Quiz 1
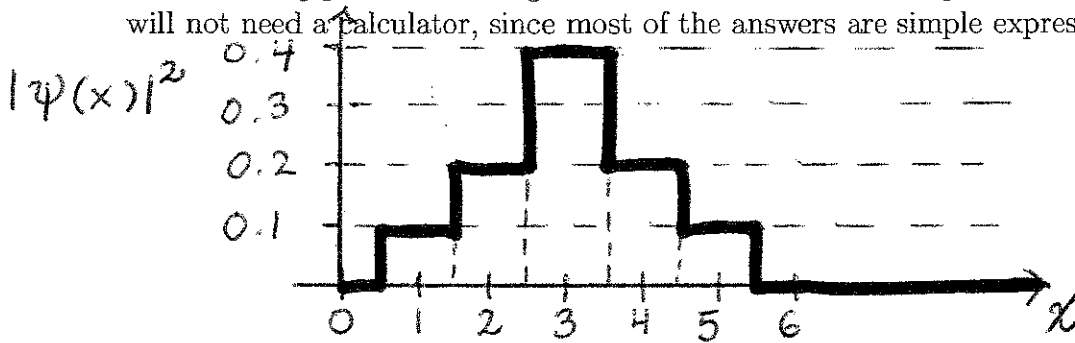
The following problem is designed to need a minimum of algebra and hence be quick. You will not need a calculator, since most of the answers are simple expressions.

$|\psi(x)|^2$

1. A graph of $|\psi(x)|^2$ is shown above. For this probability density, what is the expectation of x: $\langle x \rangle$?

$$\langle x \rangle = \int x |\psi(x)|^2 dx = 0.1 \times 1 + 0.2 \times 2 + 0.4 \times 3 + 0.2 \times 4 + 0.1 \times 5$$
$$= 3$$

2. What is the expectation of x^2: $\langle x^2 \rangle$?

$$\langle x^2 \rangle = \int x^2 |\psi(x)|^2 dx = 0.1 \times 1^2 + 0.2 \times 2^2 + 0.4 \times 3^2 + 0.2 \times 4^2 + 0.1 \times 5^2$$
$$= 10.2$$

3. What is σ_x?

$$\sigma_x = \sqrt{\langle x^2 \rangle - \langle x \rangle^2} = \sqrt{10.2 - 3^2} = \sqrt{1.2} \approx 1.1$$

4. Write a simple matlab code to compute $\langle x \rangle$ and $\langle x^2 \rangle$. (I will not be too picky about getting the syntax 100% correct.)

```
psi = [0.1  0.2  0.4  0.2  0.1];
x   = [1    2    3    4    5];
expx  = sum(x.*psi);
expx2 = sum((x.^2).*psi);
```