

## Test No.3

Name	Neptun code

### Problem 1

The outer diameter of a radial pump's impeller is  $D = 280$  mm, and the flow-through width at the outlet is  $b_2 = 10$  mm. The speed of rotation is  $n = 1450 \frac{1}{\text{min}}$ , the nominal flow rate of the machine is  $Q_{nom} = 30 \frac{\text{l}}{\text{s}}$ , and the blade angle at the outlet is  $\beta_2 = 20^\circ$ .

Question	Answer	Unit
Find the circumferential velocity at the outlet ( $u_2$ )!		$\frac{\text{m}}{\text{s}}$
Find the theoretical head at zero flow rate ( $H_{th,\infty}(0)$ )!		m
Find the theoretical head at the nominal flow rate ( $H_{th,\infty}(Q_{nom})$ )!		m
Calculate the pressure number at the nominal head! ( $\psi$ )		1
Calculate the flow number at the nominal flow rate! ( $\varphi$ )		1
Draw the theoretical performance curve of the pump!		

### Solution

$$u_2 = D_2 \pi n = 0.28 \cdot \pi \frac{1450}{60} = 21.26 \frac{\text{m}}{\text{s}}$$

$$H_{th,\infty}(0) = \frac{u_2^2}{g} = \frac{21.26^2}{9.81} = 46.06 \text{ m}$$

$$H_{th,\infty}(Q_{nom}) = \frac{u_2^2}{g} \left( 1 - \frac{Q_{nom}}{D_2 \pi b_2 \tan(\beta_2) u_2} \right) = \frac{21.26^2}{9.81} \left( 1 - \frac{0.03}{0.28 \pi 0.01 \tan(20^\circ) 21.26} \right) = 25.76 \text{ m}$$

$$\psi = \frac{2gH}{u_2^2} = \frac{2 \cdot 9.81 \cdot 25.76}{21.26^2} = 1.118$$

$$\varphi = \frac{Q}{D_2^2 \pi u_2 / 4} = \frac{0.03}{0.28^2 \pi \cdot 21.26 / 4} = 0.0229$$

