

```

In[1]:= (* Testing results of Segev - Heller paper *)
(* Distribution of energies *)
(* With plots of coefficients *)
Clear["@"];
(***** INPUT starts *****)
tabdata = { (* x0, y0, omx, omy *)
  {0, 0, 0.02, 0.18}, (* Fig. 1 *)
  {0, 0, 10., 2.2}, (* Fig. 2 *)
  {0, 0, 0.45, 0.01}, (* Fig. 3 *)
  {0, 0, 2., 18.}, (* Fig. 4 *)
  {3., 0, 2., 0.1}, (* Fig. 5 *)
  {3., 0., 2., 10.}, (* Fig. 6 *)
  {0.4, 0.2, 0.7, 1.5}, (* square pattern *)
  {0.1519, 0.2649, 0.04689, 0.05555}, (* err=38644, the worst *)
  {0.9740, 0.9398, 0.5707, 0.5647} (* err=30, the best *)
};
nntab = {20, 30, 50, 100};
(* Subr. for minimizing W.-function and printing *)
<< D:\sergeev\bgu\math\packages\harm.m;
<< D:\sergeev\purdue\math\packages\printing.m;
(***** INPUT ends *****)
dirtemp = "d:\\temp\bilha";
sd = SetDirectory[dirtemp];
If[sd != dirtemp, Print["Directory ", dirtemp, " does not exist. Exiting..."]; Abort[]];
psi[n_, x_, om_] =
  (om / Pi)^(1/4) / (2^(n/2) Sqrt[n!]) E^(-1/2 om x^2) * HermiteH[n, x Sqrt[om]];
mtabdata = Length[tabdata];
mnn = Length[nntab];
Do[
  {x0, y0, omx, omy} = tabdata[[ntabdata]];
  CellPrint[Cell["", PageBreakAbove -> True]];
  Print[
    StyleForm[
      If[ntabdata <= 6, "Fig. "<>ToString[ntabdata]<>".", "", "Section"],
      StyleForm[
        StringForm["x0 = ``, y0 = ``, ωx = ``, ωy = ``",
          Sequence@@(OutputForm[SetPrecision[#, 3]]&)/@{x0, y0, omx, omy}], "Section"]];
  tab = {{ "n", "px", "py", "px*", "py*", "x*", "y*", "-log(ρ)", "Rx", "Rx*" }};
  Clear[int];
  int[n_, om0_, om1_, a_] := int[n, om0, om1, a] = E^(-a^2/2 om0 om1 / (om0 + om1)) *
    om0^(1/4) om1^(1/4) / (om0 + om1)^(n+1/2) *
    Sqrt[2^(n+1) n!] *
    Sum[2^(-2 i) / i! / (n - 2 i)! (om1^2 - om0^2)^i *
      If[n/2 - i == 0, 1, (a^2 om0^2 om1)^(n/2 - i)], {i, 0, Floor[n/2]}];
  Do[n = nntab[[nn]];
  en = n + 1;
  {px, py, qx, qy, la, w} = harm`harmxy[omx, omy, x0, y0, 1., 1., en];
  w = 2 w;
  {e1, e2} = 1/2 {px^2 + qx^2, py^2 + qy^2};
  pltdata = {};
  {h1, h2, norm} = Sum[
    n1 = j; n2 = n - j;
    c = (int[n1, omx, 1, x0] int[n2, omy, 1, y0])^2;
    en1j = n1 + 1/2;
    en2j = n2 + 1/2;
    pltdata = Append[pltdata, {en1j/en 100, c}];
    c * {en1j, en2j, 1}
    , {j, 0, n}];
  pltdata = Transpose[pltdata];
  pltdata[[2]] = pltdata[[2]] / norm;
  ymax = 1.1 Max[pltdata[[2]]];
  pltdata = Transpose[pltdata];
  ycut = ymax / 300;
  {xmin, xmax} = {0, 100};
  mplt = Length[pltdata];

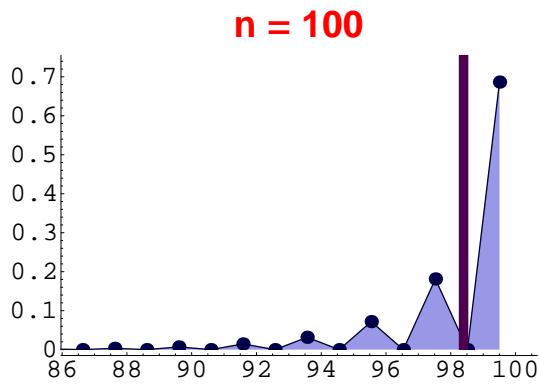
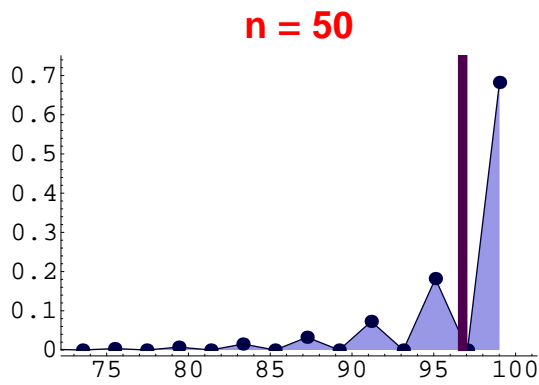
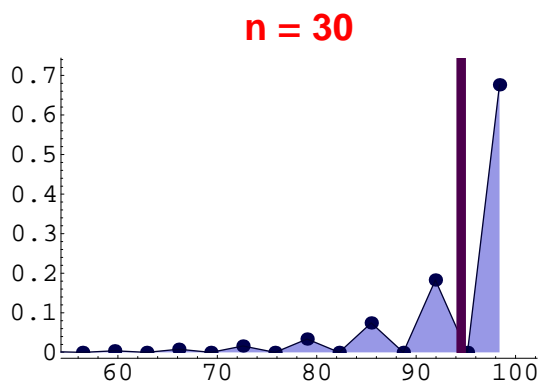
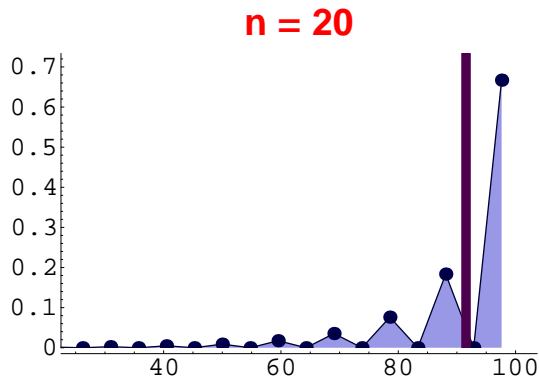
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Do[{xn, yn} = pltdata[[n]]; If[yn > ycut, Break[]]; xmin = xn, {n, mplt}];
Do[{xn, yn} = pltdata[[n]]; If[yn > ycut, Break[]]; xmax = xn, {n, mplt, 1, -1}];
xmean = (xmin + xmax) / 2;
{xmin, xmax} = {xmin, xmax} - xmean;
{xmin, xmax} = 1.1 {xmin, xmax};
{xmin, xmax} = {xmin, xmax} + xmean;
{en1, en2} = {h1, h2} / norm;
{wig, qua} = {e1, en1} / en 100;
(* Plotting *)
p0 = ListPlot[pltdata, PlotRange -> {{xmin, xmax}, {0, ymax}},
  PlotStyle -> {RGBColor[0, 0, 0.3], AbsolutePointSize[5.]},
  DisplayFunction -> Identity];
pltdatal = Join[{{First[pltdata][[1]], 0}}, pltdata, {{Last[pltdata][[1]], 0}}];
p1 = Graphics[{RGBColor[0.6, 0.6, 0.9], Polygon[pltdatal]},
  PlotRange -> {{xmin, xmax}, {0, ymax}}];
p2 = Graphics[{RGBColor[0, 0, 0.2], Line[pltdata]},
  PlotRange -> {{xmin, xmax}, {0, ymax}}];
p3 = Graphics[
  {Thickness[.02], RGBColor[0.3, 0, 0.3], Line[{{qua, -ymax/50}, {qua, ymax}}]},
  PlotRange -> {{xmin, xmax}, {0, ymax}}];
Show[p1, p0, p2, p3, Axes -> True, PlotRange -> {{xmin, xmax}, {0, ymax}},
  AxesOrigin -> {xmin, -ymax/50}, DisplayFunction -> $DisplayFunction,
  PlotLabel -> StyleForm[Definition[n], "Section", FontColor -> RGBColor[1, 0, 0]]];
(* *)
tab = Append[tab,
  {n, printing`printf[px, 6, 2], printing`printf[py, 6, 2],
  printing`printf[qx, 6, 2], printing`printf[qy, 6, 2],
  printing`printf[w, 6, 2],
  printing`printf[qua, 6, 2], printing`printf[wig, 6, 2]}
];
, {nn, mnn}];
Print[tab // MatrixForm];
, {ntabdata, mtabdata}];

```

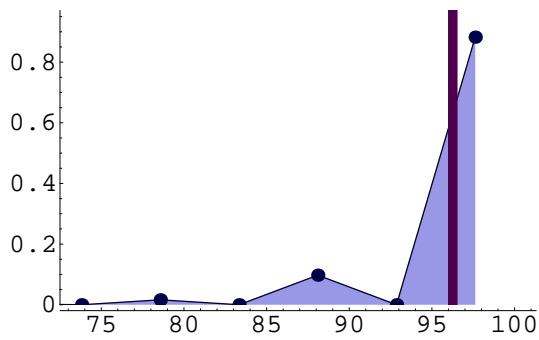
**Fig. 1.**  $x_0 = 0, y_0 = 0, \omega_x = 0.0200, \omega_y = 0.180$



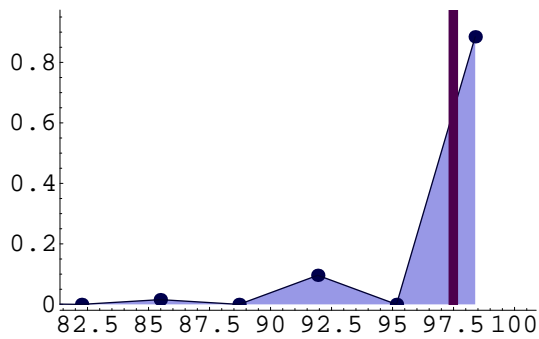
n	$p_x^*$	$p_y^*$	$x^*$	$y^*$	$-\log(\rho^*)$	$R_x$	$R_x^*$
20	0.00	0.00	6.48	0.00	0.84	91.55	100.00
30	0.00	0.00	7.87	0.00	1.24	94.53	100.00
50	0.00	0.00	10.10	0.00	2.04	96.77	100.00
100	0.00	0.00	14.21	0.00	4.04	98.39	100.00

**Fig. 2.  $x_0 = 0, y_0 = 0, \omega_x = 10.0, \omega_y = 2.20$**

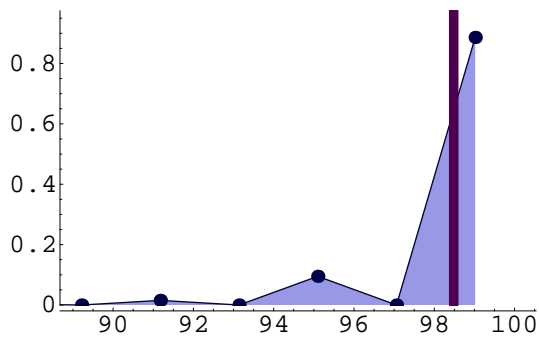
**n = 20**



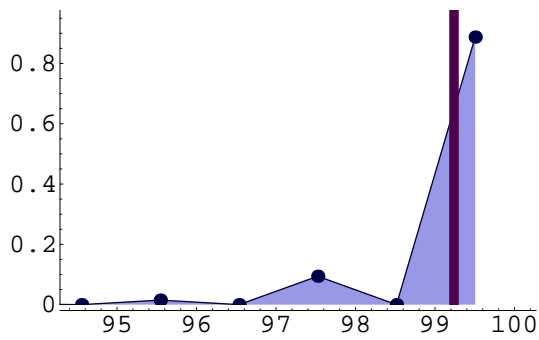
**n = 30**



**n = 50**

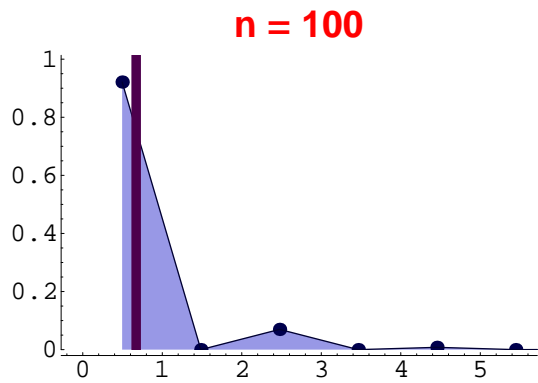
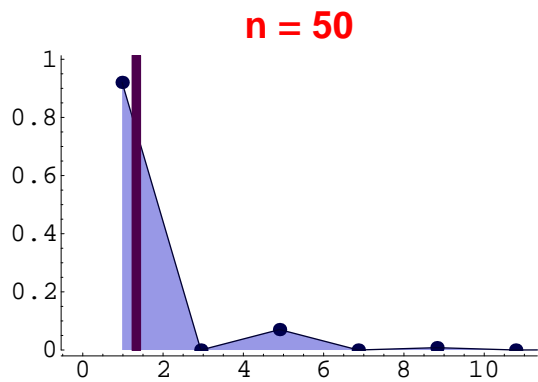
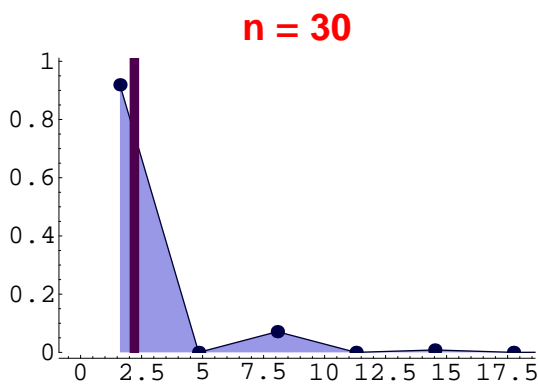
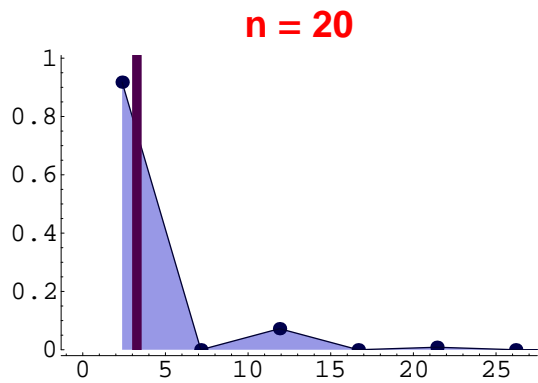


**n = 100**



n	$p_x^*$	$p_y^*$	$x^*$	$y^*$	$-\log(\rho^*)$	$R_x$	$R_x^*$
20	6.48	0.00	0.00	0.00	4.20	96.26	100.00
30	7.87	0.00	0.00	0.00	6.20	97.49	100.00
50	10.10	0.00	0.00	0.00	10.20	98.48	100.00
100	14.21	0.00	0.00	0.00	20.20	99.24	100.00

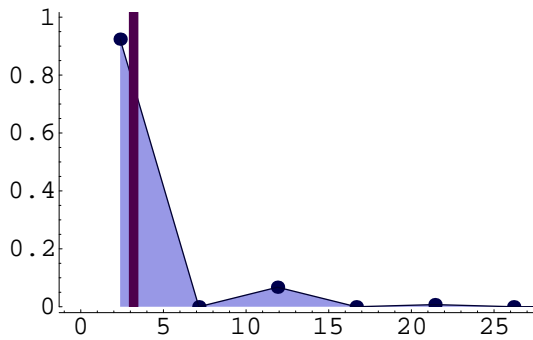
**Fig. 3.**  $x_0 = 0, y_0 = 0, \omega_x = 0.45, \omega_y = 0.0100$



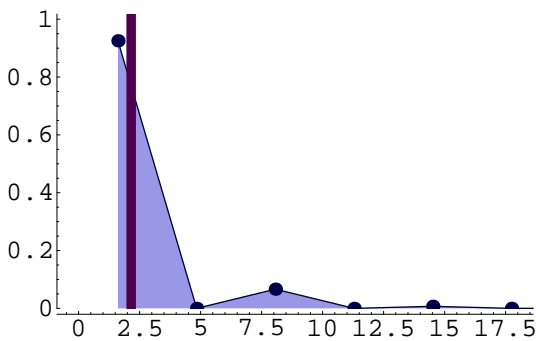
n	$p_x^*$	$p_y^*$	$x^*$	$y^*$	$-\log(\rho^*)$	$R_x$	$R_x^*$
20	0.00	0.00	0.00	6.48	0.42	3.27	0.00
30	0.00	0.00	0.00	7.87	0.62	2.20	0.00
50	0.00	0.00	0.00	10.10	1.02	1.33	0.00
100	0.00	0.00	0.00	14.21	2.02	0.67	0.00

**Fig. 4.  $x_0 = 0, y_0 = 0, \omega_x = 2.00, \omega_y = 18.0$**

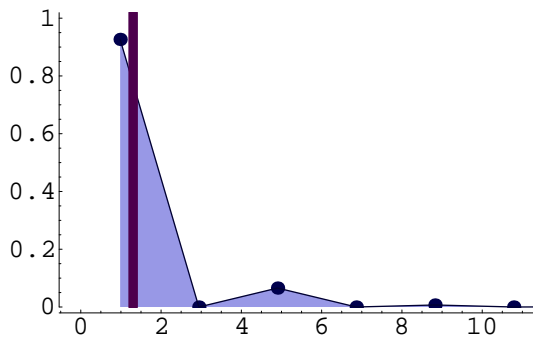
**n = 20**



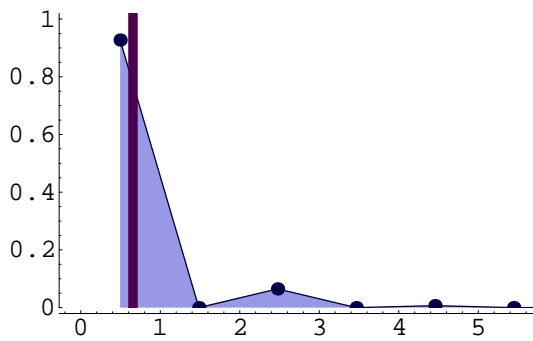
**n = 30**



**n = 50**

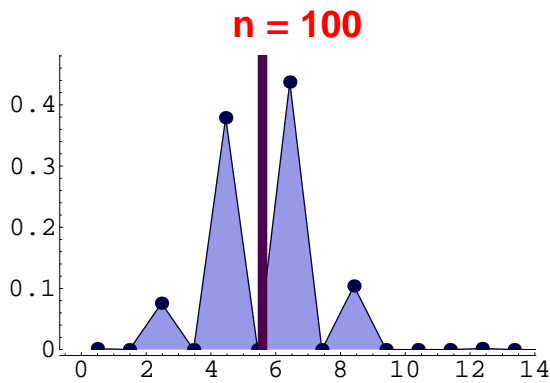
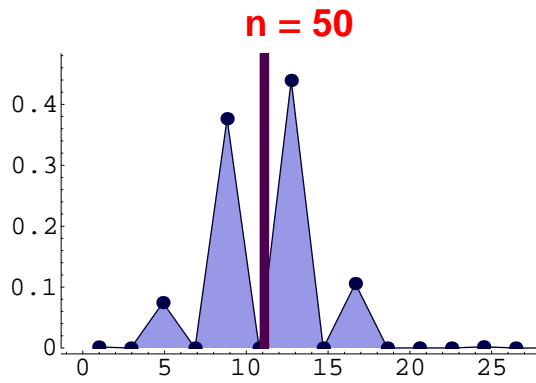
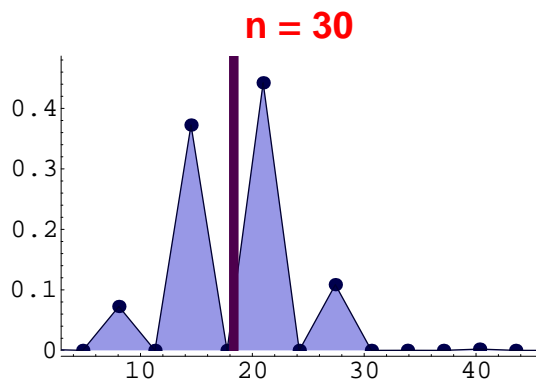
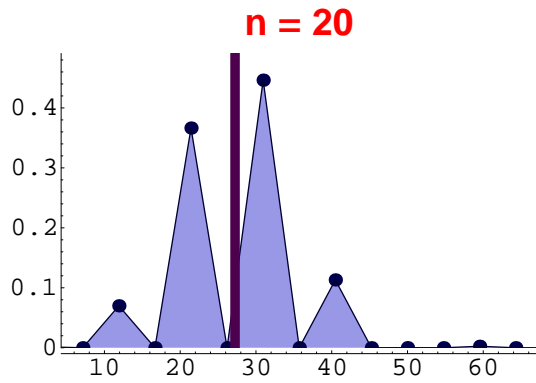


**n = 100**



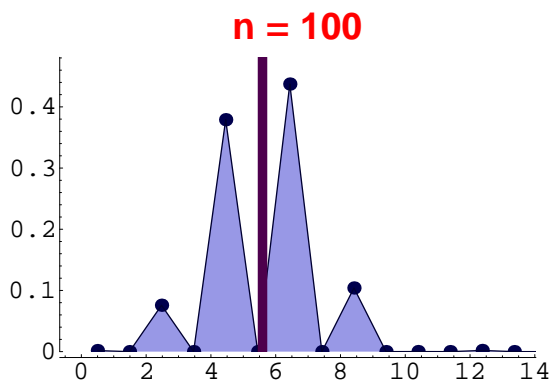
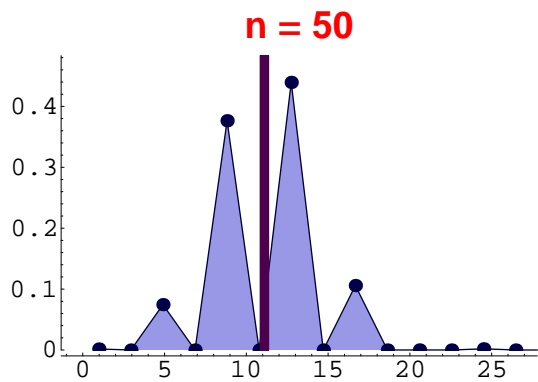
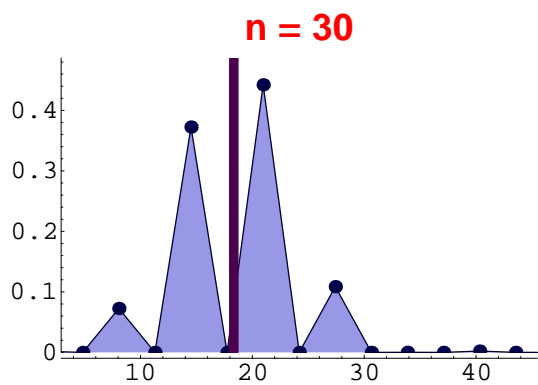
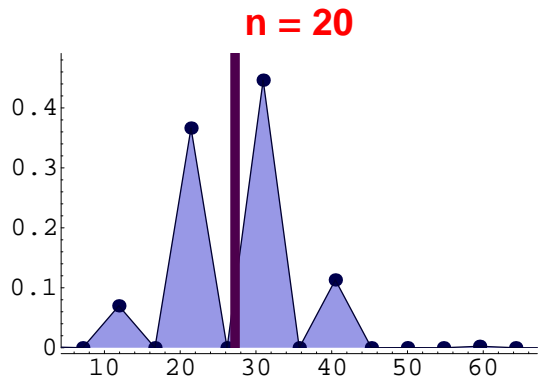
n	$p_x^*$	$p_y^*$	$x^*$	$y^*$	$-\log(\rho^*)$	$R_x$	$R_x^*$
20	0.00	6.48	0.00	0.00	2.33	3.20	0.00
30	0.00	7.87	0.00	0.00	3.44	2.15	0.00
50	0.00	10.10	0.00	0.00	5.67	1.30	0.00
100	0.00	14.21	0.00	0.00	11.22	0.66	0.00

**Fig. 5.**  $x_0 = 3.00$ ,  $y_0 = 0$ ,  $\omega_x = 2.00$ ,  $\omega_y = 0.100$



n	$p_x^*$	$p_y^*$	$x^*$	$y^*$	$-\log(\rho^*)$	$R_x$	$R_x^*$
20	0.00	0.00	3.16	5.66	3.25	27.24	23.74
30	0.00	0.00	3.16	7.21	5.25	18.34	16.08
50	0.00	0.00	3.16	9.59	9.25	11.11	9.78
100	0.00	0.00	3.16	13.86	19.25	5.59	4.94

**Fig. 6.**  $x_0 = 3.00$ ,  $y_0 = 0$ ,  $\omega_x = 2.00$ ,  $\omega_y = 10.0$

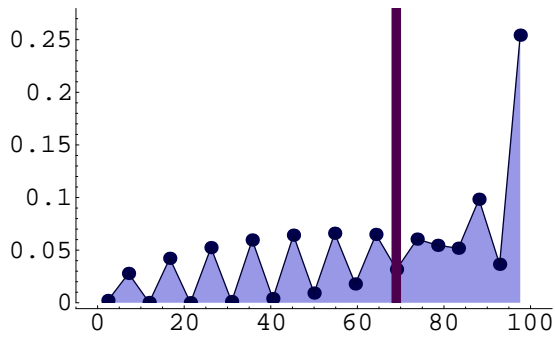


n	$p_x^*$	$p_y^*$	$x^*$	$y^*$	$-\log(\rho^*)$	$R_x$	$R_x^*$
20	0.00	5.66	3.16	0.00	3.25	27.24	23.74
30	0.00	7.21	3.16	0.00	5.25	18.34	16.08
50	0.00	9.59	3.16	0.00	9.25	11.11	9.78
100	0.00	13.86	3.16	0.00	19.25	5.59	4.94

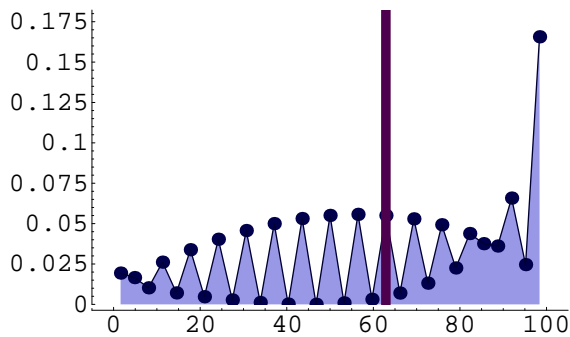


$x_0 = 0.40, y_0 = 0.200, \omega_x = 0.70, \omega_y = 1.50$

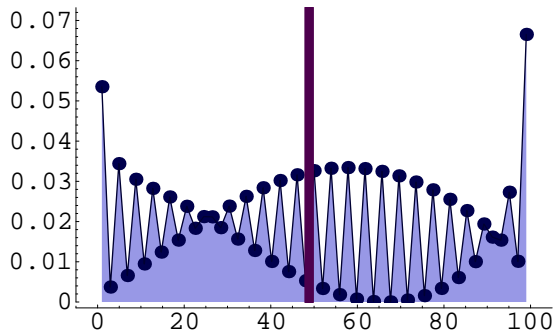
**n = 20**



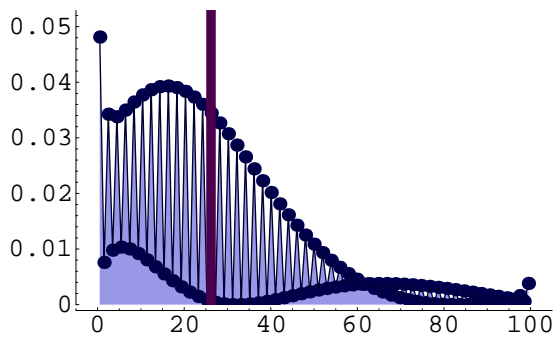
**n = 30**



**n = 50**



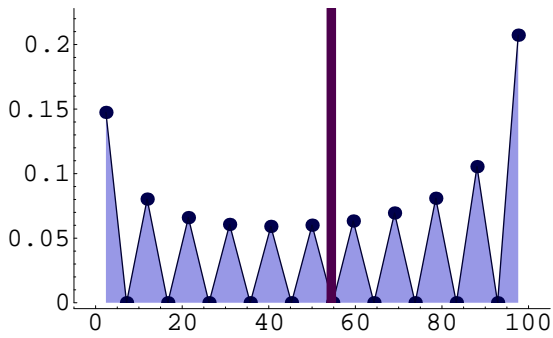
**n = 100**



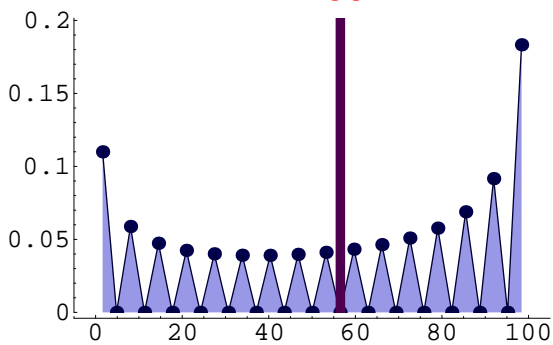
n	$p_x^*$	$p_y^*$	$x^*$	$y^*$	$-\log(\rho^*)$	$R_x$	$R_x^*$
20	0.00	0.00	6.47	0.36	25.84	68.98	99.70
30	0.00	0.00	7.87	0.36	39.05	62.89	99.79
50	0.00	5.60	8.40	0.36	65.71	48.86	69.18
100	0.00	11.46	8.40	0.36	132.40	26.19	34.93

$x_0 = 0.152, y_0 = 0.265, \omega_x = 0.047, \omega_y = 0.056$

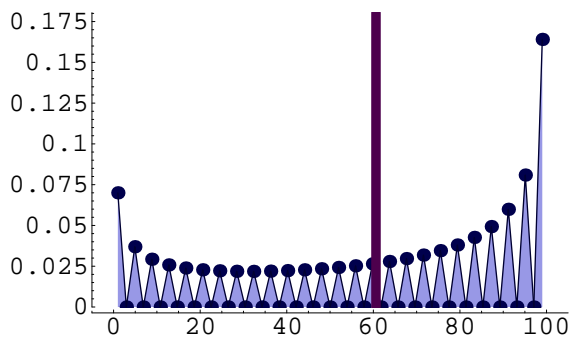
**n = 20**



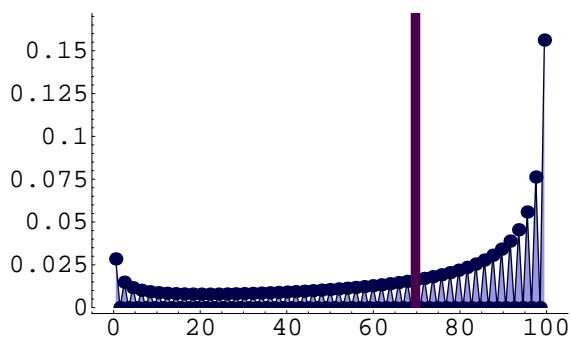
**n = 30**



**n = 50**

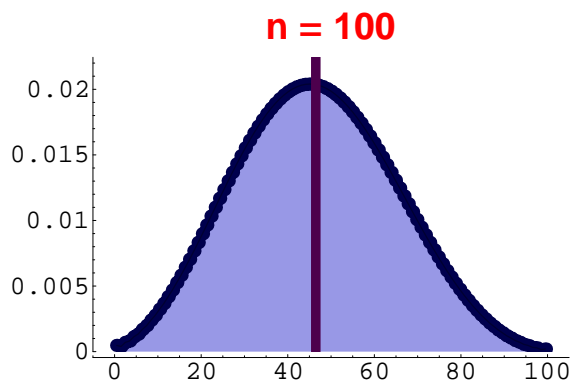
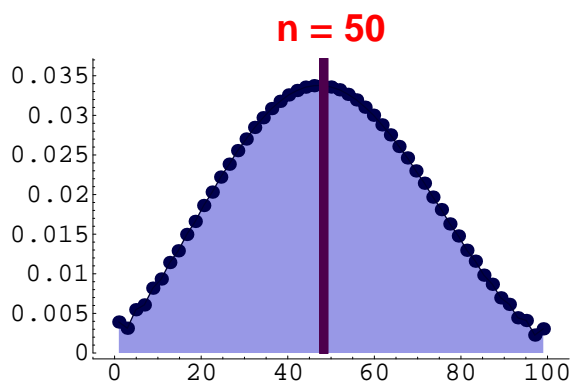
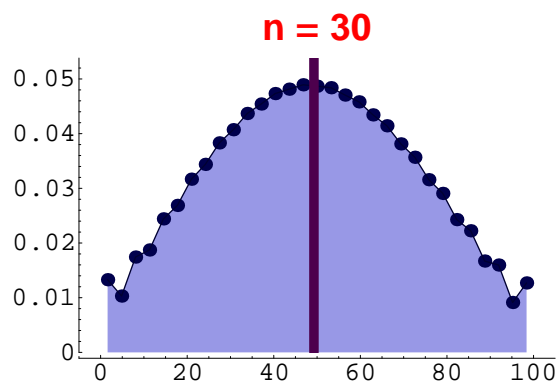
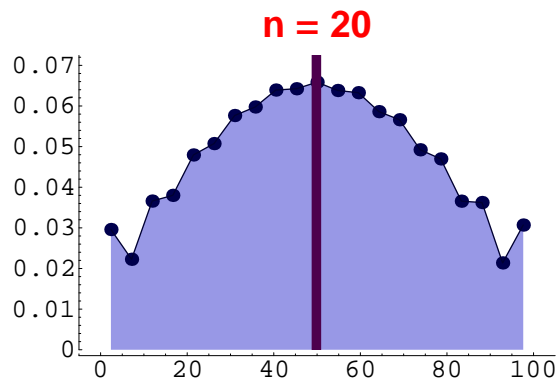


**n = 100**



n	$p_x^*$	$p_y^*$	$x^*$	$y^*$	$-\log(\rho^*)$	$R_x$	$R_x^*$
20	0.00	0.00	6.30	1.50	1.86	54.44	94.62
30	0.00	0.00	7.72	1.54	2.78	56.54	96.20
50	0.00	0.00	9.98	1.57	4.62	60.61	97.58
100	0.00	0.00	14.12	1.61	9.25	69.73	98.72

$x_0 = 0.97, y_0 = 0.94, \omega_x = 0.57, \omega_y = 0.56$



n	$p_x^*$	$p_y^*$	$x^*$	$y^*$	$-\log(\rho^*)$	$R_x$	$R_x^*$
20	0.00	0.00	4.57	4.59	14.92	49.84	49.78
30	0.00	0.00	5.53	5.61	24.14	49.27	49.24
50	0.00	0.00	7.02	7.26	43.42	48.31	48.37
100	0.00	0.00	9.72	10.37	93.86	46.47	46.78