```
Last login: Wed Mar 16 11:38:27 on ttys001
/Users/eisen/sage/sage ; exit;
Friedrich-Eisenbrands-MacBook-Pro:~ eisen$ /Users/eisen/sage/sage
; exit;
--------------------------------------------------------------------
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| Sage Version 4.6, Release Date: 2010-10-30
   |
| Type notebook() for the GUI, and license() for information.
   |
--------------------------------------------------------------------
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sage: matrix (QQ,6,3,[1,2,3,4,5,6,2,1,3,1,0,0,0,1,0,0,0,1])
[1 2 3]
[4 5 6]
[2 1 3]
[1 0 0]
[0 1 0]
[0 0 1]
sage: A = matrix (QQ,6,3,[1,2,3,4,5,6,2,1,3,1,0,0,0,1,0,0,0,1])
sage: b = vector (QQ,6,[1,5,2,3,6,2])
sage: c = vector (QQ,3,[3,4,5])
sage: A
[1 2 3]
[4 5 6]
[2 1 3]
[1 0 0]
[0 1 0]
[0 0 1]
sage: b
(1, 5, 2, 3, 6, 2)
sage: c
(3, 4, 5)
sage: L = [3,4,5]
sage: A.matrix_from_rows(L)
[1 0 0]
[0 1 0]
[0 0 1]
sage: L
[3, 4, 5]
sage: load "/us
/usr/.DS_Store     /usr/include       /usr/sbin
/usr/X11           /usr/lib           /usr/share
/usr/X11R6         /usr/libexec       /usr/standalone
/usr/bin           /usr/llvm-gcc-4.2  /usr/texbin
/usr/etc           /usr/local
sage: load "/Us
/User Guides And Information  /Users
sage: load "/Users
/Users/.localized  /Users/Shared      /Users/eisen
```

```
sage: load "/Users/eisen/Ma
/Users/eisen/Mail            /Users/eisen/MatrixUtils.py
sage: load "/Users/eisen/MatrixUtils.py"
sage: from_list(b,L)
(3, 6, 2)
sage: A.matrix_from_rows(L).determinant()
1
sage: A.matrix_from_rows(L).solve_left(c)
(3, 4, 5)
sage: x = A.matrix_from_rows(L).solve_right(from_list(b,L))
sage: x
(3, 6, 2)
sage: A*x - b
(20, 49, 16, 0, 0, 0)
sage: #first ineq will enter (Index 0)
sage: y = A.matrix_from_rows(L).solve_left(- A.row(0))
sage: y
(-1, -2, -3)
sage: y = A.matrix_from_rows(L).solve_left(c)
sage: y
(3, 4, 5)
sage: x
(3, 6, 2)
sage: y
(3, 4, 5)
sage: z
---------------------------------------------------------------
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NameError                                 Traceback (most recent c
all last)

/Users/eisen/<ipython console> in <module>()

NameError: name 'z' is not defined
sage: y = A.matrix_from_rows(L).solve_left(- A.row(0))
sage: z = A.matrix_from_rows(L).solve_left(c)
sage: y
(-1, -2, -3)
sage: z
(3, 4, 5)
sage: L
[3, 4, 5]
sage: ratios(z,y)
(3, 2, 5/3)
sage: L
[3, 4, 5]
sage: z
(3, 4, 5)
sage: y
(-1, -2, -3)
```

```
sage: L
[3, 4, 5]
sage: L.remove(5)
sage: L.append(0)
sage: L
[3, 4, 0]
sage: x = A.matrix_from_rows(L).solve_right(from_list(b,L))
sage: z = A.matrix_from_rows(L).solve_left(c)
sage: y = A.matrix_from_rows(L).solve_left(- A.row(0))
sage: x
(3, 6, -14/3)
sage: A*x - b
(0, 9, -4, 0, 0, -20/3)
sage: y = A.matrix_from_rows(L).solve_left(- A.row(1))
sage: ratios(z,y)
(2/3, 2/3, 5/6)
sage: L
[3, 4, 0]
sage: L.remove(3)
sage: L.append(1)
sage: z = A.matrix_from_rows(L).solve_left(c)
sage: z
(0, 1/3, 2/3)
sage: x = A.matrix_from_rows(L).solve_right(from_list(b,L))
sage: A*x - b
(0, 0, -17/2, -9/2, 0, -31/6)
sage: x
(-3/2, 6, -19/6)
sage: z = A.matrix_from_rows(L).solve_left(c)
sage: z
(0, 1/3, 2/3)
sage: z * A.matrix_from_rows(L) == c
True
sage: z * from_list(b,L)
11/3
sage: x*c
11/3
sage:
```