

Question 3

The length of the side of a cube is measured to be 10 cm with a possible error of 0.2 cm.

- (a) Use differentials to approximate the maximum error in the calculated surface area of the cube.
- (b) Estimate the relative error and the percentage error in the surface area.

Question 3 - Solution

Let the surface area of the cube be:

$$S = 6x^2$$

where x is the length of a side.

(a) **Approximate error using differentials:**

$$dS = \frac{dS}{dx} dx = 12x dx$$

$$dS = 12(10)(0.2) = 24 \text{ cm}^2$$

(b) **Relative error:**

$$\frac{dS}{S} = \frac{24}{6(10)^2} = \frac{24}{600} = 0.04$$

Percentage error:

$$0.04 \times 100 = \boxed{4\%}$$

Final Answer:

- Maximum error in surface area: $\boxed{24 \text{ cm}^2}$
- Relative error: $\boxed{0.04}$
- Percentage error: $\boxed{4\%}$