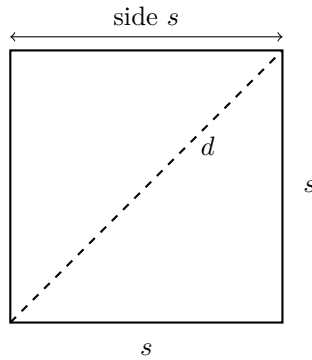


Question 5

The length of the diagonal d of a square is measured to be 10 cm with a possible error of 0.2 cm. Use differentials to approximate:

- (a) The maximum error in computing the area of the square.
- (b) The relative and percentage errors.



Question 5 - Solution

We are given that the diagonal of a square is $d = 10$ cm with an error of $dd = 0.2$ cm. The area of a square in terms of its diagonal is:

$$s = \frac{d}{\sqrt{2}}, \quad A = s^2 = \left(\frac{d}{\sqrt{2}} \right)^2 = \frac{d^2}{2}$$

Differentiate:

$$dA = \frac{d}{dx} \left(\frac{d^2}{2} \right) \cdot dd = d \cdot dd$$

(a) **Maximum error in the area:**

$$dA = d \cdot dd = 10 \cdot 0.2 = \boxed{2 \text{ cm}^2}$$

(b) **Relative and percentage error:**

Actual area:

$$A = \frac{10^2}{2} = 50 \text{ cm}^2$$

Relative error:

$$\frac{dA}{A} = \frac{2}{50} = 0.04$$

Percentage error:

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

Final Answer:

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