

Quiz 7.2 – Linear Algebra Review

Name: _____

Complex Conjugates

Give the complex conjugate of the following functions:

○ e^{-ix}

○ $\sin(\pi x) + i \cos(2\pi x)$

○ $3x^2 + x - 2.4$

OperatorsBelow are two linear algebra operators. Find the result when each operator operates on the function $f(x) = 2x^3 + \sin(x)$

○ $\hat{A} = x^2$

○ $\hat{B} = -\frac{1}{c} \frac{d}{dx}$

EigenfunctionsGive an example of an eigenfunction (ϕ) and its associated eigenvalue for each of the three operators below:

○ $\hat{C} = 2$

○ $\hat{D} = \frac{d}{dx}$

○ $\hat{E} = \frac{d^2}{dx^2}$

Orthogonality

Consider two even functions:

$$\phi_1(x) = \sqrt{\frac{3}{2}}x \qquad \phi_2(x) = \sqrt{\frac{175}{8}} \left(x^3 - \frac{3}{5}x \right)$$

Show that these two functions are orthogonal over the interval $[-1, 1]$

Commutators

Consider two operators: $\hat{A} = \frac{d^2}{dx dy}$ and $\hat{B} = x^2 + y$

Give the commutator $[\hat{A}, \hat{B}]$. You may assume that the operators will only be used with functions that are separable. i.e. You may use a trial function of $f(x)g(y)$

Птичка (A Little Bird)

Ву Александр Сергеевич Пушкин (Alexander Sergeyevich Pushkin)

В чужбине свято наблюдаю
Родной обычай старины:
На волю птичку выпускаю
При светлом празднике весны.

Я стал доступен утешенью;
За что на бога мне роптать,
Когда хоть одному творенью
Я мог свободу даровать!

In alien lands I keep the body
Of ancient native rites and things:
I gladly free a little birdie
At celebration of the spring.

I'm now free for consolation,
And thankful to almighty Lord:
At least, to one of his creations
I've given freedom in this world!