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piem#rs 1: Simboliskie elementi

```
syms a b c d
A = [a b;c d]
syms h g p q
B = [h g;p q]
C = A*B
D = A.*B
fprintf('\npiem#rs 1 end\n')
```

```
A =

[a, b]
[c, d]


B =

[h, g]
[p, q]


C =

[a*h + b*p, a*g + b*q]
[c*h + d*p, c*g + d*q]


D =

[a*h, b*g]
[c*p, d*q]
```

piem#rs 1 end

piem#rs 2: Simbolisko elementu defin#šana

```
% pirmais veids
fprintf('\npirmais veids k# def')
a = sym('a');
% apr##ins
sqrt(a^2)
% defin#cija, a, kur a > 0
a = sym('a','positive');
% apr##ins
sqrt(a^2)

% otrais veids
fprintf('\notrais veids k# def')
syms a b c d
A = [a b; c d]
A'
%{
"'"(apostrofs) - transpon#šana
Kompl. skait#iem tas taisa kompl. saist#tus
 skait#us("conj"conjunction).
Simboliskais main#gais šaj# situ#cij# ir dom#ts kompl. skaitlis.
(Šis visticam#k b#s noder#gi fizikas atvasin#tos priekšmetos ar
 laukiem utt.)
%}

% def a b c d k# ne kompl. sk.
syms a b c d real
A = [a b; c d]
A'

% treš#is veids
fprintf('\ntrešais veids k# def')
% uzreiz def izveido matricu, pieliek indeksus
 A = sym('a',[2 3])
fprintf('\npiem#rs 2 end\n')
```

```
pirmais veids k# def
ans =

(a^2)^(1/2)


ans =

a
```

```
otrais veids k# def
A =

[a, b]
[c, d]


ans =

[conj(a), conj(c)]
[conj(b), conj(d)]


A =

[a, b]
[c, d]


ans =

[a, c]
[b, d]


trešais veids k# def
A =

[a1_1, a1_2, a1_3]
[a2_1, a2_2, a2_3]


piem#rs 2 end
```

uzdevums 1: izveidot 3*3 a indeks#tu matricu ar visiem tr#s variantiem

```
% pirmais veids
fprintf('\npirmais veids k# def')
a11 = sym('a11');
a12 = sym('a12');
a13 = sym('a13');
a21 = sym('a21');
a22 = sym('a22');
a23 = sym('a23');
a31 = sym('a31');
a32 = sym('a32');
a33 = sym('a33');
A = [a11 a12 a13; a21 a22 a23; a31 a32 a33]
A*A
A.*A
fprintf('Absol#ti ne#rti, katru elementu j#defin# atseviš#i.\n')
```

```
% otrais veids
fprintf('\notrais veids k# def')
syms a11 a12 a13 a21 a22 a23 a31 a32 a33;
A = [a11 a12 a13; a21 a22 a23; a31 a32 a33]
A*A
A.*A
fprintf('#rt#k, jo visi main#gie tiek defin#ti vien# rind#,\nv#lproj#m
 ne#rti, jo matricu j#defin# pa atsevi#iem elementiem.\n')

% treš#is veids
fprintf('\ntrešais veids k# def')
A = sym('a',[3 3])
A*A
A.*A
fprintf('#rt#kais veids k# defin#t, jo elementi tiek indeks#ti
 autom#tiski.\n')
fprintf('\nAtbilde uz uzdevumu:\n')
fprintf('Izteiksme "A*A" reizina matricas.\n')
fprintf('Simbols "." nor#da "elementwise" darb#bu.\n')
fprintf('Izteiksme ".*" reizina elementus ar savstarp#ji vien#diem
 indeksiem,\n')
fprintf('jeb "A.*A" gadijum#, katrs elements tiek k#pin#ts kvadr#t#.
\n')
fprintf('\nuzdevums 1 end\n')
```

```
pirmais veids k# def
A =

[a11, a12, a13]
[a21, a22, a23]
[a31, a32, a33]


ans =

[  a11^2 + a12*a21 + a13*a31, a11*a12 + a12*a22 + a13*a32, a11*a13 +
 a12*a23 + a13*a33]
[a11*a21 + a21*a22 + a23*a31,   a22^2 + a12*a21 + a23*a32, a13*a21 +
 a22*a23 + a23*a33]
[a11*a31 + a21*a32 + a31*a33, a12*a31 + a22*a32 + a32*a33,   a33^2 +
 a13*a31 + a23*a32]


ans =

[a11^2, a12^2, a13^2]
[a21^2, a22^2, a23^2]
[a31^2, a32^2, a33^2]

Absol#ti ne#rti, katru elementu j#defin# atsevi#i.

otrais veids k# def
```

```
A =

[a11, a12, a13]
[a21, a22, a23]
[a31, a32, a33]


ans =

[  a11^2 + a12*a21 + a13*a31, a11*a12 + a12*a22 + a13*a32, a11*a13 +
 a12*a23 + a13*a33]
[a11*a21 + a21*a22 + a23*a31,   a22^2 + a12*a21 + a23*a32, a13*a21 +
 a22*a23 + a23*a33]
[a11*a31 + a21*a32 + a31*a33, a12*a31 + a22*a32 + a32*a33,   a33^2 +
 a13*a31 + a23*a32]


ans =

[a11^2, a12^2, a13^2]
[a21^2, a22^2, a23^2]
[a31^2, a32^2, a33^2]

#rt#k, jo visi main#gie tiek defin#ti vien# rind#,
v#lproj#m ne#rti, jo matricu j#defin# pa atsevi#iem elementiem.

trešais veids k# def
A =

[a1_1, a1_2, a1_3]
[a2_1, a2_2, a2_3]
[a3_1, a3_2, a3_3]


ans =

[   a1_1^2 + a1_2*a2_1 + a1_3*a3_1, a1_1*a1_2 + a1_2*a2_2 + a1_3*a3_2,
 a1_1*a1_3 + a1_2*a2_3 + a1_3*a3_3]
[a1_1*a2_1 + a2_1*a2_2 + a2_3*a3_1,    a2_2^2 + a1_2*a2_1 + a2_3*a3_2,
 a1_3*a2_1 + a2_2*a2_3 + a2_3*a3_3]
[a1_1*a3_1 + a2_1*a3_2 + a3_1*a3_3, a1_2*a3_1 + a2_2*a3_2 + a3_2*a3_3,
    a3_3^2 + a1_3*a3_1 + a2_3*a3_2]


ans =

[a1_1^2, a1_2^2, a1_3^2]
[a2_1^2, a2_2^2, a2_3^2]
[a3_1^2, a3_2^2, a3_3^2]

#rt#kais veids k# defin#t, jo elementi tiek indeks#ti autom#tiski.

Atbilde uz uzdevumu:
Izteiksme "A*A" reizina matricas.
```

```
Simbols "." nor#da "elementwise" darb#bu.
Izteiksme ".*" reizina elementus ar savstarp#ji vien#diem indeksiem,
jeb "A.*A" gadijum#, katrs elements tiek k#pin#ts kvadr#t#.

uzdevums 1 end
```

piem#rs 3: Atvasin#šana

atvasin#šana

```
fprintf('\nvienk#rša atvasin#šana')
syms x
y = x^2
diff(y)
diff(x^2)

% sintakse
% diff(ko_atvasin#t,p#c_k#_atvasin#t,cik_reizes)
fprintf('\natvasin#šana z p#c x, z p#c y')
syms x y
z = x^5*y^3;
diff(z,x)
diff(z,y)

% daudzk#rt#gie atvaisin#jumi
fprintf('\natvasin#šana divreiz')
syms x
diff(x^2,x,2)
fprintf('\npiem#rs 3 end\n')
```

```
vienk#rša atvasin#šana
y =

x^2


ans =

2*x


ans =

2*x


atvasin#šana z p#c x, z p#c y
ans =

5*x^4*y^3


ans =
```

```
3*x^5*y^2


atvasin#šana divreiz
ans =

2


piem#rs 3 end
```

uzdevums 2: apr##in#t atvisn#jumu funkcijai z = a.*x.^2

```
syms a x
z = a.*x.^2;
diff(z,x)
diff(z,y)
fprintf('\nuzdevums 2 end\n')


ans =

2*a*x


ans =

0


uzdevums 2 end
```

uzdevums 3: apr##in#t atvasin#jumu savai funkcijai

```
syms a b x
fprintf('\nfunkcija:')
y = a*x^3 + b*cos(x^5) + a*b*x^3
fprintf('\npirm#s k#rtas atv')
diff(y,x)
fprintf('\notr#s k#rtas atv')
diff(y,x,2)
fprintf('\ntreš#s k#rtas atv')
diff(y,x,3)
fprintf('\nceturt#s k#rtas atv')
diff(y,x,4)
fprintf('\nuzdevums 3 end\n')
```

```
funkcija:
y =

a*x^3 + b*cos(x^5) + a*b*x^3


pirm#s k#rtas atv
ans =

3*a*x^2 - 5*b*x^4*sin(x^5) + 3*a*b*x^2


otr#s k#rtas atv
ans =

6*a*x + 6*a*b*x - 25*b*x^8*cos(x^5) - 20*b*x^3*sin(x^5)


treš#s k#rtas atv
ans =

6*a + 6*a*b - 300*b*x^7*cos(x^5) - 60*b*x^2*sin(x^5) +
 125*b*x^12*sin(x^5)


ceturt#s k#rtas atv
ans =

625*b*x^16*cos(x^5) - 2400*b*x^6*cos(x^5) - 120*b*x*sin(x^5) +
 3000*b*x^11*sin(x^5)


uzdevums 3 end
```

piem#rs 4: Integr#šana

```
fprintf('\nfunkcija:
 int(izteiksme_kuru_integr#,diferenci#lis_p#c_k#_integr#)')
fprintf('\n!!!integr#jot matlab# nepar#d#s const C!!!')
fprintf('\npiem#rs 4 end\n')


funkcija: int(izteiksme_kuru_integr#,diferenci#lis_p#c_k#_integr#)
!!!integr#jot matlab# nepar#d#s const C!!!
piem#rs 4 end
```

uzdevums 4: darb#bas ar integr#šanu

```
fprintf('\nfunkcija:')
syms x y
z = x^5*y^3
fprintf('\natvasin#t p#c y, saglab#t main#gaj# p')
p = diff(z,y)
```

```
fprintf('integr#t p#c dy')
int(p,y)
fprintf('\nuzdevums 4 end\n')
```

```
funkcija:
z =

x^5*y^3


atvasin#t p#c y, saglab#t main#gaj# p
p =

3*x^5*y^2

integr#t p#c dy
ans =

x^5*y^3


uzdevums 4 end
```

piem#rs 5: noteiktais integr#lis

```
%{
Noteiktais integr#lis: fig#ras laukums, ko grafiski veido zemintegr##a
izteiksme, koordin#šu asis(x) un integr#šanas robežas.
Jeb anal#tiski integr##a v#rt#ba noteikt#s robež#s.
Noteikto inegr#li apr##ina nosakot izteiksmes nenoteikto integr#li,
ievietojot robežu v#rt#bas main#g# viet# un apr##inot ieg#to
 izteiksmju
starp#bu.
%}
fprintf('\nNoteikt# integr##a sintakse MATLAB vid#:')
fprintf('\nint(izteiksme,diferenci#lis_p#c_k#_integr#t,kreis#/
apakš#j#_robeža,laba/augš#j#_robeža)\n')
fprintf('\npiem#rs 5 end\n')
```

```
Noteikt# integr##a sintakse MATLAB vid#:
int(izteiksme,diferenci#lis_p#c_k#_integr#t,kreis#/
apakš#j#_robeža,laba/augš#j#_robeža)

piem#rs 5 end
```

uzdevums 5: apr##in#t noteikto integr#li

```
syms x;
y = sin(x)
int(y,x,0,pi)
fprintf('\nuzdevums 5 end\n')
```

```
y =

sin(x)


ans =

2


uzdevums 5 end
```

uzdevums 6: integr#lis, robežas, vien#dojumi

```
fprintf('\nINTEGR#ŠANA:\n')
syms x;
y = sin(x)^2

fprintf('\nbez double\n')
int(y,x,0,pi/3)
fprintf('\nar double\n')
double(int(y,x,0,pi/3))

fprintf('\nROBEŽAS:\n')
fprintf('\nRobežu sintakse MATLAB vid#:')
fprintf('\nlimit(izteiksme,main#gais,uz_ko_tiecas,no_kuras_puses)\n')
fprintf('\npiem#rs:\n')
syms x;
y = 1/(x-1)
fprintf('\nizteiksme:')
fprintf('\n         / 1 \\          ')
fprintf('\n  lim   |-----|          ')
fprintf('\n x -> 1  \\x-1/           ')
fprintf('\n                        ')
fprintf('\n\nno kreis#s puses:')
limit((1/(x-1)),x,1,'left')
fprintf('\nno lab#s puses:')
limit((1/(x-1)),x,1,'right')

fprintf('\nVIEN#DOJUMI:\n')
fprintf('\nsolve sintakse MATLAB vid#:')
fprintf('\nsolve(izteiksme_ko_atrisin#t,ko_j#atrod)\n')

fprintf('\nvienk#ršas izteksmes\n')
syms x
fprintf('\nAtrast saknes izteiksmei x^2-3*x+2=0:\n')
solve(x^2-3*x+2==0,x)

fprintf('\nsist#mas:\n')
syms x y
[x_atb,y_atb] = solve(5*x+2*y==16,x-y==-1)
atb = solve(5*x+2*y==16,x-y==-1)
```

```
%atbilde ir datu strukt#ra, elementus var ieg#tu rakstot pieš#irto
 main#go
%un ".x" indeksu.
%x risin#jums: atb.x
atb.x
%y risin#jums: atb.y
atb.y

fprintf('\nuzdevums 6 end\n')


INTEGR#ŠANA:

y =

sin(x)^2


bez double

ans =

pi/6 - 3^(1/2)/8


ar double

ans =

    0.3071


ROBEŽAS:

Robežu sintakse MATLAB vid#:
limit(izteiksme,main#gais,uz_ko_tiecas,no_kuras_puses)

piem#rs:

y =

1/(x - 1)


izteiksme:
         / 1 \
  lim    |-----|
 x -> 1  \x-1/


no kreis#s puses:
ans =

-Inf
```

```
no lab#s puses:
ans =

Inf


VIEN#DOJUMI:

solve sintakse MATLAB vid#:
solve(izteiksme_ko_atrisin#t,ko_j#atrod)

vienk#ršas izteksmes

Atrast saknes izteiksmei x^2-3*x+2=0:

ans =

1
2


sist#mas:

x_atb =

2


y_atb =

3


atb =

  struct with fields:

    x: [1×1 sym]
    y: [1×1 sym]


ans =

2


ans =

3


uzdevums 6 end
```

uzdevums 7: "individualized task 2023"

```
%izteiksme x+a*sqrt(x^2) = c, a - ?
syms x a c
solve(x+a*sqrt(x^2)==c,a)
%integr#t f(x) = -(cos(x)-1)/(x-sin(x))^2, F(x)-?, robež#s x pieder
 [pi,5pi]
f = -1*(cos(x)-1)/(x-sin(x))^2
%izteiksme
int(f,x,pi,5*pi)
%skaitlisk# v#rt#ba
double(int(f,x,pi,5*pi))
fprintf('\nuzdevums 7 end\n')
```

```
ans =

(c - x)/(x^2)^(1/2)


f =

-(cos(x) - 1)/(x - sin(x))^2


ans =

4/(5*pi)


ans =

    0.2546


uzdevums 7 end
```

piem#rs 6: vienk#ršošana

```
syms x y
y = (sin(x)^2 + cos(x)^2);
y
simplify(y)
%piem#rs
F = (x-1)*(x-2)/((x-3)*(x-4))
Fi = diff(F)
simplify(Fi)
%izteiksmju p#rveidošana
F = (x - 1)*(x - 2);
%atv#rt iekavas
F2 = expand(F)
%p#rveidot reizin#t#jos
factor(F2)
```

```
%p#rveidot p#c hornera sh#mas
horner(F2)
%sagrup#t collect(izteiksme,p#c_k#_grup#t)
collect(F2)
fprintf('\npiem#rs 6 end\n')
```

```
y =

cos(x)^2 + sin(x)^2


ans =

1


F =

((x - 1)*(x - 2))/((x - 3)*(x - 4))


Fi =

(x - 1)/((x - 3)*(x - 4)) + (x - 2)/((x - 3)*(x - 4)) - ((x - 1)*(x -
 2))/((x - 3)*(x - 4)^2) - ((x - 1)*(x - 2))/((x - 3)^2*(x - 4))


ans =

-(2*(2*x^2 - 10*x + 11))/(x^2 - 7*x + 12)^2


F2 =

x^2 - 3*x + 2


ans =

[x - 1, x - 2]


ans =

x*(x - 3) + 2


ans =

x^2 - 3*x + 2


piem#rs 6 end
```

piem#rs 7: k# skaist#k att#lot

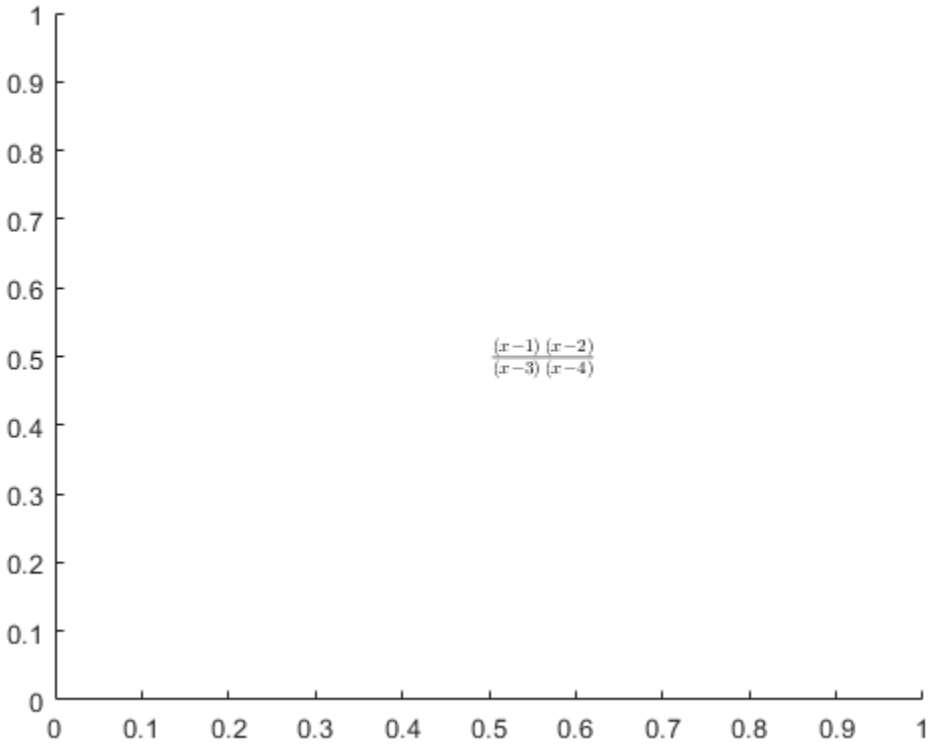
```
%piem#rs 1
syms x
F = ((x - 1)*(x - 2))/((x - 3)*(x - 4));
pretty(F)
%piem#rs 2
syms x
F = ((x - 1)*(x - 2))/((x - 3)*(x - 4));
latex(F)
Fltx=latex(F);
h=text(0.5,0.5,['$',Fltx,'$']);set(h,'Interpreter','latex')
fprintf('\npiem#rs 7 end\n')
```

```
(x - 1) (x - 2)
---------------
(x - 3) (x - 4)


ans =

    '\frac{\left(x-1\right)\,\left(x-2\right)}{\left(x-3\right)\,
\left(x-4\right)}'


piem#rs 7 end
```



piem#rs 8: substit#cija

```
syms x y z
z = x^2+y^3
subs(z,y,5*x)
```

```
z =

x^2 + y^3


ans =

125*x^3 + x^2
```

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