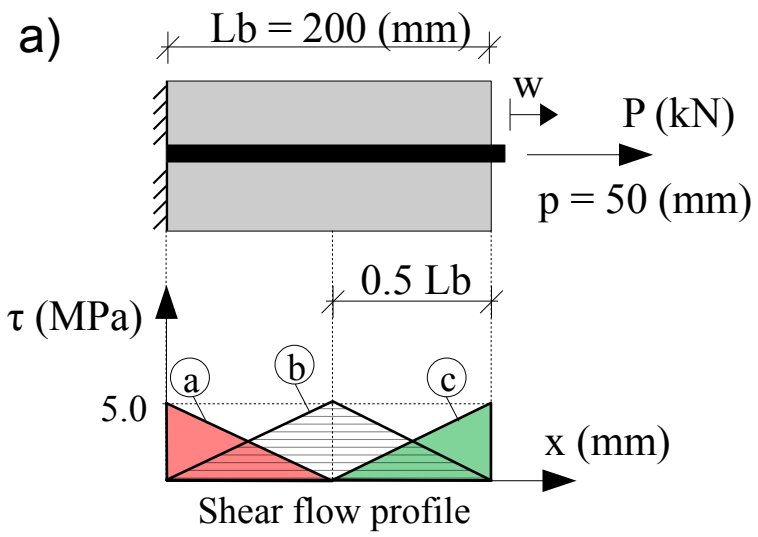
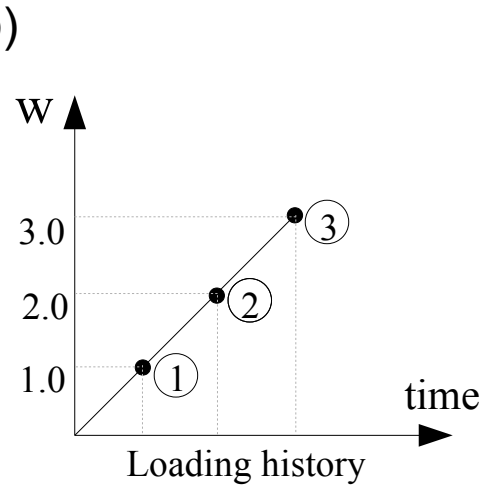
Pull-out curve versus shear stress profiles

The shear flow profiles of the displayed pull-out test are given with the bond length of 200mm and perimeter of 50mm for three stages of the monotonic loading history.
Remark: for simplicity, the shear flow profiles have been assumed linear.

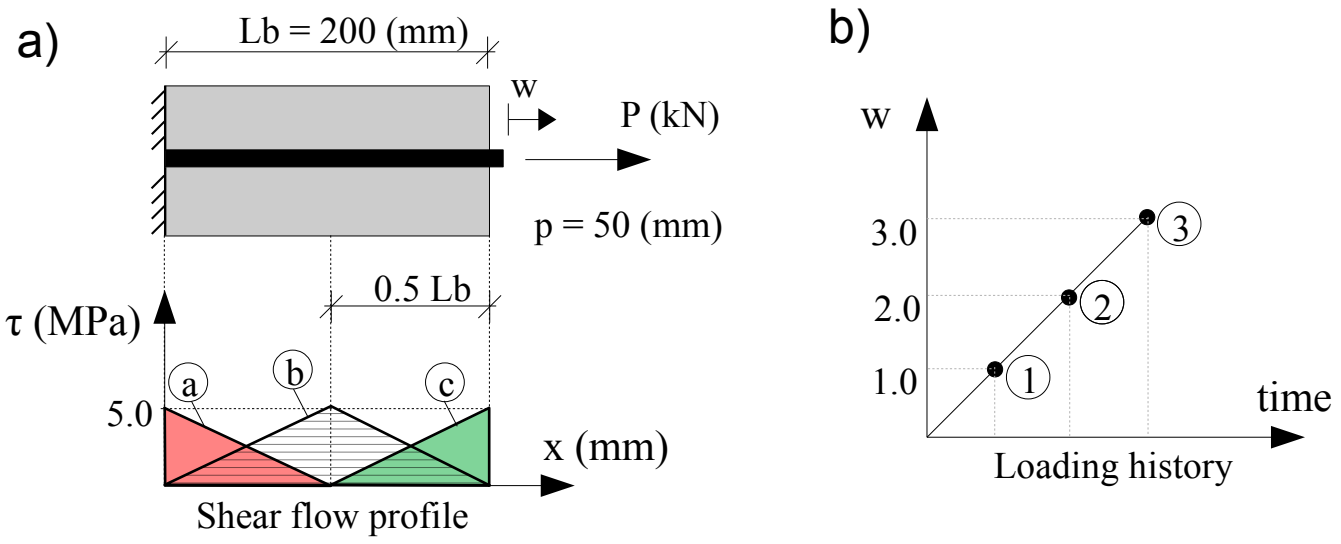




a) Associate each shear flow profile in Figure. a) with the corresponding loading stage in Figure b).
b) Evaluate the pull-out force corresponding to the stages 1, 2 and 3, sketch graphically the pull-out curve in the P(u) curve.
c) Qualitatively sketch the bond-slip law leading to this pull-out behavior.
d) Qualitatively plot the profiles of slip along the embedded length for the load stages 1, 2, and 3.

Consider a pull-out specimen with the same bond-slip law and changed length of Lb=400mm:
e) Sketch the shear flow profiles for the stages 1, 2 and 3.
f) Plot the corresponding pull-out curve for the stages 1, 2 and 3 as done in question b).

Pull-out curve versus shear stress profiles

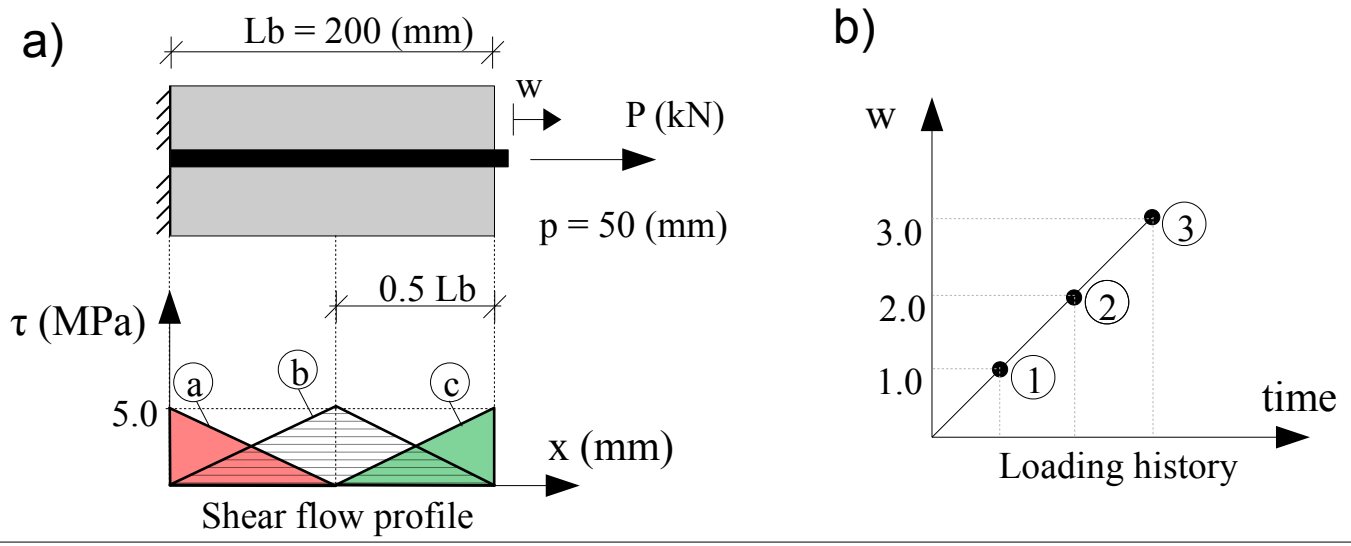


a) Associate each shear flow profile in Figure. a) with the corresponding loading stage in Figure b).

Solution:

Loading stage	Shear flow profile
1	c
2	b
3	a

Pull-out curve versus shear stress profiles



b) Evaluate the pull-out force corresponding to the stages 1, 2 and 3, sketch graphically the pull-out curve in the P(u) curve.

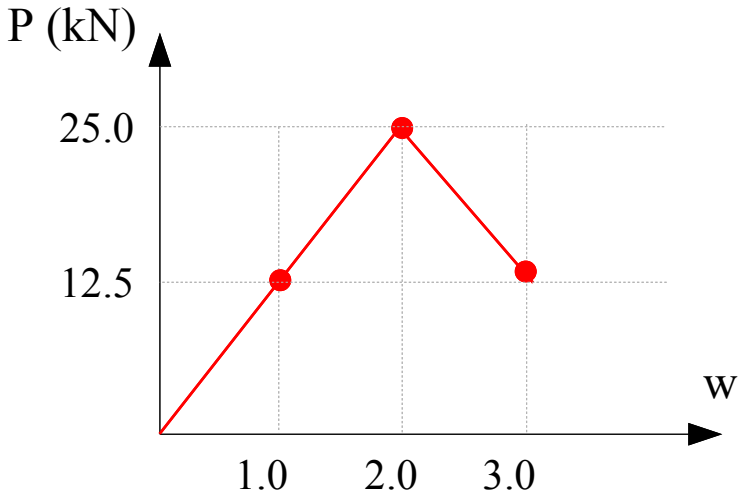
Solution:

$$\mathrm{P} = \int_0^L p\,\tau(x)\mathrm{d}x$$

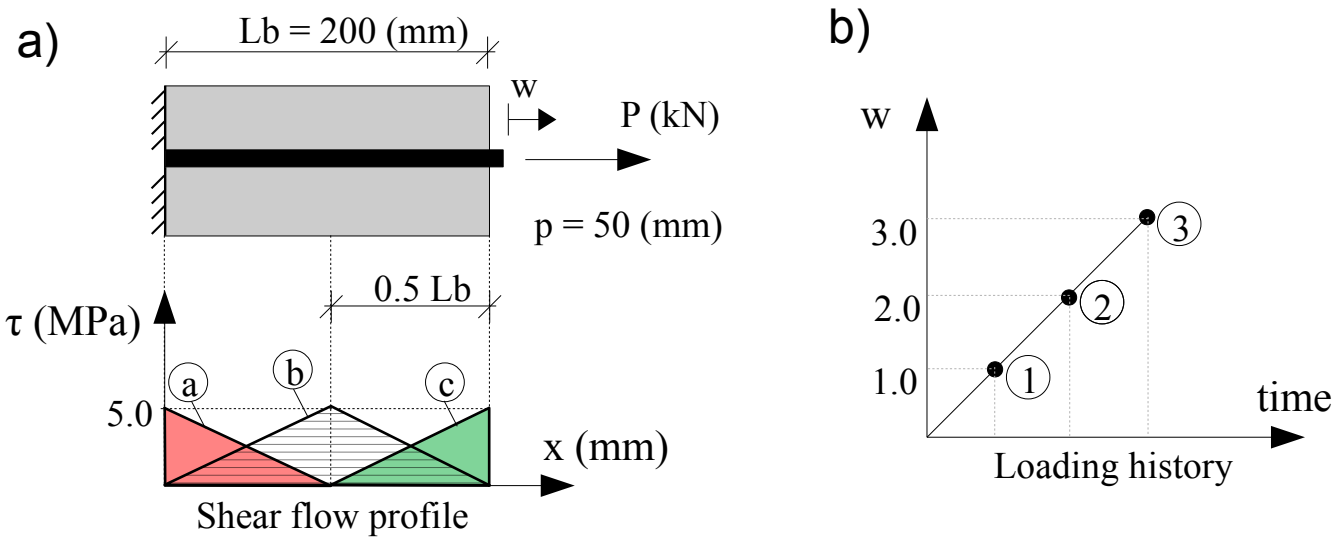
Stage 1: P1(w=1.0) = 0.5 x 0.5 Lb x 5 x 50 = 12.5 kN

Stage 2: P2(w=2.0) = 0.5 x Lb x 5 x 50 = 25.0 kN

Stage 3: P3(w=3.0) = 0.5 x 0.5 Lb x 5 x 50 = 12.5 kN

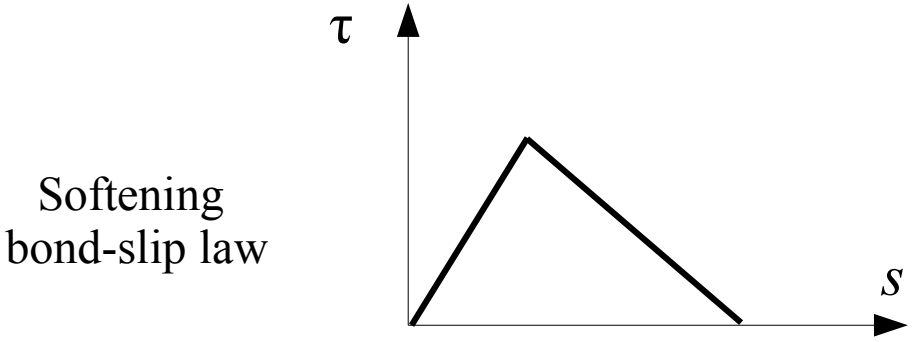


Pull-out curve versus shear stress profiles

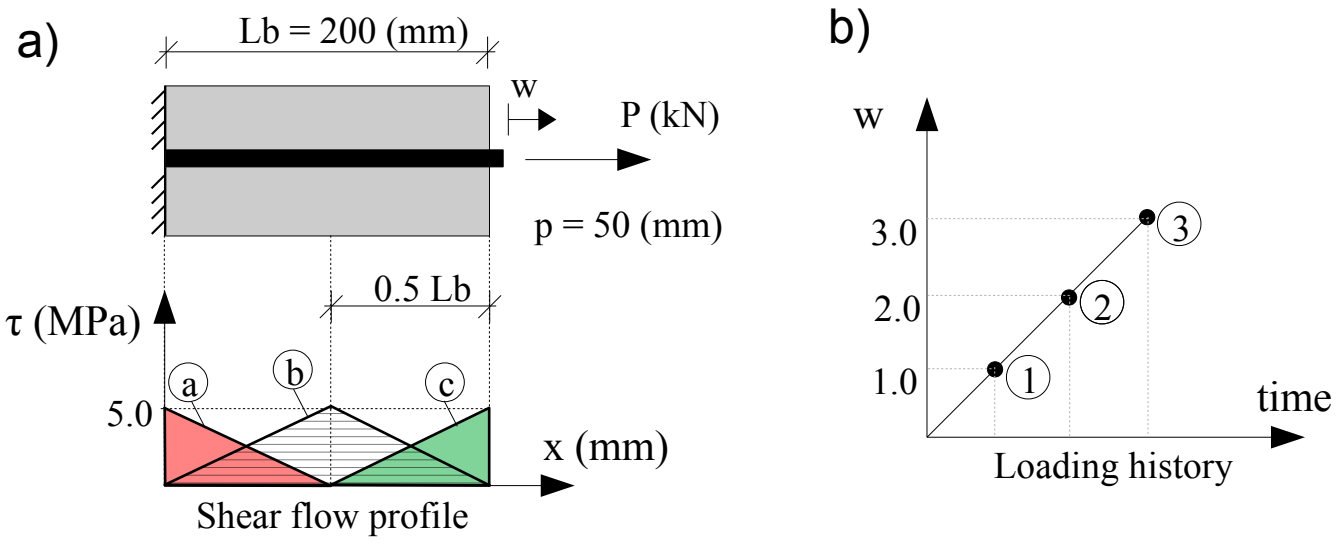


c) Qualitatively sketch the bond-slip law leading to this pull-out behavior.

Solution:

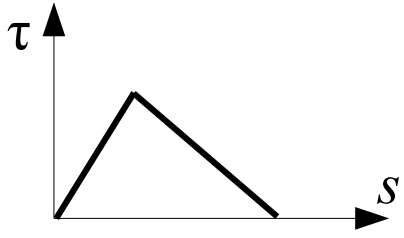


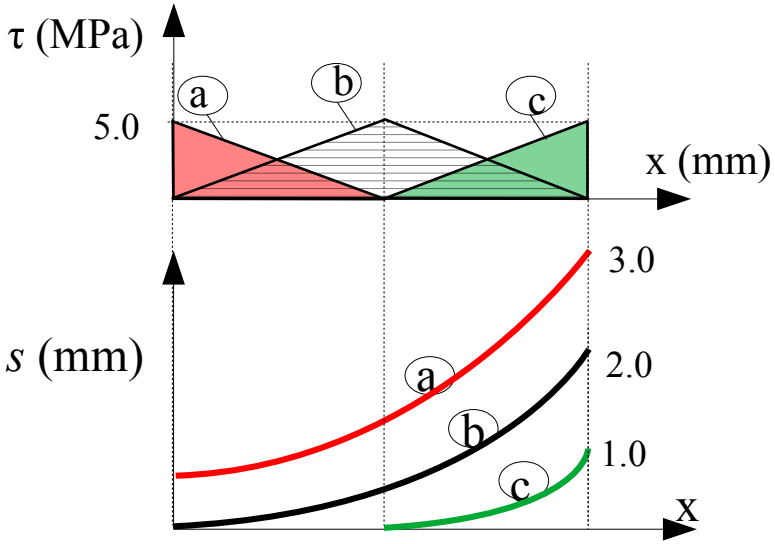
Pull-out curve versus shear stress profiles



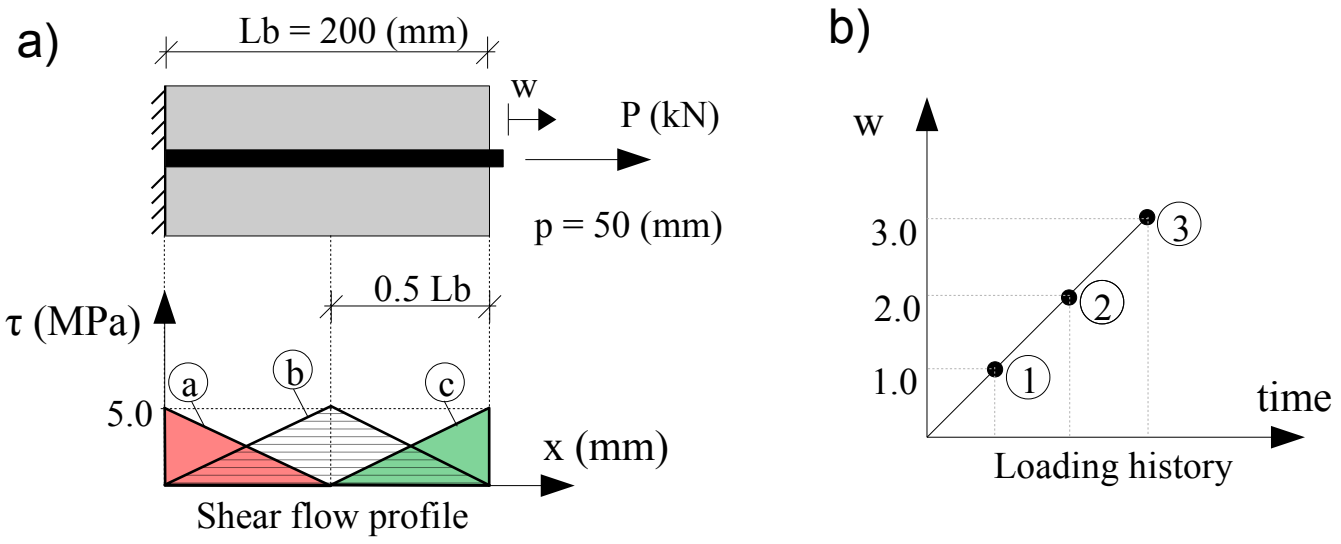
d) Qualitatively plot the profiles of slip along the embedded length for the load stages 1, 2, and 3.

Solution:



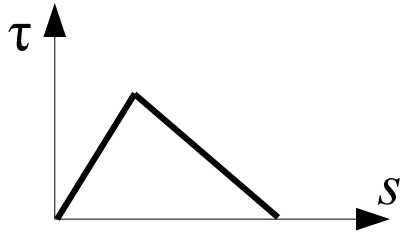


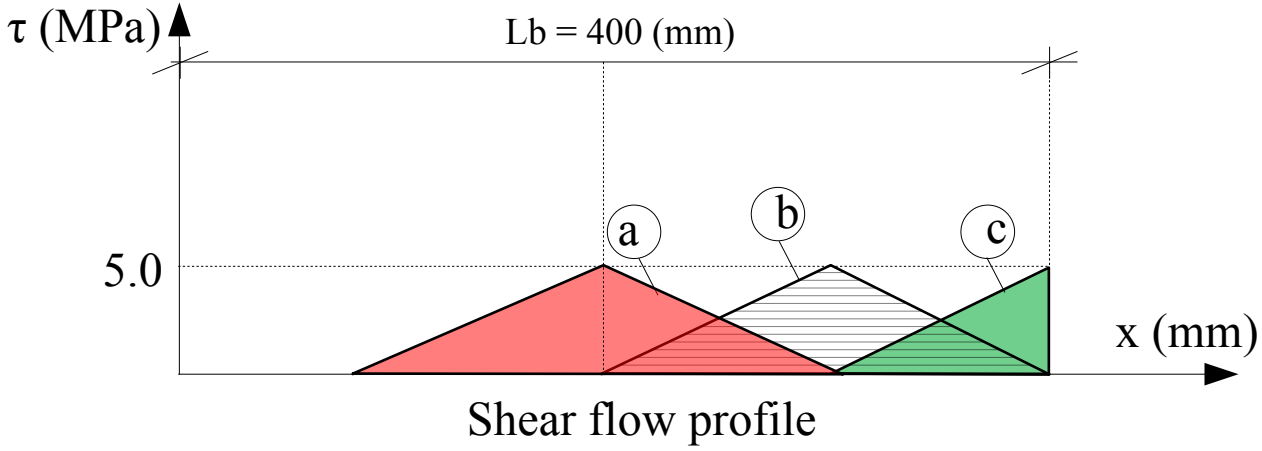
Pull-out curve versus shear stress profiles



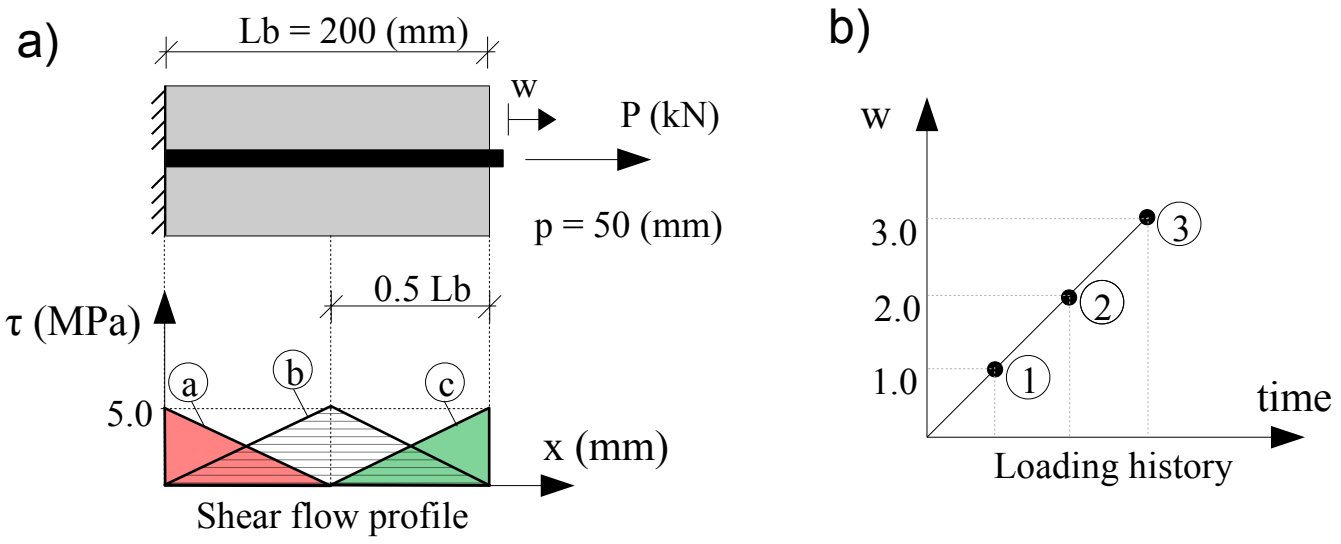
Consider a pull-out specimen with the same bond-slip law and changed length of Lb=400mm:
e) Sketch the shear flow profiles for the stages 1, 2 and 3.

Solution:





Pull-out curve versus shear stress profiles



Consider a pull-out specimen with the same bond-slip law and changed length of Lb=400mm:
f) Plot the corresponding pull-out curve for the stages 1, 2 and 3 as done in question b).

Solution:

$$\mathrm{P} = \int_0^L p\,\tau(x)\mathrm{d}x$$

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