

**PHYS 451 Quantum Mechanics I (Spring 2020)**  
**Homework #2, due Thursday February 6 in class**

Schrödinger equation, wave function, probability density, expectation values, particle in the box

1. Problem 1.7 in Griffiths
2. Problem 1.8 in Griffiths
3. Problem 1.16 in Griffiths
4. A particle of mass  $m$  moves in an infinite square well ( $0 < x < a$ ). The initial wave function is given by

$$\Psi(x, t = 0) = A \cos \frac{\pi x}{a} \sin \frac{3\pi x}{a}.$$

- (a) Determine the normalization constant  $A$ .
- (b) Expand the wavefunction at the initial time in terms of the eigenfunctions  $\phi_n(x)$  of the infinite square well, i.e. determine the coefficients  $c_n$  that define  $\Psi(x, 0)$  as a superposition of eigenstates of the infinite square well.
- (c) Determine the time-dependent wave function,  $\Psi(x, t)$ .
- (d) Is the motion periodic? If so, what is the period?
- (e) If a measurement of the energy is made, what will be the outcome(s) and, with what probability will those value(s) be measured?
- (f) What is the average energy of the particle? How does it change with time (assuming that no measurement is performed)?
- (g) Will the particle's energy change if an energy measurement is made?