1 Expectations for this course

Welcome to the class!

We would like to get to know you a bit and learn about your expectations for this course. Please take a few minutes to share your thoughts on the following questions.

(a) What have you heard or learned about quantum mechanics? Where did you learn it?

(b) What do you expect to get out of this class? (This could include how you hope your understanding, ways of thinking, confidence, or feelings about quantum mechanics will develop over the term.)

(c) How do you feel about taking this class? Nervous, excited, bored, etc.? What makes you feel that way?

(d) Are there aspects of quantum mechanics you are particularly curious about?

2 Complex Arithmetic: Rectangular Form

For the complex numbers $z_1 = 3 - 4i$ and $z_2 = 7 + 2i$, compute:

(a) $z_1 - z_2$

(b) $z_1\, z_2$

(c) $\frac{z_1}{z_2}$

3 Matrix Refresher

Calculate the following quantities for the matrices:

$$A \doteq \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{pmatrix} \qquad B \doteq \begin{pmatrix} a & b & c \\ d & e & f \\ g & h & j \end{pmatrix} \qquad C \doteq \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$$

and the vector:

$$|D\rangle \doteq \begin{pmatrix} 1 \\ i \\ -1 \end{pmatrix}$$

(a) AB

(b) $\mathrm{tr}(B)$

(c) $A|D\rangle$

(d) $\det(\lambda\mathcal{I} - A)$ where λ is a scalar.

(e) C^{-1} (Hint: Geometrically, what is the C transformation? What transformation undoes what C does?)

4 Euler's Formula I

(a) Use Euler's formula $e^{i\phi} = \cos\phi + i\sin\phi$ and its complex conjugate to find formulas for $\sin\phi$ and $\cos\phi$. In your physics career, you will often need to read these formula "backwards," (i.e. notice one of these combinations of exponentials in a sea of other symbols and say, Ah ha! that is $\cos\phi$). So, pay attention to the result of the homework problem!

(b) Show that Euler's formula:

$$e^{i\phi} = \cos\phi + i\sin\phi$$

is true, by comparing the power series for the various terms.