```
/· RELACIÓN 1·/

/·EJERCICIO 1·/
;
```

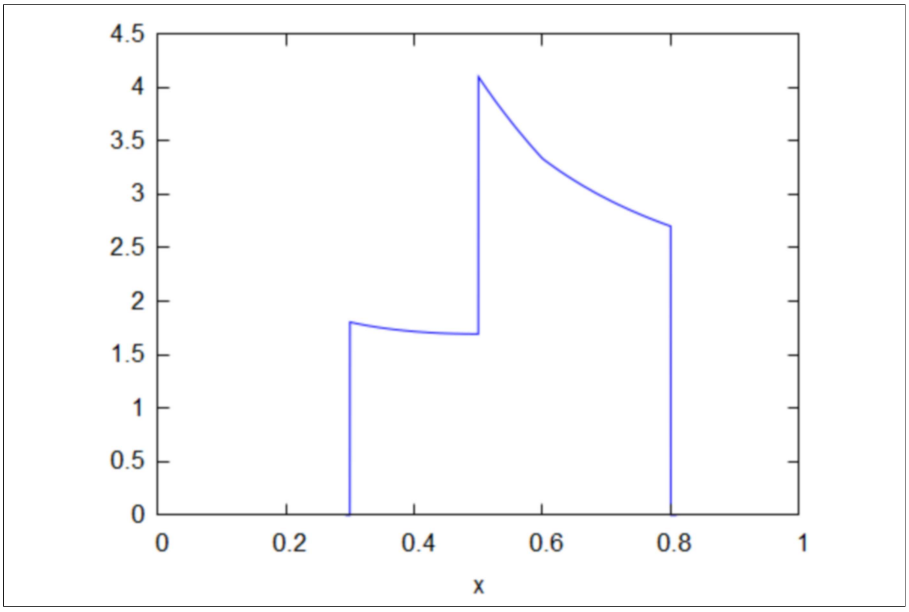
(%i1)
```
ratprint:false$;
```
Warning: Can set maxima's working directory but cannot change it during the maxima se

(%i2)
```
f(x):= if x >= 0.3 and x <= 0.5 then 2·x−log(x)
       else if x >= 0.5 and x <= 0.8 then 2/x + abs(x−0.6)
       else 0;
```

(%o2) $f(x):=\text{if } x\geq 0.3 \text{ and } x\leq 0.5 \text{ then } 2x-\log(x) \text{ else if } x\geq 0.5 \text{ and } x\leq 0.8 \text{ then } \frac{2}{x}+\left|x-0.6\right| \text{ else } 0$

(%i3)
```
wxplot2d([f(x)], [x,0,1])$
```

(%t3)



(%i4)
```
integrate(2·x−log(x),x,0.3,0.5)+ integrate(2/x + abs(x−0.6),x,0.5,0.8);
```

(%o4) $\frac{161763033471671152471314 1}{123446573917419213981697 5}$

(%i5)
```
float(%o8);
```

(%o5) *%o8*

(%i6)
```
kill(all);
/·EJERCICIO 2·/
```

(%o0) *done*

(%i1)
```
z: genmatrix(lambda([i,j], abs(2·i−4·j)),4,4);
```

(z)
$$\begin{pmatrix} 2 & 6 & 10 & 14 \\ 0 & 4 & 8 & 12 \\ 2 & 2 & 6 & 10 \\ 4 & 0 & 4 & 8 \end{pmatrix}$$

(%i2)
```
radioespectral(x):=apply(max,abs(eigenvalues(x))[1]);
```

(%o2)
$$\text{radioespectral}(x) := \text{apply}\left(max, \left(\left|\text{eigenvalues}(x)\right|\right)_1\right)$$

(%i3)
```
radioespectral(z);
```

(%o3)
$$\left(\frac{16\sqrt{6409}}{3^{3/2}}+\frac{9872}{27}\right)^{1/3}+\frac{376}{9\left(\frac{16\sqrt{6409}}{3^{3/2}}+\frac{9872}{27}\right)^{1/3}}+\frac{20}{3}$$

(%i4)
```
kill(all);

/·EJERCICIO 3·/
```

(%o0) *done*

(%i1)
```
  x:0;
```

(x) 0

(%i2)
```
for i:1 thru 23 do(
   x: x + i^3);
```

(%o2) *done*

(%i3)
```
x;
```

(%o3) 76176

(%i4)
```
x:makelist(i^3,i,1,23);
```

(x) [1,8,27,64,125,216,343,512,729,1000,1331,1728,2197,2744, 3375,4096,4913,5832,6859,8000,9261,10648,12167]

(%i5)
```
apply("+",x);
```

(%o5) 76176

(%i6)
```
kill(all);
/·EJERCICIO 4·/
```

(%o0) *done*

```
(%i1) x:1;
(x) 1

(%i2) for i:6 thru 19 do(
x:x·i^−1);
(%o2) done

(%i3) x;
(%o3) 1/1013709170073600

(%i4) x:makelist(i^−1,i,6,19);
(x) [1/6,1/7,1/8,1/9,1/10,1/11,1/12,1/13,1/14,1/15,1/16,1/17,1/18,1/19]

(%i5) apply("·",x);
(%o5) 1/1013709170073600

(%i6) kill(all);
/·EJERCICIO 5·/

(%o0) done

(%i1) x:makelist(0,i,1,43);
(x) [0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0]

(%i2) x[1]:1;
(x[1]) 1

(%i3) x[2]:1;
(x[2]) 1

(%i4) x;
(%o4) [1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0]

(%i5) for i:3 thru 43 do(
   x[i]:x[i−1] + x[i−2]);
(%o5) done
```

(%i6) x;

(%o6) [1,1,2,3,5,8,13,21,34,55,89,144,233,377,610,987,1597,
2584,4181,6765,10946,17711,28657,46368,75025,121393,196418,
317811,514229,832040,1346269,2178309,3524578,5702887,9227465,
14930352,24157817,39088169,63245986,102334155,165580141,
267914296,433494437]

(%i7) x[43];

(%o7) 433494437

(%i8) z:1/sqrt(5) ;

(z) $\frac{1}{\sqrt{5}}$

(%i9) p:(1−sqrt(5))/2;

(p) $\frac{1-\sqrt{5}}{2}$

(%i11) solucion: z·((%phi)^43−(p)^43);
kill(all);

(solucion) $\frac{\varphi^{43}-\frac{(1-\sqrt{5})^{43}}{8796093022208}}{\sqrt{5}}$

(%o0) *done*

➔ /·EJERCICIO 6·/
;

```
(%i1) for i:1 thru 20 do(
        print(float(sqrt(5+10^(-i))-sqrt(5)))
      );
```

0.02224998062745343

0.002234951060149371

$2.235956185270283\ 10^{-4}$

$2.236056797277897\ 10^{-5}$

$2.23606685878508\ 10^{-6}$

$2.236067868643943\ 10^{-7}$

$2.236067864203051\ 10^{-8}$

$2.236068219474419\ 10^{-9}$

$2.236055784976543\ 10^{-10}$

$2.236077989437035\ 10^{-11}$

$2.234212814755665\ 10^{-12}$

$2.233768725545815\ 10^{-13}$

$2.042810365310288\ 10^{-14}$

$2.220446049250313\ 10^{-15}$

$-1.77635683940025\ 10^{-15}$

0.0

$-2.220446049250313\ 10^{-15}$

0.0

$-2.220446049250313\ 10^{-15}$

0.0

(%o1) *done*

```
(%i2) for i:1 thru 20 do(
        print(float(10^(-i)/(sqrt(5+10^(-i))+sqrt(5))))
      );
```

0.02224998062745329
0.002234951060149439
$2.235956185279858\ 10^{-4}$
$2.236056797271704\ 10^{-5}$
$2.236066859466919\ 10^{-6}$
$2.236067865696402\ 10^{-7}$
$2.23606796631945\ 10^{-8}$
$2.236067976381756\ 10^{-9}$
$2.236067977387987\ 10^{-10}$
$2.236067977488609\ 10^{-11}$
$2.236067977498672\ 10^{-12}$
$2.236067977499678\ 10^{-13}$
$2.23606797749978\ 10^{-14}$
$2.236067977499789\ 10^{-15}$
$2.23606797749979\ 10^{-16}$
$2.23606797749979\ 10^{-17}$
$2.23606797749979\ 10^{-18}$
$2.23606797749979\ 10^{-19}$
$2.23606797749979\ 10^{-20}$
$2.23606797749979\ 10^{-21}$

(%o2) *done*

➔ /·INTERPRETACION En el primer bucle la expresión converge demasiado rápido lo cual gener
errores tales como los 0.0 que nos aparecen. En el segundo bucle sin embargo
la expresión converge más lento lo cual no genera errores como el del primer bucle.·/;

```
(%i3) kill(all)
      /·EJERCICIO 7·/
      ;
```

(%o0) *done*

```
(%i1) normainfinito(A):=(

        lmax (makelist ( apply ("+", abs(A[i])),i , 1 , matrix_size(A)[1] ) )
      );
```

(%o1) normainfinito$(A) :=$

$\mathrm{lmax}\left(\mathrm{makelist}\left(\mathrm{apply}\left(+,\left|A_i\right|\right),i,1,\left(\mathrm{matrix\_size}\left(A\right)\right)_1\right)\right)$

```
(%i2) A:matrix(
      [1,1,1],
      [2,80,2],
      [3,3,3]
      );
```

$$(A)\quad \begin{pmatrix} 1 & 1 & 1 \\ 2 & 80 & 2 \\ 3 & 3 & 3 \end{pmatrix}$$

```
(%i3) normainfinito(A);
(%o3) 84

(%i4) norma1(A):=normainfinito(transpose(A));
(%o4) norma1(A):=normainfinito(transpose(A))

(%i5) norma1(A);
(%o5) 84

(%i6) kill(all)
      ;
(%o0) done

 ➔    /·EJERCICIO 8·/;

(%i1) normainfinito(A):=(

        lmax (makelist ( apply ("+", abs(A[i])),i , 1 , matrix_size(A)[1] ) )
      );
(%o1) normainfinito(A):=
      lmax(makelist(apply(+,|A_i|),i,1,(matrix_size(A))_1))

(%i2) condicionamiento(A):= if(determinant(d) = 0) then print ("La matriz no es regular")
        else normainfinito(transpose(A))·normainfinito(A);
(%o2) condicionamiento(A):=if determinant(d)=0 then
      print(La matriz no es regular) else normainfinito(transpose(A))
      normainfinito(A)

 ➔    ;

 ➔    /·EJERCICIO 9·/;
```

(%i3) norma_euclidea (A) := sqrt(lmax(abs(eigenvalues(transpose(A).A)[1])));

(%o3) norma_euclidea(A) :=

$$\sqrt{\text{lmax}\left(\left|\left(\text{eigenvalues}\left(\text{transpose}\left(A\right)\ .\ A\right)\right)_1\right|\right)}$$

(%i4) A:genmatrix(lambda([i, j], i/(i+j+1)), 2, 4);

(A)
$$\begin{pmatrix} \frac{1}{3} & \frac{1}{4} & \frac{1}{5} & \frac{1}{6} \\ \frac{1}{2} & \frac{2}{5} & \frac{1}{3} & \frac{2}{7} \end{pmatrix}$$

(%i5) norma_euclidea(A);

(%o5)
$$\frac{\sqrt{\sqrt{22126530049}+148905}}{105\ 2^{5/2}}$$

(%i6) kill(all)

/·RELACION 2·/

/·EJERCICIO 1·/

;

(%o0) *done*

(%i1) u:matrix([0.34,−1.99,2/7,0],[0,1.1,2.3,−3.57],[0,0,3.2,33],
[0,0,0,66.72]);

(u)
$$\begin{pmatrix} 0.34 & -1.99 & \frac{2}{7} & 0 \\ 0 & 1.1 & 2.3 & -3.57 \\ 0 & 0 & 3.2 & 33 \\ 0 & 0 & 0 & 66.72 \end{pmatrix}$$

(%i2) x:[1,1,1,1];

(x) [1,1,1,1]

(%i3) b:[1,34,78,−9.42];

(b) [1,34,78,−9.42]

(%i4) c:matrix_size(u);

(c) [4,4]

(%i5) for i:c[1] step −1 thru 1 do x[i]: ((1/u[i][i])·(b[i] − sum(u[i][j]·x[j] , j, i+1 , c[1])));

(%o5) *done*

(%i6) u.x;

(%o6)
$$\begin{pmatrix} 1.0 \\ 34.0 \\ 78.00000000000001 \\ -9.42 \end{pmatrix}$$

(%i7)
```
kill(all)
/·EJERCICIO 2·/

;
```

(%o0) *done*

(%i1) A:matrix([0.24,1.1,3/2,3.45],[−1.2,1,3.5,6.7],[33.1,1,2,−3/8],[4,17,71,−4/81]);

(A)
$$\begin{pmatrix} 0.24 & 1.1 & \frac{3}{2} & 3.45 \\ -1.2 & 1 & 3.5 & 6.7 \\ 33.1 & 1 & 2 & -\frac{3}{8} \\ 4 & 17 & 71 & -\frac{4}{81} \end{pmatrix}$$

(%i2) b:[1,2,4,−21/785];

(b)
$$\left[1,2,4,-\frac{21}{785}\right]$$

(%i3)
```
for k : 1 thru matrix_size(A)[1] do(
   for i: k+1 thru matrix_size(A)[1] do(
      m: A[i][k]/ A[k][k],
      b[i]: b[i] − m·b[k],
      for j: k thru matrix_size(A)[1] do(
         A[i][j]: A[i][j]−m·A[k][j]
      )
   )
);
```

(%o3) *done*

(%i4) A;

(%o4)
$$\begin{pmatrix} 0.24 & 1.1 & \frac{3}{2} & 3.45 \\ 0.0 & 6.5 & 11.0 & 23.95 \\ 0.0 & 0.0 & 50.16987179487182 & 79.11474358974363 \\ 0.0 & 0.0 & 0.0 & -128.7338968666914 \end{pmatrix}$$

(%i5) b;

(%o5) [1,7.0,28.38461538461542,−42.55955680541491]

(%i6) x:makelist(1,i,1,matrix_size(A)[1]);

(x) [1,1,1,1]

(%i7)
```
for i : matrix_size(A)[1] step −1 thru 1 do(
x[i]: (b[i] − sum(A[i][j]·x[j],j,i+1,matrix_size(A)[1]))/ A[i][i]);
```

(%o7) *done*

(%i8) A.x;

(%o8)
$$\begin{pmatrix} 1.0 \\ 7.0 \\ 28.38461538461542 \\ -42.55955680541491 \end{pmatrix}$$

(%i9) b;

(%o9) [1,7.0,28.38461538461542,−42.55955680541491]

(%i10) x;

(%o10) [0.1284446578136524,−0.2164089146507665,
0.04443306058363873,0.330601013729017]

(%i11)
```
kill(all)
/·EJERCICIO 3·/;
```

(%o0) *done*

(%i1) A:matrix([3,6,9],[1,4,11],[0,4,19]);

(A)
$$\begin{pmatrix} 3 & 6 & 9 \\ 1 & 4 & 11 \\ 0 & 4 & 19 \end{pmatrix}$$

(%i2) B:[1/2,−2/3,−3/4];

(B) $\left[\frac{1}{2},-\frac{2}{3},-\frac{3}{4}\right]$

(%i3) u:ident(matrix_size(A)[1]);

(u)
$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

```
(%i4) l:ident(matrix_size(A)[1]);
```

$$(l)\quad \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

```
(%i5) At:transpose(A);
```

$$(At)\quad \begin{pmatrix} 3 & 1 & 0 \\ 6 & 4 & 4 \\ 9 & 11 & 19 \end{pmatrix}$$

```
(%i6) for i:1 thru matrix_size(At)[1] do(
    for j:1 thru matrix_size(At)[1]do
        u[i][j] : At[i][j] − sum(l[i][k]·u[k][j],k,1,i−1),
    for h: i+1 thru matrix_size(At)[1]do
        l[h][i]: 1/u[i][i]·(At[h][i]−sum(l[h][k]·u[k][i],k,1,i−1)));
(%o6) done

(%i7) u;
```

$$(\%o7)\quad \begin{pmatrix} 3 & 1 & 0 \\ 0 & 2 & 4 \\ 0 & 0 & 3 \end{pmatrix}$$

```
(%i8) l;
```

$$(\%o8)\quad \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 4 & 1 \end{pmatrix}$$

```
(%i9) ut:transpose(u);
```

$$(ut)\quad \begin{pmatrix} 3 & 0 & 0 \\ 1 & 2 & 0 \\ 0 & 4 & 3 \end{pmatrix}$$

```
(%i10) lt:transpose(l);
```

$$(lt)\quad \begin{pmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{pmatrix}$$

```
(%i11) x:makelist(1,i,1,matrix_size(A)[1]);
(x) [1,1,1]
```

(%i12)
```
y:makelist(1,i,1,matrix_size(A)[1]);
```
(y) $[1,1,1]$

(%i13)
```
y[1]:B[1]/ut[1][1];
```
(y[1]) $\frac{1}{6}$

(%i14)
```
for i:2 thru matrix_size(A)[1] do y[i]:(1/ut[i][i])·(B[i]−sum(ut[i][j]·y[j],j,1,i−1));
```
(%o14) *done*

(%i15)
```
y;
```
(%o15) $\left[\frac{1}{6},-\frac{5}{12},\frac{11}{36}\right]$

(%i16)
```
x[matrix_size(A)[1]]:y[matrix_size(A)[1]]/lt[matrix_size(A)[1]][matrix_size(A)[1]];
```
(%o16) $\frac{11}{36}$

(%i17)
```
for i:matrix_size(A)[1]−1 step −1 thru 1 do
    x[i]:(1/lt[i][i])·(y[i]−sum(lt[i][j]·x[j],j,i+1,matrix_size(A)[1]));
```
(%o17) *done*

(%i18)
```
x;
```
(%o18) $\left[\frac{91}{36},-\frac{59}{36},\frac{11}{36}\right]$

(%i19)
```
A.x;
```
(%o19)
$$\begin{pmatrix} \frac{1}{2} \\ -\frac{2}{3} \\ -\frac{3}{4} \end{pmatrix}$$

(%i20)
```
kill(all)
/·EJERCICIO 4 APARTADO A·/

;
```
(%o0) *done*

(%i1)
```
A:matrix([3,−2,0.25],[2,9,−5],[2,3,−6]);
```
(A)
$$\begin{pmatrix} 3 & -2 & 0.25 \\ 2 & 9 & -5 \\ 2 & 3 & -6 \end{pmatrix}$$

```
(%i2) b:[1.1,2.2,3.3];
(b)   [1.1,2.2,3.3]

(%i3) x:[1,-1.34,1.456];
(x)   [1,-1.34,1.456]

(%i4) for i:1 thru 15 do(
        for j:1 thru matrix_size(A)[1] do(
          aux:0,
          for z:1 thru matrix_size(A)[1] do(
            if j#z then aux:aux +A[j][z]·x[z]),
          x[j]:(1/A[j][j])·(b[j]-aux)));
(%o4) done

(%i5) x;
(%o5) [0.3393174570092826,-0.102013966967479,-
      0.4879011644806453]

(%i6) A.x;
(%o6) ⎛ 1.100005013842644 ⎞
      ⎜ 2.200015033714481 ⎟
      ⎝         3.3       ⎠

(%i7) kill(all);
(%o0) done

➔     /·EJERCICIO 4 APARTADO B·/;

(%i1) A:matrix([3,-2,0.25],[2,9,-5],[2,3,-6]);
(A)   ⎛ 3  -2  0.25 ⎞
      ⎜ 2   9   -5  ⎟
      ⎝ 2   3   -6  ⎠

(%i2) b:[1.1,2.2,3.3];
(b)   [1.1,2.2,3.3]

(%i3) x:[1,-1.34,1.456];
(x)   [1,-1.34,1.456]

(%i4) for i:1 thru 15 do(
        for j:1 thru matrix_size(A)[1] do(
          x[j]:(1/A[j][j])·(b[j]-sum(A[j][z]·x[z],z,1,j-1)-sum(A[j][k]·x[k],k,j+1,matrix_size(A)[1]))));
(%o4) done
```

(%i5) A.x;

(%o5)
$$\begin{pmatrix} 1.100005013842644 \\ 2.200015033714481 \\ 3.3 \end{pmatrix}$$

➔ ;