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Sub-subject: Solid Mechanics

Topic: Shear Force Diagram (SFD)

Given:

- A simply supported beam.
- Uniformly distributed load of 1 kN/m over the length of the beam.
- Beam length is 3 meters.

Step 1: Determine the Reactions at Supports

$R_A = R_B = \text{Reaction forces at supports A and B}$
Since the load is symmetric, the reactions will be equal.
$R_A + R_B = \int_0^3 (1 \, \text{kN/m}) \, dx = 3 \, \text{kN}$
Given symmetry,
$R_A = R_B = \frac{3 \, \text{kN}}{2} = 1.5 \, \text{kN}$

Supporting Statement:

Due to the uniform distribution of the load and symmetry, the reaction forces at both supports A and B are equal and can be computed by dividing the total load by 2.

Step 2: Shear Force Calculation along the Beam Length

The shear force (V) at any section x meters from the left end can be determined using the formula:
$V(x) = R_A - \int_0^x (1 \, \text{kN/m}) \, dx$
For the interval $0 \le x \le 3$,
$V(x) = 1.5 \, \text{kN} - x \, \text{kN}$

Supporting Statement:

The shear force at any point is derived from the reaction at the left support minus the cumulative load applied from the left support to the point considered.

Step 3: Plotting the Shear Force Diagram

- At $x = 0$:
$V(0) = 1.5 \, \text{kN}$
- At $x = 3$:
$V(3) = 1.5 \, \text{kN} - 3 \, \text{kN} = -1.5 \, \text{kN}$
Between A(at $x=0$) and B(at $x=3$), the shear force varies linearly from $1.5 \, \text{kN}$ to $-1.5 \, \text{kN}$.

Supporting Statement:

Using the shear force values at the boundaries, the linear variation can be plotted, showing a linear decrease from 1.5 kN at A to -1.5 kN at B.

Step 4: Selecting the Correct Shear Force Diagram

By examining the provided diagrams:
- Diagram (3) shows a linear decrease from $+1.5 \, \text{kN}$ to $-1.5 \, \text{kN}$.
Thus, the correct shear Force diagram for the given beam is Diagram (3).

Supporting Statement:

The correct SFD shows linear variation in shear force from the positive highest value at the left support to the negative highest value at the right support, consistent with the calculated values.

Final Solution

The correct shear force diagram for the given beam configuration is:
$$\boxed{\text{Diagram 3}}$$

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