

Math 204 Day 3

p22 #11

$$\begin{bmatrix} 1 & 2 & 4 & 8 \\ 2 & 4 & 8 \\ 3 & 6 & 9 & 12 \end{bmatrix} \begin{array}{l} R_2 - 2R_1 \rightarrow R_2 \\ R_3 - 3R_1 \rightarrow R_3 \end{array} \begin{bmatrix} 1 & 2 & 4 & 8 \\ 0 & 0 & -2 & -8 \\ 0 & 0 & -3 & -12 \end{bmatrix} \begin{array}{l} R_3 + 1.5R_2 \\ \rightarrow R_2 \end{array} \begin{array}{c} \text{EF} \\ \begin{bmatrix} 1 & 2 & 4 & 8 \\ 0 & 0 & -2 & -8 \\ 0 & 0 & 0 & 0 \end{bmatrix} \\ \frac{1}{2}R_2 \rightarrow R_2 \end{array}$$

$$\begin{bmatrix} 1 & 2 & 4 & 8 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{array}{l} R_1 - 4R_2 \\ \rightarrow R_1 \end{array} \begin{bmatrix} 1 & 2 & 0 & -8 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad \text{pivot columns: 1 and 3}$$

p22 #4

$$\begin{bmatrix} 1 & 2 & 4 & 5 \\ 2 & 5 & 4 \\ 4 & 5 & 2 \end{bmatrix} \begin{array}{l} R_2 - 2R_1 \rightarrow R_2 \\ R_3 - 4R_1 \rightarrow R_3 \end{array} \begin{bmatrix} 1 & 2 & 4 & 5 \\ 0 & 1 & -4 & -5 \\ 0 & -3 & -12 & -15 \end{bmatrix} \begin{array}{l} R_2 \leftrightarrow R_3 \\ R_2 + 3R_3 \end{array} \begin{array}{c} \text{EF} \\ \begin{bmatrix} 1 & 2 & 4 & 5 \\ 0 & -3 & -12 & -18 \\ 0 & 0 & -3 & -6 \end{bmatrix} \\ -\frac{1}{3}R_2 \rightarrow R_2 \\ -\frac{1}{3}R_3 \rightarrow R_3 \end{array}$$

$$\begin{bmatrix} 1 & 2 & 4 & 5 \\ 0 & 1 & 4 & 6 \\ 0 & 0 & 1 & 2 \end{bmatrix} \begin{array}{l} R_2 - 4R_3 \rightarrow R_2 \\ R_1 - 4R_3 \rightarrow R_1 \end{array} \begin{bmatrix} 1 & 2 & 0 & -3 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & 2 \end{bmatrix} \begin{array}{l} R_1 - 2R_2 \\ \rightarrow R_1 \end{array} \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & 2 \end{bmatrix}$$

pivot columns: 1, 2, 3

p22 #12

$$\begin{bmatrix} 1 & 0 & -9 & 0 & 4 \\ 0 & 1 & 3 & 0 & -1 \\ 0 & 0 & 0 & 1 & -7 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

No solutions. Pivot in rightmost column

p22 #14

$$\begin{bmatrix} 1 & 0 & -5 & 0 & -8 & 3 \\ 0 & 1 & 4 & -1 & 0 & 6 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 0 & -5 & 0 & 0 & 3 \\ 0 & 1 & 4 & -1 & 0 & 6 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{array}{l} x_1 - 5x_3 = 3 \\ x_2 + 4x_3 - x_4 = 6 \\ x_5 = 0 \end{array}$$

$$\begin{array}{l} x_1 = 3 + 5x_3 \\ x_2 = 6 - 4x_3 + x_4 \\ x_3 = \text{free} \\ x_4 = \text{free} \\ x_5 = 0 \end{array}$$

Answers to Day 3 Maple Problems.

Page 23, Exercise 33. The augmented matrix is

`with(LinearAlgebra) :`

$$A := \begin{bmatrix} 1 & 1 & 1 & 6 \\ 1 & 2 & 2^2 & 15 \\ 1 & 3 & 3^2 & 28 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 1 & 6 \\ 1 & 2 & 4 & 15 \\ 1 & 3 & 9 & 28 \end{bmatrix}$$

**(1)**

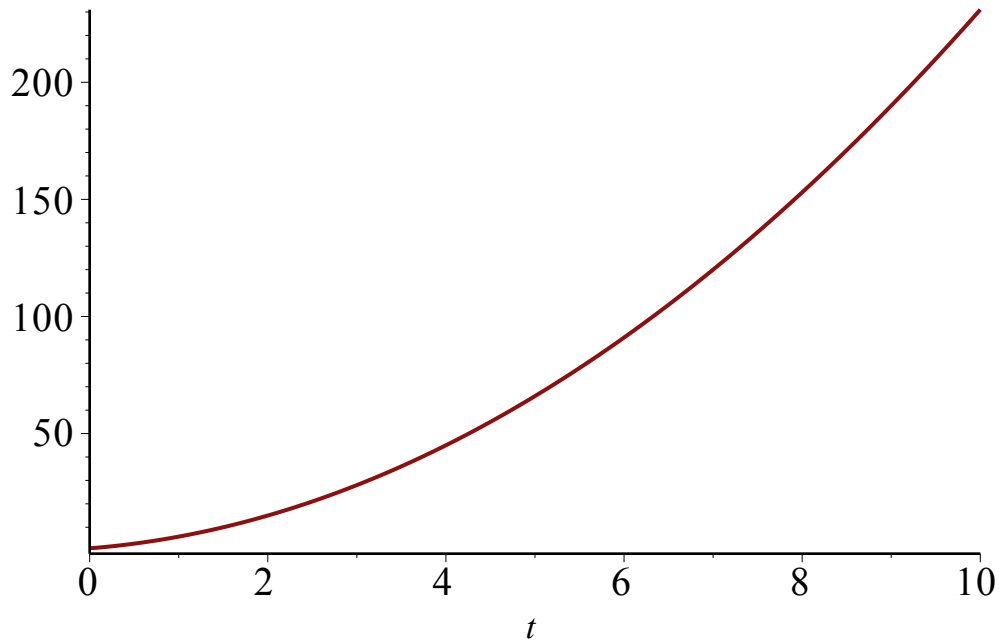
`ReducedRowEchelonForm(A)`

$$\begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 2 \end{bmatrix}$$

**(2)**

Solution:  $p(t) = 1 + 3t + 2t^2$ .

`plot(1 + 3 t + 2 t^2, t=0..10)`



Page 23, Exercise 34. The augmented matrix is

$$B := \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 2 & 2^2 & 2^3 & 2^4 & 2^5 & \frac{29}{10} \\ 1 & 4 & 4^2 & 4^3 & 4^4 & 4^5 & \frac{148}{10} \\ 1 & 6 & 6^2 & 6^3 & 6^4 & 6^5 & \frac{396}{10} \\ 1 & 8 & 8^2 & 8^3 & 8^4 & 8^5 & \frac{743}{10} \\ 1 & 10 & 10^2 & 10^3 & 10^4 & 10^5 & 119 \end{bmatrix}$$

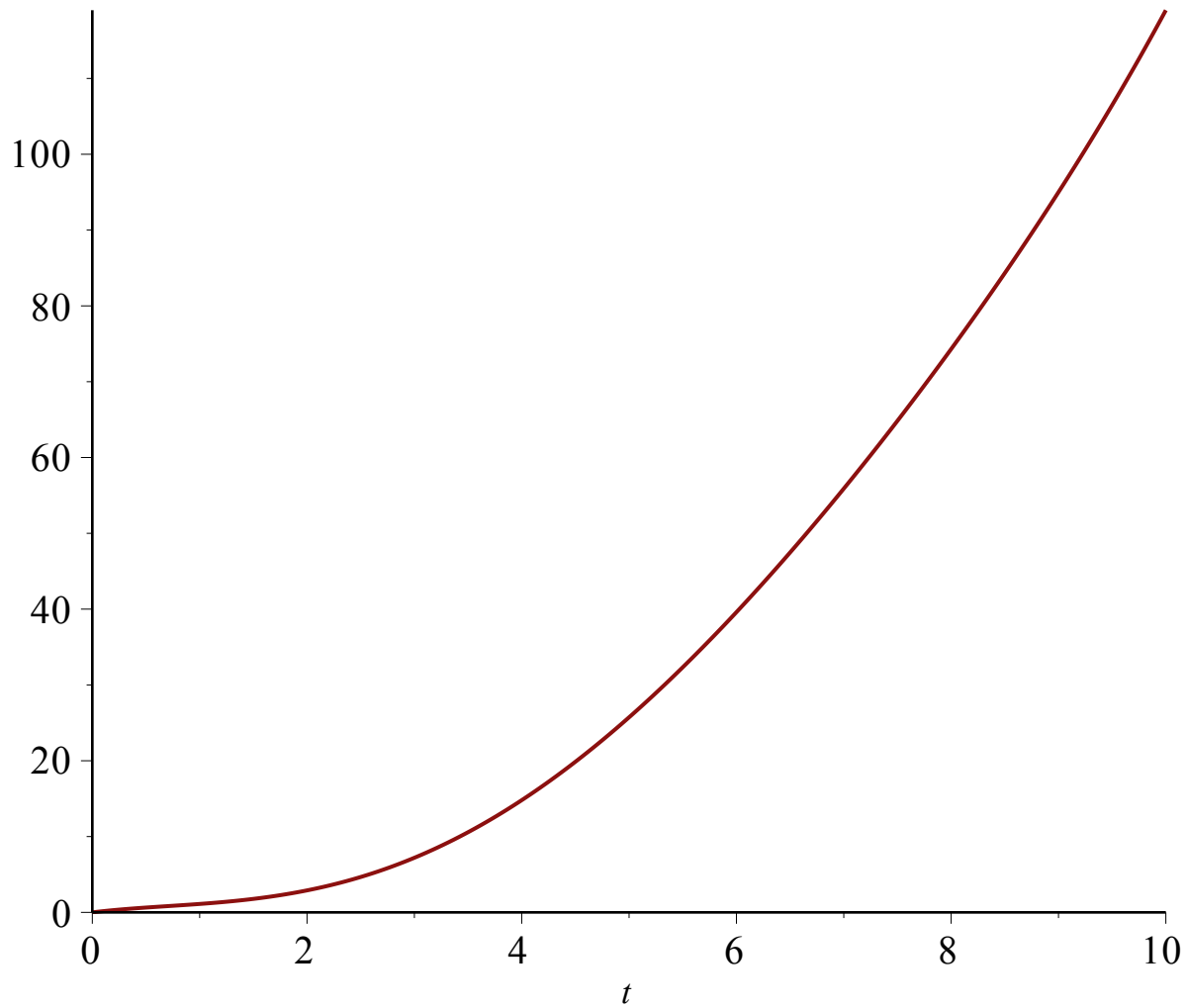
$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 2 & 4 & 8 & 16 & 32 & \frac{29}{10} \\ 1 & 4 & 16 & 64 & 256 & 1024 & \frac{74}{5} \\ 1 & 6 & 36 & 216 & 1296 & 7776 & \frac{198}{5} \\ 1 & 8 & 64 & 512 & 4096 & 32768 & \frac{743}{10} \\ 1 & 10 & 100 & 1000 & 10000 & 100000 & 119 \end{bmatrix} \quad (3)$$

*ReducedRowEchelonForm(B)*

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & \frac{137}{80} \\ 0 & 0 & 1 & 0 & 0 & 0 & -\frac{1147}{960} \\ 0 & 0 & 0 & 1 & 0 & 0 & \frac{127}{192} \\ 0 & 0 & 0 & 0 & 1 & 0 & -\frac{269}{3840} \\ 0 & 0 & 0 & 0 & 0 & 1 & \frac{1}{384} \end{bmatrix} \quad (4)$$

Solution :  $p(t) = 0 + 137t/80 - 1147t^2/960 + 127t^3/192 - 269t^4/3840 + t^5/384$

$$\text{plot}\left(\frac{137 t}{80} - \frac{1147 t^2}{960} + \frac{127 t^3}{192} - \frac{269 t^4}{3840} + \frac{t^5}{384}, t=0..10\right)$$



When the force = 750 ft/secc,  $t = 7.5$  ( $t$  is measured in units of 100 ft/sec), so the Force in units of 100 lbs is

$$0 + \frac{137 \cdot 7.5}{80} - \frac{1147 \cdot 7.5^2}{960} + \frac{127 \cdot 7.5^3}{192} - \frac{269 \cdot 7.5^4}{3840} + \frac{7.5^5}{384}$$

64.83837900

(5)

So the force is 6483.8 lbs.