**Item 1**

The uncertainty of the Vernier caliper is 0.05 mm. The caliper is able to measure to 0.1 mm, thus the user must estimate the next 0.05 mm between two 0.1 mm markings.

The uncertainty associated with the linear scale mounted on the optical bench is 0.5 mm. The linear scale can measure down to 1 mm, so the user must estimate the next 0.5 mm between two 1 mm markings.

**Item 2**

When , , and

In order to maximize , we must maximize

*m* may be ignored because for all integers m.

**Item3**

𝑏𝑑𝑎 .:

**Item 4**

At a minimum, . To minimize , we must minimize .

In order to minimize , we must minimize .

at a minimum.

for all p.