Problem 1   (3 pts)

Griffiths, Problem 1.1. For the distribution of ages in the example in Section 1.3.1:
   a) Compute $<j^2>$ and $<j>^2$.
   b) Determine Δj for each j, and use Equation 1.11 to compute the standard deviation.
   c) Use your results in a) and b) to check Equation 1.12.

Problem 2   (2 pts)

Griffiths, Problem 1.2
   a) Find the standard deviation of the distribution in Example 1.2.
   b) What is the probability that a photograph, selected at random, would show a distance x more than one standard deviation away from the average?

Problem 3   (5 pts)

Griffiths, Problem 1.4 At time $t = 0$ a particle is represented by the wave function

$$\Psi(x,0) = \begin{cases} A(x/a), & 0 \leq x \leq a \\ A(b-x)/(b-a), & a \leq x \leq b \\ 0, & \text{otherwise} \end{cases}$$

where A, a and b are (positive) constants.
   a) Normalize Ψ (that is, find A, in terms of a and b).
   b) Sketch $\Psi(x,0)$ as a function of x.
   c) Where is the particle most likely to be found, at $t = 0$?
   d) What is the probability of finding the particle to the left of a? Check your result in the limiting cases $b = a$ and $b = 2a$.
   e) What is the expectation value of x?

Problem 4   (2 pts)

Describe a proposed or actual technical device that relies fundamentally on the quantum mechanical behaviour of one or more of its components. Make clear what the quantum mechanical property is that is being exploited. (max 150 words)