

```

K = 5;
L = 5;
M = 5;
KLM = Max[K, L, M];
Array[h, K + 1, 0];
Array[b, L + 1, 0];
Array[g, M + 1, 0];
H1 = Sum[h[Abs[i]] * x^(i + KLM), {i, 0, K, 3}] +
      Sum[h[Abs[i]] * x^(i + KLM), {i, -3, -K, -3}];
H2 = Sum[h[Abs[i]] * x^(i + KLM), {i, 2, K, 3}] +
      Sum[h[Abs[i]] * x^(i + KLM), {i, -1, -K, -3}];
H3 = Sum[h[Abs[i]] * x^(i + KLM), {i, 1, K, 3}] +
      Sum[h[Abs[i]] * x^(i + KLM), {i, -2, -K, -3}];
B1 = -Sum[b[Abs[i]] * x^(i + KLM), {i, 0, L, 3}] +
      Sum[b[Abs[i]] * x^(i + KLM), {i, -3, -L, -3}];
B2 = -Sum[b[Abs[i]] * x^(i + KLM), {i, 2, L, 3}] +
      Sum[b[Abs[i]] * x^(i + KLM), {i, -1, -L, -3}];
B3 = -Sum[b[Abs[i]] * x^(i + KLM), {i, 1, L, 3}] +
      Sum[b[Abs[i]] * x^(i + KLM), {i, -2, -L, -3}];
G1 = Sum[g[Abs[i]] * x^(i + KLM), {i, 0, M, 3}] +
      Sum[g[Abs[i]] * x^(i + KLM), {i, -3, -M, -3}];
G2 = Sum[g[Abs[i]] * x^(i + KLM), {i, 2, M, 3}] +
      Sum[g[Abs[i]] * x^(i + KLM), {i, -1, -M, -3}];
G3 = Sum[g[Abs[i]] * x^(i + KLM), {i, 1, M, 3}] +
      Sum[g[Abs[i]] * x^(i + KLM), {i, -2, -M, -3}];
HGDet = {{H1, B1, G1}, {H2, B2, G2}, {H3, B3, G3}};
f = Det[HGDet];
ff = CoefficientList[f, x];
HGDetH = {{1, B1, G1}, {1, B2, G2}, {1, B3, G3}};
fh = Det[HGDetH];
ffh = CoefficientList[fh, x];
Length[ffh];
HGDetB = {{H1, 1, G1}, {H2, 1, G2}, {H3, 1, G3}};
fb = Det[HGDetB];
ffb = CoefficientList[fb, x];
HGDetG = {{H1, B1, 1}, {H2, B2, 1}, {H3, B3, 1}};
fg = Det[HGDetG];
ffg = CoefficientList[fg, x];
K1 = Length[ffh] / 2 - 1;
Array[kh, K1 + 1, 0];
For[i = K1 + 1; j = Length[ffh], i > 0, i--; j--, kh[i - 1] = -ffh[[j]]];
M1 = Length[ffg] / 2 - 1;
Array[kg, M1 + 1, 0];
For[i = M1 + 1; j = Length[ffg], i > 0, i--; j--, kg[i - 1] = -ffg[[j]]];

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L1 = Length[ffb] / 2 - 1;
Array[kb, L1 + 1, 0];
For[i = L1 + 1; j = Length[ffb], i > 0, i--; j--, kb[i - 1] = -ffb[[j]]];
Print["(K, L, M)      = (" , K, " , " , L, " , " ,
      M, ")      (" , 2 * K + 1, " , " , 2 * L + 1, " , " , 2 * M + 1, " )"]
Print["(K1, L1, M1) = (" , K1, " , " , L1, " , " , M1,
      ")      (" , 2 * K1 + 1, " , " , 2 * L1 + 1, " , " , 2 * M1 + 1, " )"]
Print["Длина детерминанта - " , Length[ff]]
Print["Середина детерминанта, равная 1, - " , Length[ff] / 2 - 2]
Print["Количество уравнений - " , K + L + M + 3]

(K, L, M)      = (5, 5, 5)      (11, 11, 11)
(K1, L1, M1) = (9, 9, 9)      (19, 19, 19)

Длина детерминанта - 28
Середина детерминанта, равная 1, - 12
Количество уравнений - 18

```

```

s = 2 ^ (2 / 3);
aa = 0.09;
NSLv = NSolve[{
  b[0] == 0,
  ff[Length[ff]] == 0,
  ff[Length[ff] - 3] == 0,
  ff[Length[ff] - 6] == 0,
  ff[Length[ff] - 9] == 0,
  ff[Length[ff] - 12] == -1,

  Sum[h[Abs[i]] * (-1) ^ i, {i, -K, K}] == 0,
  Sum[g[Abs[i]], {i, -M, M}] == 0,
  Sum[kh[Abs[i]], {i, -K1, K1}] == s,
  Sum[kh[Abs[i]] * (-1) ^ i, {i, -K1, K1}] == 0,
  Sum[kg[Abs[i]], {i, -M1, M1}] == 0,
  Sum[kg[Abs[i]] * (-1) ^ i, {i, -M1, M1}] == s,

  Sum[i ^ 2 * kh[i], {i, 1, K1}] == 0,
  Sum[i ^ 2 * kh[i] * (-1) ^ (i - 1), {i, 1, K1}] == 0,

  Sum[i ^ 2 * kg[i], {i, 1, M1}] == 0,
  Sum[i ^ 2 * kg[i] * (-1) ^ (i - 1), {i, 1, M1}] == 0,

  Sum[i * kb[i], {i, 1, L1}] == 0,
  (*Sum[i * kb[i] * (-1) ^ (i - 1), {i, 1, L1}] == 0, *)
  (*Sum[i * kb[i] * Cos[Pi * i * 0.65], {i, 1, L1}] == 0, *)
  (*Sum[kb[i] * Sin[Pi * i * 0.7], {i, 1, L1}] == s / 2, *)

  (h[0] * g[0] + 2 * h[1] * g[1]) ^ 2 -
    aa ^ 2 * Sum[h[Abs[i]] ^ 2, {i, -K, K}] * Sum[g[Abs[i]] ^ 2, {i, -M, M}] == 0
}(*, Reals*))];
Print["Количество решений - ", Length[NSLv]]
Количество решений - 10

```

```

ph = 100 * (h[0] + 2 * Sum[h[i] * Cos[Pi * i * x], {i, 1, K}]);
pb = 100 * 2 * Sum[b[i] * Sin[Pi * i * x], {i, 1, L}];
pg = 100 * (g[0] + 2 * Sum[g[i] * Cos[Pi * i * x], {i, 1, M}]);
pkh = 100 * (kh[0] + 2 * Sum[kh[i] * Cos[Pi * i * x], {i, 1, K1}]);
pkb = 100 * 2 * Sum[kb[i] * Sin[Pi * i * x], {i, 1, L1}];
pkg = 100 * (kg[0] + 2 * Sum[kg[i] * Cos[Pi * i * x], {i, 1, M1}]);
pkhh = ph * pkh / 300;
pkbb = pb * pkb / 300;
pkgg = pg * pkg / 300;

Do[Print[kk];
ssh = Sqrt[Sum[(h[Abs[i]] /. NSLv[[kk]])^2, {i, -K, K}]];
ssb = Sqrt[Sum[(b[Abs[i]] /. NSLv[[kk]])^2, {i, -L, L}]];
ssg = Sqrt[Sum[(g[Abs[i]] /. NSLv[[kk]])^2, {i, -M, M}]];
Print[(h[0] /. NSLv[[kk]]) * (g[0] /. NSLv[[kk]]) +
2 * (h[1] /. NSLv[[kk]]) * (g[1] /. NSLv[[kk]])] / (ssh * ssg)];
Print[Sum[(h[i] /. NSLv[[kk]])^2, {i, 2, K}] /
((h[0] /. NSLv[[kk]])^2 + 2 * (h[1] /. NSLv[[kk]])^2)];
Print[Sum[(b[i] /. NSLv[[kk]])^2, {i, 2, L}] /
((b[0] /. NSLv[[kk]])^2 + 2 * (b[1] /. NSLv[[kk]])^2)];
Print[Sum[(g[i] /. NSLv[[kk]])^2, {i, 2, M}] /
((g[0] /. NSLv[[kk]])^2 + 2 * (g[1] /. NSLv[[kk]])^2)];
Print[Plot[{ph /. NSLv[[kk]], pb /. NSLv[[kk]], pg /. NSLv[[kk]]},
{x, 0, 1}, AxesLabel -> {"x", "y"},
LabelStyle -> Directive[FontFamily -> "Times", FontSize -> 12],
PlotStyle -> {Thickness[0.01]}, ImageSize -> Medium],
Plot[{pkh /. NSLv[[kk]], pkb /. NSLv[[kk]], pkg /. NSLv[[kk]]},
{x, 0, 1}, AxesLabel -> {"x", "y"},
LabelStyle -> Directive[FontFamily -> "Times", FontSize -> 12],
PlotStyle -> {Thickness[0.01]}, ImageSize -> Medium]], {kk, Length[NSLv]}]
(*kk=14;
Plot[{ph /. NSLv[[kk]], pb /. NSLv[[kk]], pg /. NSLv[[kk]]}, {x, 0, 1}, AxesLabel -> {"x", "y"},
LabelStyle -> Directive[FontFamily -> "Times", FontSize -> 12],
PlotStyle -> {Thickness[0.01]}]
Plot[{pkh /. NSLv[[kk]], pkb /. NSLv[[kk]], pkg /. NSLv[[kk]]},
{x, 0, 1}, AxesLabel -> {"x", "y"},
LabelStyle -> Directive[FontFamily -> "Times", FontSize -> 12],
PlotStyle -> {Thickness[0.01]}]
Plot[{pkhh /. NSLv[[kk]], pkbb /. NSLv[[kk]], pkgg /. NSLv[[kk]],
(pkhh + pkbb + pkgg) /. NSLv[[kk]]}, {x, 0, 1}, AxesLabel -> {"x", "y"},
LabelStyle -> Directive[FontFamily -> "Times", FontSize -> 12],
PlotStyle -> {Thickness[0.01]}] *)

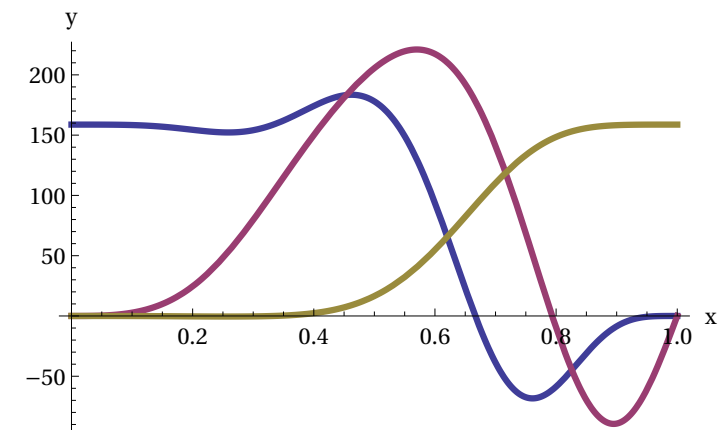
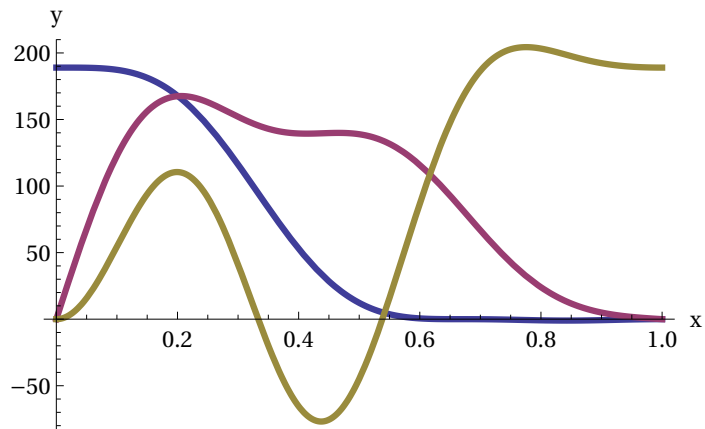
```

0.09

0.0508925

0.110973

0.225906



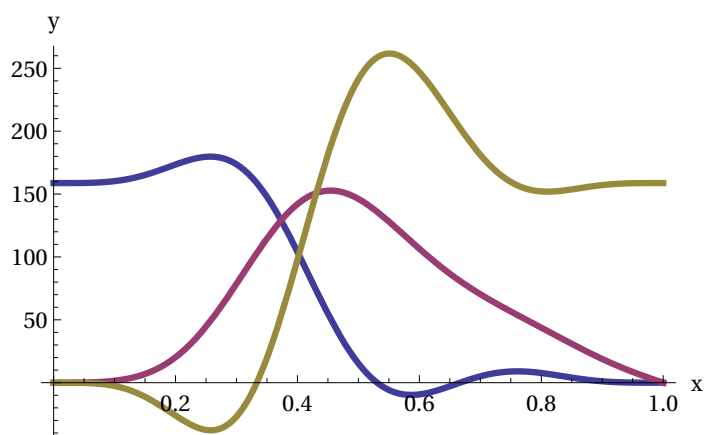
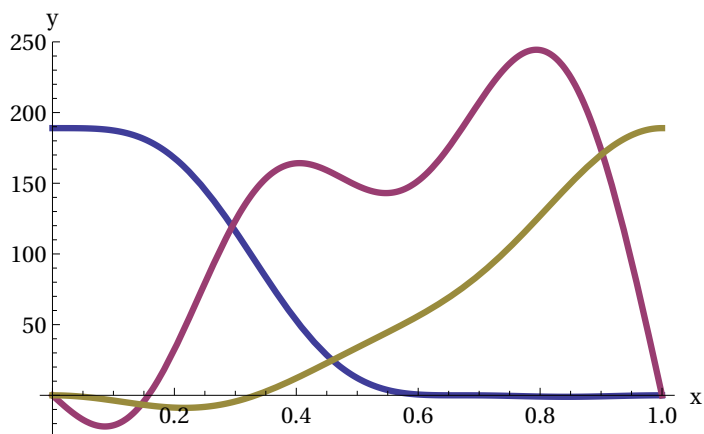
2

-0.09

0.0508925

0.145825

0.0371004



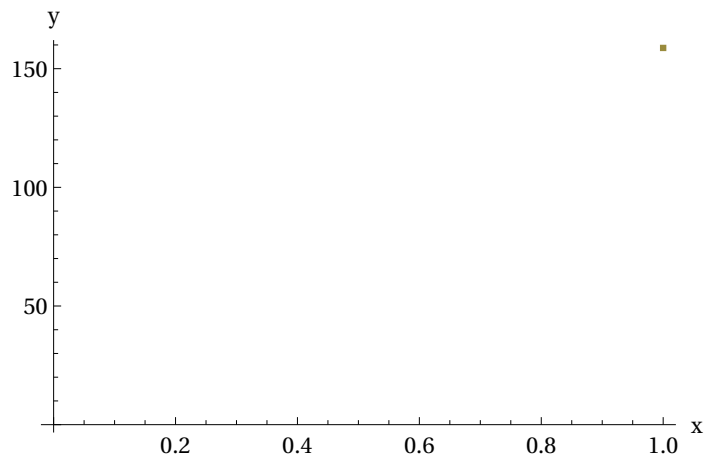
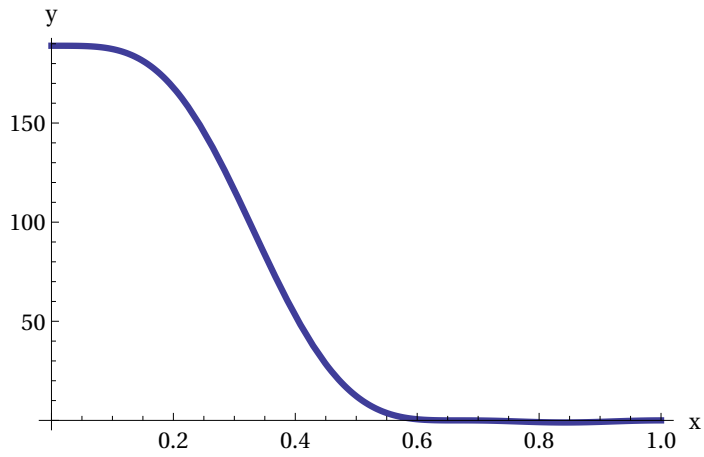
3

$$0.09 + 2.52425 \times 10^{-12} i$$

$$0.0508925$$

$$-0.0278406 + 0.0105344 i$$

$$-0.386696 - 0.205153 i$$



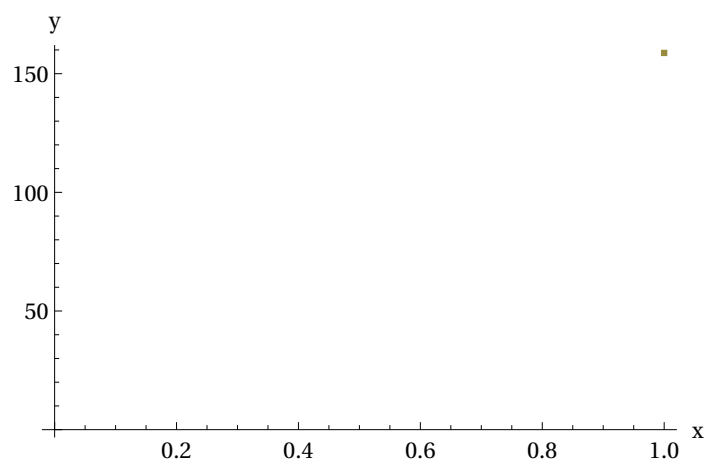
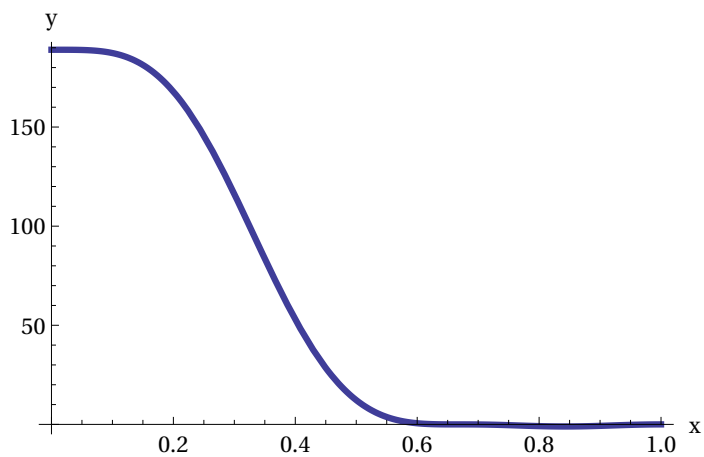
4

$$0.09 - 2.52425 \times 10^{-12} i$$

$$0.0508925$$

$$-0.0278406 - 0.0105344 i$$

$$-0.386696 + 0.205153 i$$



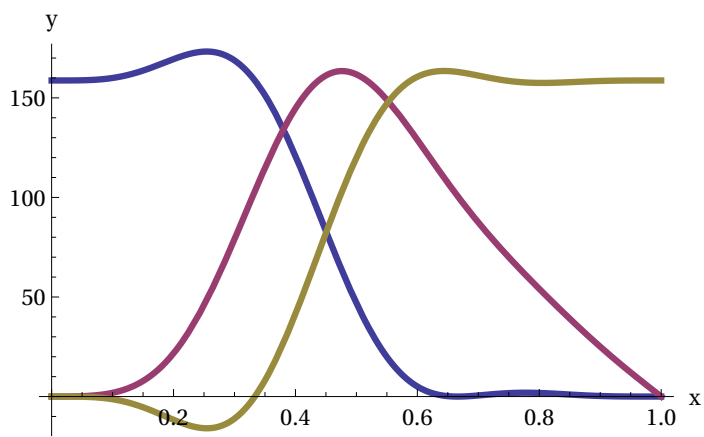
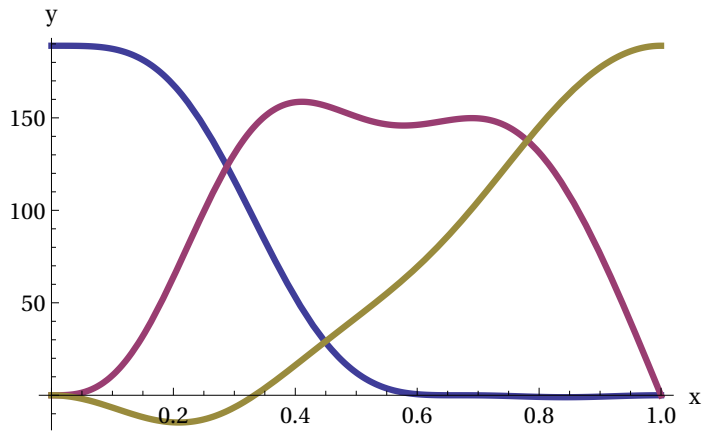
5

-0.09

0.0508925

0.0194301

0.0215904



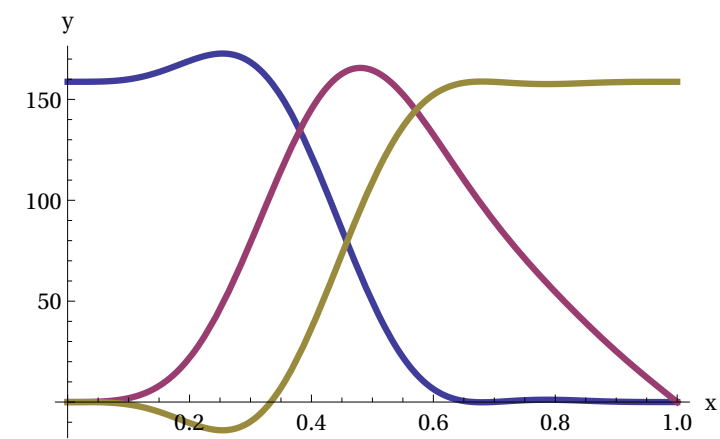
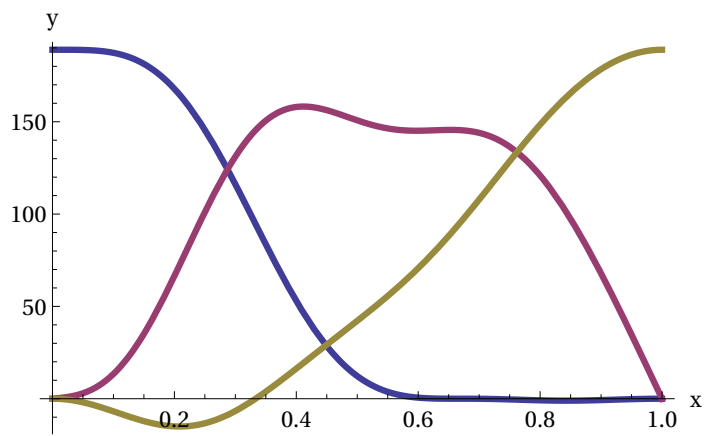
6

-0.09

0.0508925

0.0137953

0.0206895



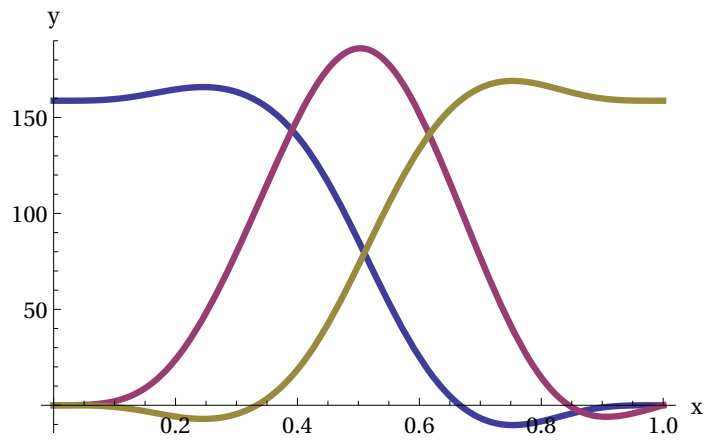
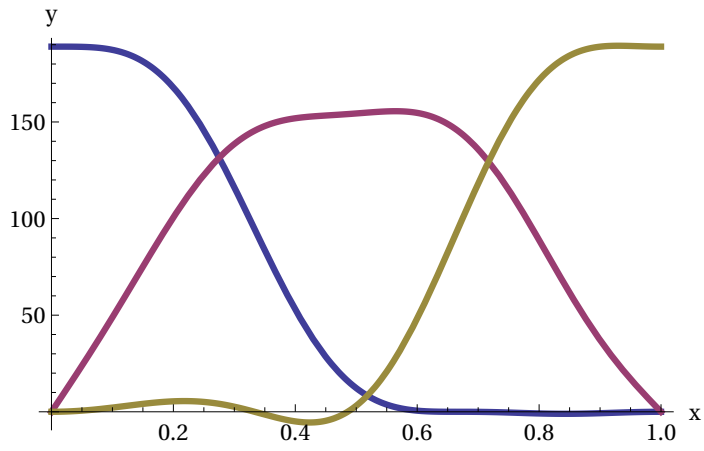
7

-0.09

0.0508925

0.00145148

0.065446



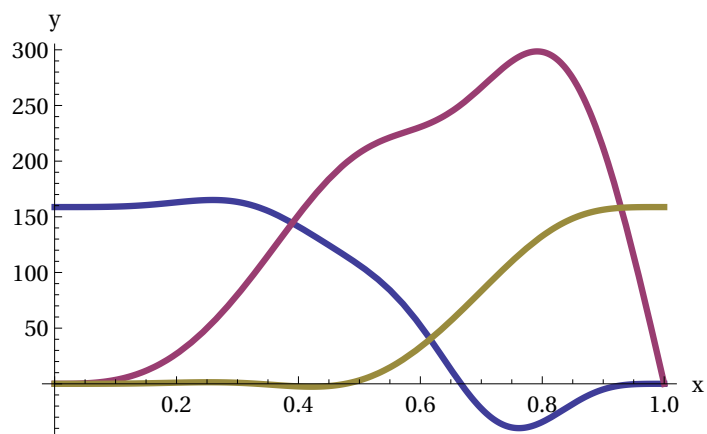
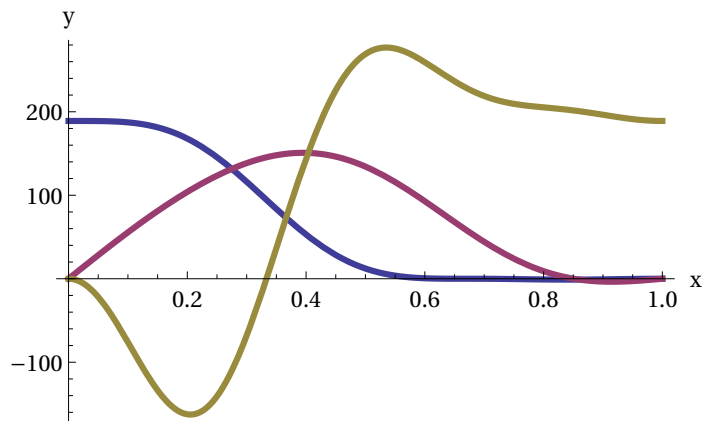
8

-0.09

0.0508925

0.0940404

0.152775



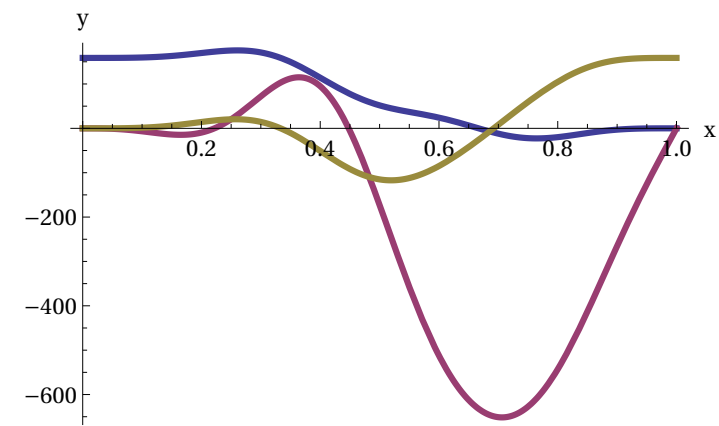
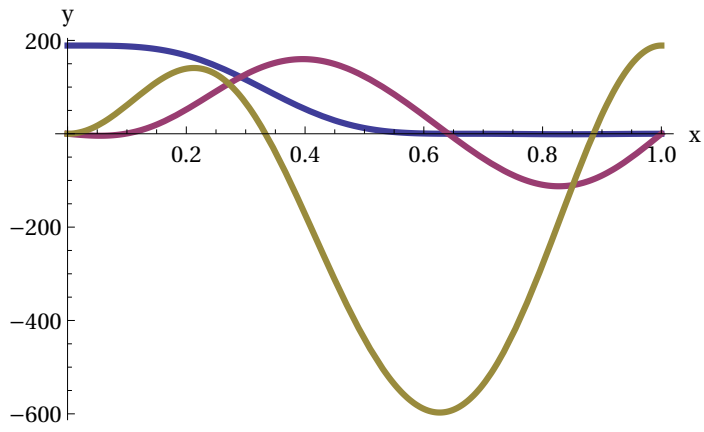
9

-0.09

0.0508925

1.66443

0.819224



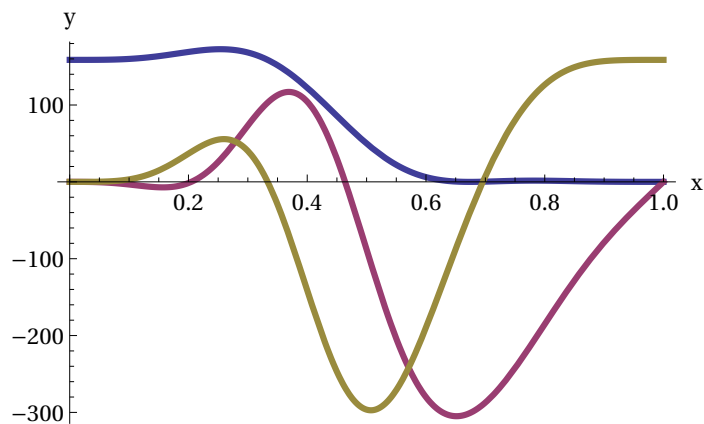
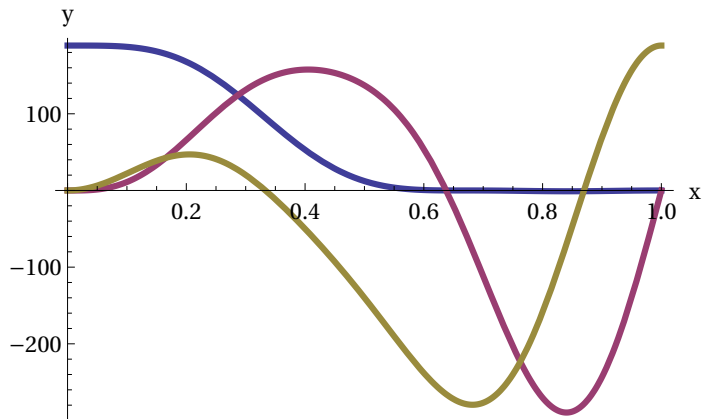
10

-0.09

0.0508925

19.7365

1.53029



```
kk = 7; (* 0.05 - 20 28 33 *) (* 0.01 - 25 *) (* 0 - 12 13 *)
(* 0.03 - 24 27 28 *) (* 0.07 - 20 26 27 *) (* 0.1 - 20 29 30 31 34 *)
(*fs=OpenWrite["D:\Documents\Wavelets\W3 777 s014.txt",PageWidth→200]
  SetOptions[fs, FormatType→StandardForm,CharacterEncoding→ "ASCII"]*)
KLM2 = Max[K, K1, L, L1, M, M1]
min = 10^-12;
```

```
Array[h2, 2 * KLM2 + 1, -KLM2];
For[i = -KLM2, i ≤ KLM2, i++, h2[i] = 0.0];
For[i = -K, i ≤ K, i++, h2[i] = h[Abs[i]] /. NSLv[[kk]]];
Array[kh2, 2 * KLM2 + 1, -KLM2];
For[i = -KLM2, i ≤ KLM2, i++, kh2[i] = 0.0];
For[i = -K1, i ≤ K1, i++, kh2[i] = kh[Abs[i]] /. NSLv[[kk]]];
shh = Sqrt[Sum[h2[i]^2, {i, -K, K}]];
skh = Sqrt[Sum[kh2[i]^2, {i, -K1, K1}]];
```

```
Array[g2, 2 * KLM2 + 1, -KLM2];
For[i = -KLM2, i ≤ KLM2, i++, g2[i] = 0.0];
For[i = -M, i ≤ M, i++, g2[i] = g[Abs[i]] /. NSLv[[kk]]];
Array[kg2, 2 * KLM2 + 1, -KLM2];
```

```

For[i = -KLM2, i ≤ KLM2, i++, kg2[i] = 0.0];
For[i = -M1, i ≤ M1, i++, kg2[i] = kg[Abs[i]] /. NSLv[[kk]]];
shg = Sqrt[Sum[g2[i]^2, {i, -M, M}]];
skg = Sqrt[Sum[kg2[i]^2, {i, -M1, M1}]];

Array[b2, 2 * KLM2 + 1, -KLM2];
For[i = -KLM2, i ≤ KLM2, i++, b2[i] = 0.0];
For[i = -L, i ≤ L, i++, b2[i] = Sign[i] * b[Abs[i]] /. NSLv[[kk]]];
Array[kb2, 2 * KLM2 + 1, -KLM2];
For[i = -KLM2, i ≤ KLM2, i++, kb2[i] = 0.0];
For[i = -L1, i ≤ L1, i++, kb2[i] = -Sign[i] * kb[Abs[i]] /. NSLv[[kk]]];
shb = Sqrt[Sum[b2[i]^2, {i, -L, L}]];
skb = Sqrt[Sum[kb2[i]^2, {i, -L1, L1}]];

```

(* нормировка по обратным функциям *)

```

(*For[i=-K,i≤K,i++,ss=h2[i]*skh;h2[i]=If[Abs[ss]<min,0.0,ss]];
For[i=-K1,i≤K1,i++,ss=kh2[i]/skh;kh2[i]=If[Abs[ss]<min,0.0,ss]];
For[i=-M,i≤M,i++,ss=g2[i]*skg;g2[i]=If[Abs[ss]<min,0.0,ss]];
For[i=-M1,i≤M1,i++,ss=kg2[i]/skg;kg2[i]=If[Abs[ss]<min,0.0,ss]];
For[i=-L,i≤L,i++,ss=b2[i]*skb;b2[i]=If[Abs[ss]<min,0.0,ss]];
For[i=-L1,i≤L1,i++,ss=kb2[i]/skb;kb2[i]=If[Abs[ss]<min,0.0,ss]];*)

```

(* нормировка по прямым функциям *)

```

For[i = -K, i ≤ K, i++, ss = h2[i] / shh;
  h2[i] = If[Abs[ss] < min, 0.0, ss]];
For[i = -K1, i ≤ K1, i++, ss = kh2[i] * shh;
  kh2[i] = If[Abs[ss] < min, 0.0, ss]];
For[i = -M, i ≤ M, i++, ss = g2[i] / shg;
  g2[i] = If[Abs[ss] < min, 0.0, ss]];
For[i = -M1, i ≤ M1, i++, ss = kg2[i] * shg;
  kg2[i] = If[Abs[ss] < min, 0.0, ss]];
For[i = -L, i ≤ L, i++, ss = b2[i] / shb;
  b2[i] = If[Abs[ss] < min, 0.0, ss]];
For[i = -L1, i ≤ L1, i++, ss = kb2[i] * shb;
  kb2[i] = If[Abs[ss] < min, 0.0, ss]];

```

(*For[i=-KLM2,i≤KLM2,i++,Print[kh2[i]]];*)

```

sep = "\t";
(*For[i=-KLM2,i≤KLM2,i++,WriteString[fs,h2[i],sep,
  kh2[i],sep,b2[i],sep,kb2[i],sep,g2[i],sep,kg2[i]],"\n"]];
Close[fs];*)
For[i = -KLM2, i ≤ KLM2, i++,
  Print[h2[i], sep, kh2[i], sep, b2[i], sep, kb2[i], sep, g2[i], sep, kg2[i]]];

```

```

ph2 = 100 * (h2[0] + 2 * Sum[h2[i] * Cos[Pi * i * x], {i, 1, KLM2}]);
pb2 = 100 * 2 * Sum[b2[i] * Sin[Pi * i * x], {i, 1, KLM2}];
pg2 = 100 * (g2[0] + 2 * Sum[g2[i] * Cos[Pi * i * x], {i, 1, KLM2}]);
pkh2 = 100 * (kh2[0] + 2 * Sum[kh2[i] * Cos[Pi * i * x], {i, 1, KLM2}]);
pkb2 = -100 * 2 * Sum[kb2[i] * Sin[Pi * i * x], {i, 1, KLM2}];
pkg2 = 100 * (kg2[0] + 2 * Sum[kg2[i] * Cos[Pi * i * x], {i, 1, KLM2}]);
pkhh2 = ph2 * pkh2 / 300;
pkbb2 = pb2 * pkb2 / 300;
pkgg2 = pg2 * pkg2 / 300;

Print[h2[0] * g2[0] + 2 * h2[1] * g2[1]];
Print[kh2[0] * kg2[0] + 2 * kh2[1] * kg2[1]];
Plot[{ph2, pb2, pg2}, {x, 0, 1}, AxesLabel -> {"x", "y"},
  LabelStyle -> Directive[FontFamily -> "Times", FontSize -> 12],
  PlotStyle -> {Thickness[0.01]}]
Plot[{pkh2, pkb2, pkg2}, {x, 0, 1}, AxesLabel -> {"x", "y"},
  LabelStyle -> Directive[FontFamily -> "Times", FontSize -> 12],
  PlotStyle -> {Thickness[0.01]}]
Plot[{pkhh2, pkbb2, pkgg2, (pkhh2 + pkbb2 + pkgg2)}, {x, 0, 1}, AxesLabel -> {"x", "y"},
  LabelStyle -> Directive[FontFamily -> "Times", FontSize -> 12],
  PlotStyle -> {Thickness[0.01]}]

```



```

0.    0.00202806    0.    0.00279068    0.    -0.00204712
0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.    0.
0.    -0.00396775    0.    -0.00231687    0.    0.00400505
-0.0221438    0.0211386    0.0297596    0.0290874    0.0186313    -0.0213373
-0.0487165    0.0119032    -0.0167578    0.0163793    -0.0711074    -0.0120151
0.    -0.132697    0.    -0.32117    0.    0.133945
0.208152    -0.0119032    -0.0167578    0.0163793    0.229058    0.0120151
0.500451    0.501538    -0.706083    0.708581    -0.492484    -0.506253
0.637743    0.791951    0.    0.    0.631804    0.783375
0.500451    0.501538    0.706083    -0.708581    -0.492484    -0.506253
0.208152    -0.0119032    0.0167578    -0.0163793    0.229058    0.0120151
0.    -0.132697    0.    0.32117    0.    0.133945
-0.0487165    0.0119032    0.0167578    -0.0163793    -0.0711074    -0.0120151
-0.0221438    0.0211386    -0.0297596    -0.0290874    0.0186313    -0.0213373
0.    -0.00396775    0.    0.00231687    0.    0.00400505
0.    0.    0.    0.    0.    0.
0.    0.    0.    0.    0.    0.
0.    0.00202806    0.    -0.00279068    0.    -0.00204712
-0.09
0.112584

```

