0 / 10 pts

Find the result of the operation $\mathbf{B} - \lambda \mathbf{I}$

where $\lambda = 2$, $\mathbf{I}$ is the identity matrix of the appropriate
size, and,

$$\mathbf{B} = \begin{pmatrix} 2 & 1 & 0 & 3 \\ 4 & 0 & 2 & 5 \\ 6 & 3 & 7 & 1 \\ 1 & 5 & 4 & 3 \end{pmatrix}, \quad \mathbf{I} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

- ○ $\begin{pmatrix} 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 7 & 0 \\ 0 & 0 & 0 & 3 \end{pmatrix}$

- ○ $\begin{pmatrix} 2 & 1 & 0 & 3 \\ 4 & 0 & 2 & 5 \\ 6 & 3 & 7 & 1 \\ 1 & 5 & 4 & 3 \end{pmatrix}$

$$\circ \begin{pmatrix} 0 & 1 & 0 & 3 \\ 4 & -2 & 2 & 5 \\ 6 & 3 & 5 & 1 \\ 1 & 5 & 4 & 1 \end{pmatrix}$$

$$\circ \begin{pmatrix} 5 & 1 & 0 & 3 \\ 4 & 3 & 2 & 5 \\ 6 & 3 & 10 & 1 \\ 1 & 5 & 4 & 6 \end{pmatrix}$$

Question 5   0 / 10 pts

Is the matrix U unitary?

$$U = \begin{pmatrix} -\frac{1}{\sqrt{3}} & \sqrt{\frac{2}{3}} \\ \sqrt{\frac{2}{3}} & \frac{1}{\sqrt{3}} \end{pmatrix}$$

○ True

○ False

Question 6   0 / 10 pts

Find the tensor product (Kronecker product) $\mathbf{A} \otimes \mathbf{B}$ where,

$$A = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \text{and } B = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

$$\circ \begin{pmatrix} 0 & 0 & 1 & 2 \\ 0 & 0 & 3 & 4 \\ 1 & 2 & 0 & 0 \\ 3 & 4 & 0 & 0 \end{pmatrix}$$

$$\circ \begin{pmatrix} 1 & 2 & 1 & 2 \\ 3 & 4 & 3 & 4 \\ 1 & 2 & 1 & 2 \\ 3 & 4 & 3 & 4 \end{pmatrix}$$

$$\circ \begin{pmatrix} 1 & 0 & 2 & 0 \\ 0 & 1 & 0 & 2 \\ 3 & 0 & 4 & 0 \\ 0 & 3 & 0 & 4 \end{pmatrix}$$

$$\circ \begin{pmatrix} 0 & 0 & -1 & -2 \\ 0 & 0 & -3 & -4 \\ 1 & 2 & 0 & 0 \\ 3 & 4 & 0 & 0 \end{pmatrix}$$

Question 7   0 / 10 pts

What is the **bra** of the **ket** $|\psi\rangle$?

$$\begin{pmatrix} -i \end{pmatrix}$$

$$|\psi\rangle = \begin{pmatrix} 3 - i \\ 2 + 2i \end{pmatrix}$$

○ $\langle\psi| = \begin{pmatrix} i \\ 3 + i \\ 2 - 2i \end{pmatrix}$

○ $\langle\psi| = \begin{pmatrix} -i \\ 3 - 1 \\ 2 + 2i \end{pmatrix}$

○ $\langle\psi| = (\,-i \quad 3 - i \quad 2 + 2i\,)$

○ $\langle\psi| = (\,i \quad 3 + i \quad 2 - 2i\,)$

Find the *bra-ket* (or inner product) $\langle w | u \rangle$ where

$$|w\rangle = \begin{pmatrix} 3 + 2i \\ -2i \\ 1 \end{pmatrix} \text{ and } u = \begin{pmatrix} -2 \\ 1 - i \\ i \end{pmatrix}$$

○ $7i$

○ $4 + 7i$

○ $-4 + 7i$

○ $-4 - 7i$

What should the commented line be replaced with so that the following code calculates $\mathbf{B}\,\vec{b}$?

```
import numpy as np

b = np.array([1, 3])
B = np.array([ [ 2 ,  2], [-6 ,  5] ])

# missing line
print(c)
```

○ `c = b.mul(B)`

○ `c = b.dot(B)`

○ `c = B.dot(b)`

○ `h = B.dot(c)`

Question 10

0 / 10 pts

What postulate of quantum mechanics tells us how to extract information from quantum systems?

- ○ Postulate 3
- ○ Postulate 2
- ○ Postulate 1
- ○ Postulate 4

Quiz Score: **0** out of 100

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