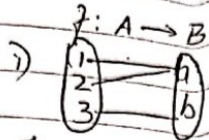


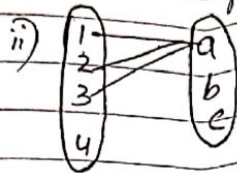
Calculus:

Function (f): is a rule which associates every element of set A to a unique element of set B.

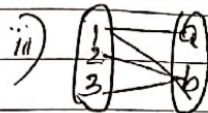
Ex 1



\therefore It is a function.



\therefore It is not a function because 4 does not have an image.



\therefore It is not a function as 1 does not have a unique image.

iv) $f(x) = 2x + 3$ is a function on Natural nos.

v) $x = f(p)$ is a demand function, where $x \rightarrow$ quantity
 $p \rightarrow$ price

Limit of a function:

$f(x)$ is said to have a limit as $x \rightarrow a$ if $\lim_{x \rightarrow a^+} f(x) = f(a) = \lim_{x \rightarrow a^-} f(x)$

Properties of limits

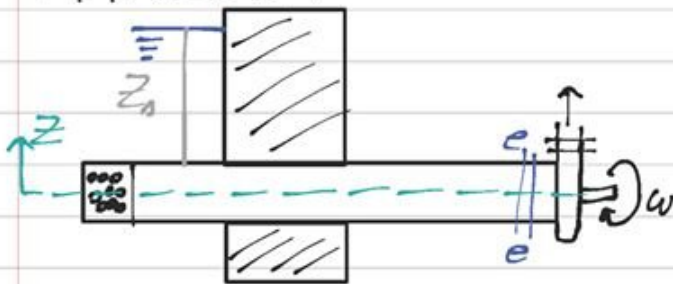
$$\bullet \lim_{x \rightarrow a} (f(x) \pm g(x)) = \lim_{x \rightarrow a} f(x) \pm \lim_{x \rightarrow a} g(x)$$

$$\bullet \lim_{x \rightarrow a} (f(x) \cdot g(x)) = \lim_{x \rightarrow a} f(x) \cdot \lim_{x \rightarrow a} g(x)$$

$$\bullet \lim_{x \rightarrow a} \left[\frac{f(x)}{g(x)} \right] = \frac{\lim_{x \rightarrow a} f(x)}{\lim_{x \rightarrow a} g(x)}$$

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$$Z_s + \left(\frac{P_s}{\rho g} \right)_{abs} + \frac{V_s^2}{2g} = Z_e + \frac{V_e^2}{2g} + \left(\frac{P_e}{\rho g} \right)_{abs} + \Delta H_s \Leftrightarrow$$

$$\left[\left(\frac{P_e}{\rho g} \right)_{abs} + \frac{V_e^2}{2g} - \frac{P_v}{\rho g} \right] = \left(\frac{P_{atm}}{\rho g} \right)_{abs} + Z_s - \Delta H_s$$

$$NPSH_{req} = \left(\frac{P_{atm}}{\rho g} \right)_{abs} + \Delta Z - \Delta H_s - \frac{P_v}{\rho g}$$

$$* \text{ Dica: } (P_{abs})_{atm} = \rho_{Hg} \cdot g \cdot h_{Hg} = 13600 \cdot 9,81 \cdot 0,76 = 101361 \text{ Pa}$$

$$\left(\frac{P_{atm}}{\rho g} \right)_{abs} = \frac{101361}{1000 \cdot 9,81} = 10,33 \text{ m} ; \left(\frac{P_{atm}}{\rho g} \right) = 10,33 - \frac{Z}{900}$$

$$\rightarrow \left(\frac{P_v}{\rho g} \right) = 0,077 \cdot e^{0,0558 \cdot \Theta}, \text{ com } \Theta \text{ em } ^\circ \text{C}$$

$$\rightarrow \text{Diâmetro ótimo da flange de sucção: } D_{g \text{ ótimo}} = 4,5 \cdot \sqrt[3]{\frac{Q}{n}}$$

com Q em m^3/s ; n em rpm ; D em m

$$\rightarrow NPSH_{req} \approx 0,203 \cdot \omega_1^{3/4} \cdot H^* ; \omega_1 = \omega \cdot \frac{\sqrt{Q^*}}{(gH^*)^{3/4}}$$

$\rightarrow \eta_{man}$