

**San Francisco State University
School of Engineering**

SAMPLE: UNCERTAINTY CALCULATION

Given

$$q = x^2 y - xy^2$$

Measurement : best estimate

$$x = 3.0$$

$$y = 2.0$$

Measurement : probable range

$$\delta x = 0.1$$

$$\delta y = 0.1$$

Determine

$$q \pm \delta q$$

$$\text{where } q = x^2 y - xy^2 \text{ and } \delta q = \sqrt{\left(\frac{\partial q}{\partial x} \delta x\right)^2 + \left(\frac{\partial q}{\partial y} \delta y\right)^2}$$

$$q = (3.0)^2(2.0) - (3.0)(2.0)^2$$

$$q = (9.0)(2.0) - (3.0)(4.0)$$

$$q = 6.0$$

$$\delta q = \sqrt{[(2xy - y^2)0.1]^2 + [(x^2 - 2xy)0.1]^2}$$

$$\delta q = \sqrt{[(2 \cdot 3 \cdot 2 - 2^2)0.1]^2 + [(3^2 - 2 \cdot 2 \cdot 3)0.1]^2}$$

$$\delta q = \sqrt{[0.8]^2 + [0.3]^2}$$

$$\delta q = 0.9$$

Answer

$$q = 6.0 \pm 0.9$$