a) $M_\infty = \frac{V_\infty}{a_\infty} = \frac{V_\infty}{\sqrt{\gamma R T_\infty}}$, but $RT = \frac{p}{\rho}$, so $a_\infty = \sqrt{\frac{\gamma p_\infty}{\rho_\infty}}$

$$\boxed{M_\infty = V_\infty \sqrt{\frac{\rho_\infty}{\gamma p_\infty}}}$$

b) $$\boxed{p_0 = p_\infty \left[1 + \frac{\gamma-1}{2} M_\infty^2\right]^{\frac{\gamma}{\gamma-1}}}$$ exact

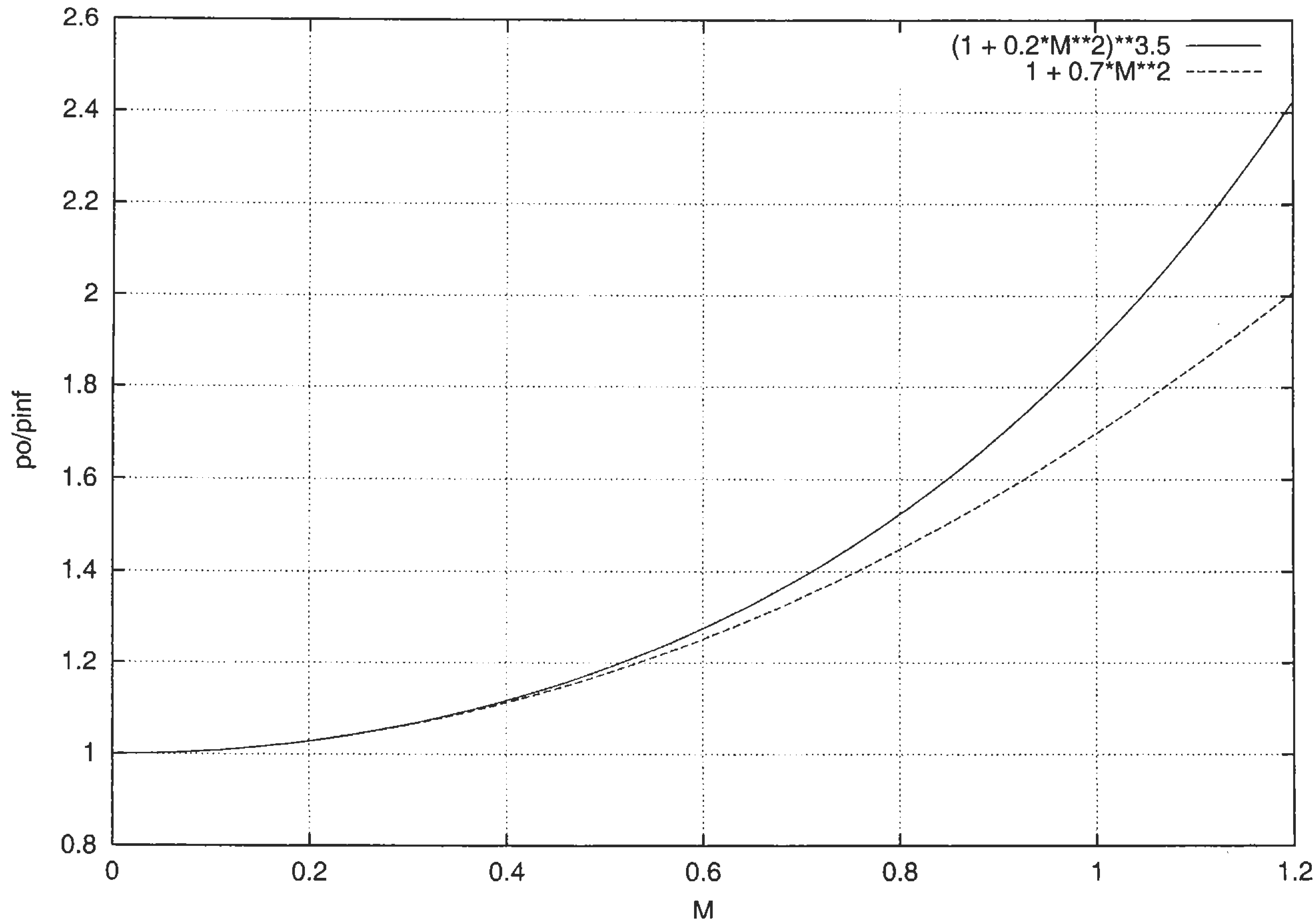
$$p_0 = p_\infty + \frac{1}{2}\rho_\infty V_\infty^2$$

$$= p_\infty + \frac{1}{2}\rho_\infty M_\infty^2 \cdot \frac{\gamma p_\infty}{\rho_\infty}$$

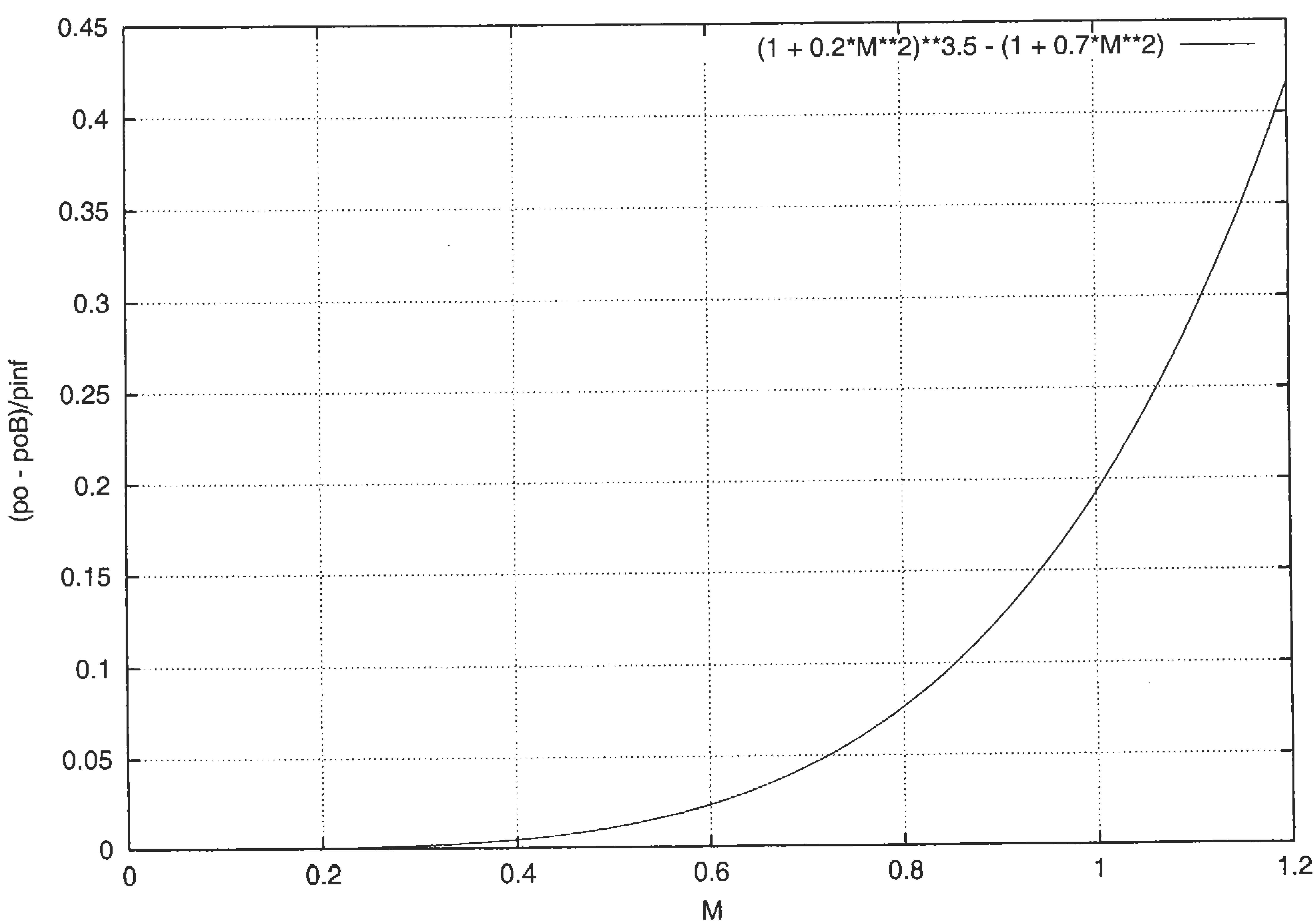
$$\boxed{p_0 = p_\infty \left[1 + \frac{\gamma}{2} M_\infty^2\right]}$$ Bernoulli

Plot $\left(1 + \frac{\gamma-1}{2} M_\infty^2\right)^{\frac{\gamma}{\gamma-1}}$ and $1 + \frac{\gamma}{2} M_\infty^2$ attached

Plot $\left(1 + \frac{\gamma-1}{2} M_\infty^2\right)^{\frac{\gamma}{\gamma-1}} - \left(1 + \frac{\gamma}{2} M_\infty^2\right)$ attached



(1 + 0.2*M**2)**3.5
1 + 0.7*M**2
po/pinf
M
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0
0.2
0.4
0.6
0.8
1
1.2



(1 + 0.2*M**2)**3.5 - (1 + 0.7*M**2)
(po - poB)/pinf
M
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.2
0.4
0.6
0.8
1
1.2