1)

$$A := \begin{pmatrix} 1 & -1 & 0 & 0 \\ 1 & -2 & 1 & 0 \\ 0 & 1 & -2 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix} \qquad b := \begin{pmatrix} 0 \\ 1 \\ 1 \\ 0 \end{pmatrix}$$

badmat(cnd) := if(cnd + 0.001 = cnd, "Solution will be inaccurate", "OK")

singmat(cnd) := if(cnd + 0.25 = cnd, "Matrix is singular to machine precision", badmat(cnd))

cnd := cond2(A) = 17.632

singmat(cnd) = "OK"

$$sol := lsolve(A, b) = \begin{pmatrix} -3 \\ -3 \\ -2 \\ 0 \end{pmatrix}$$

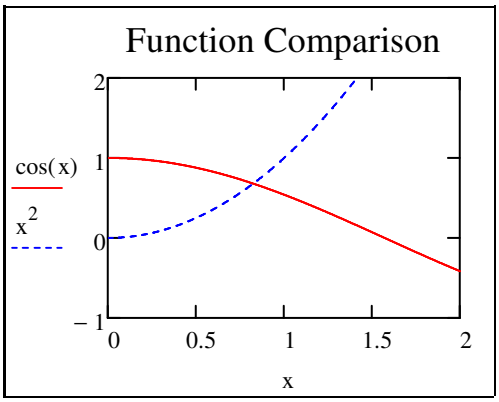
ORIGIN := 1 = 1

$A_{4,3} := -1$ $\qquad A = \begin{pmatrix} 1 & -1 & 0 & 0 \\ 1 & -2 & 1 & 0 \\ 0 & 1 & -2 & 1 \\ 0 & 0 & -1 & 1 \end{pmatrix}$

cnd := cond2(A) = 4.086×10^{16}

singmat(cnd) = "Matrix is singular to machine precision"

2)



$f(x) := \cos(x) - x^2$

$f(0) = 1$ $f(1) = -0.46$ OK, different sign.

$x_1 := \text{root}(f(x), x, 0, 1) = 0.824$

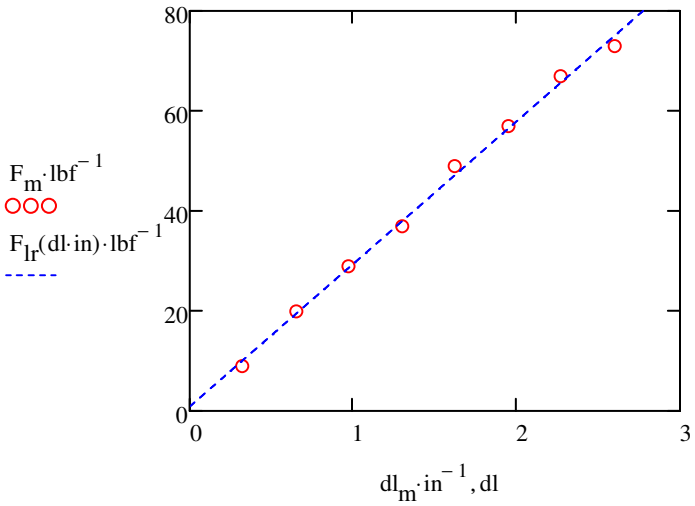
3)

$$dl_m := \begin{pmatrix} 0.32 \\ 0.65 \\ 0.97 \\ 1.3 \\ 1.62 \\ 1.95 \\ 2.27 \\ 2.6 \end{pmatrix} \cdot in \qquad F_m := \begin{pmatrix} 9 \\ 20 \\ 29 \\ 37 \\ 49 \\ 57 \\ 67 \\ 73 \end{pmatrix} \cdot lbf$$

ORIGIN := 0 = 0

$$C_{lr} := line\left(dl_m \cdot in^{-1}, F_m \cdot lbf^{-1}\right) = \begin{pmatrix} 0.999 \\ 28.511 \end{pmatrix}$$

$$F_{lr}(dl) := \left(C_{lr_0} + C_{lr_1} \cdot dl \cdot in^{-1}\right) \cdot lbf$$



4)

$$\rho_0 := 4\,\frac{\text{lbm}}{\text{in}} \qquad l := 5\,\text{in}$$

$$\int_{0\,\text{in}}^{5\,\text{in}} \left(2 + 3\cdot\frac{x}{l} + \frac{x^2}{l^2}\right)\cdot\rho_0\,dx \rightarrow \frac{230\cdot\text{lbm}}{3}$$