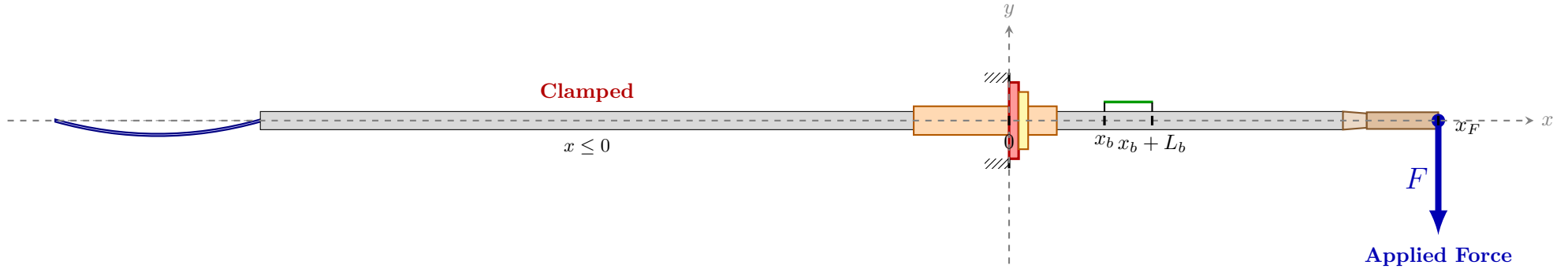


# Theory 1: Boundary Conditions

Force at Handle, Clamped at Oarlock



## Boundary Conditions - Theory 1

### Description

A vertical force  $F$  is applied at the handle end ( $x = x_F = 900$  mm). The oar is clamped at the oarlock position for all  $x \leq 0$ .

### Mathematical Formulation

Location	Condition	Description
$x = x_F$	$V(x_F) = -F$	Applied force (shear force)
$x = x_F$	$M(x_F) = 0$	Free end (no moment)
$x = 0$	$w(0) = 0$	No vertical displacement
$x = 0$	$\theta(0) = 0$	No rotation (clamped)
$x \leq 0$	Fixed	Clamped region

where:

- $F$  = applied vertical force at handle [N]
- $V(x)$  = shear force at position  $x$  [N]
- $M(x)$  = bending moment at position  $x$  [N·mm]
- $w(x)$  = vertical deflection at position  $x$  [mm]
- $\theta(x)$  = rotation angle at position  $x$  [rad]
- $x_F = 900$  mm = handle position

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