Problem 1.13

Check your results in Problem 1.11(b) with the following "numerical experiment." The position of the oscillator at time t is

$$x(t) = A\cos(\omega t). \tag{1.44}$$

You might as well take $\omega = 1$ (that sets the scale for time) and $A = 1$ (that sets the scale for length). Make a plot of x at 10,000 random times, and compare it with $\rho(x)$.
Hint: In Mathematica, first define

x[t_] := Cos[t]

then construct a table of positions:

snapshots = Table[x[πRandomReal[j]], {j, 10000}]

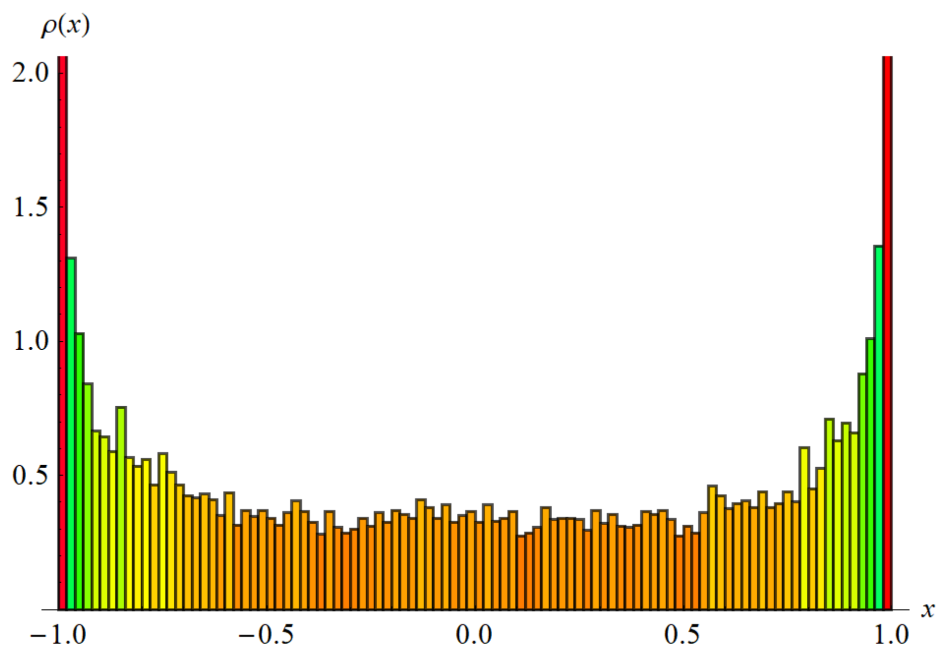
and finally, make a histogram of the data:

Histogram[snapshots, 100, "PDF", PlotRange → {0,2}]

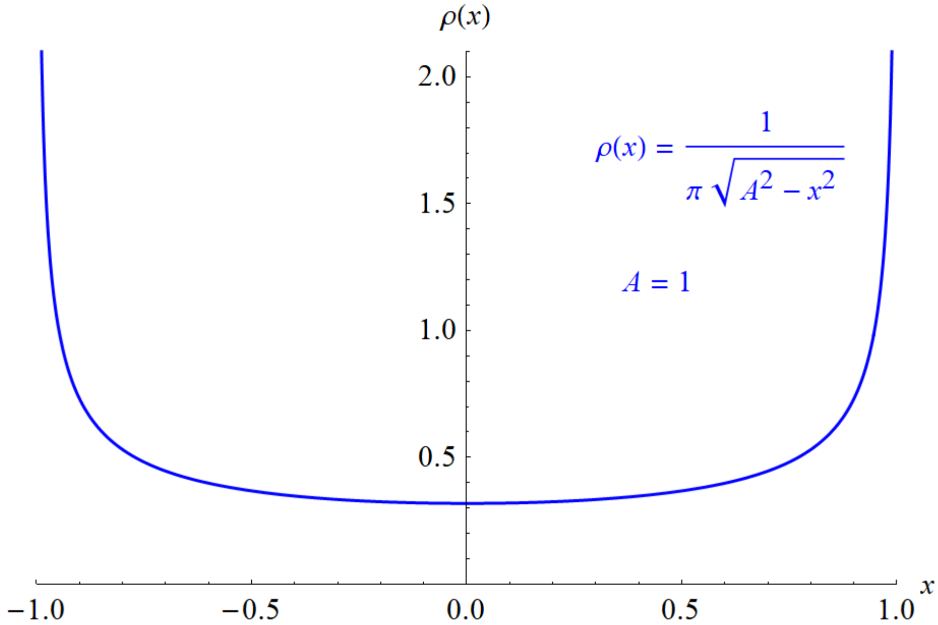
Meanwhile, make a plot of the density function, $\rho(x)$, and using **Show**, superimpose the two.

Solution

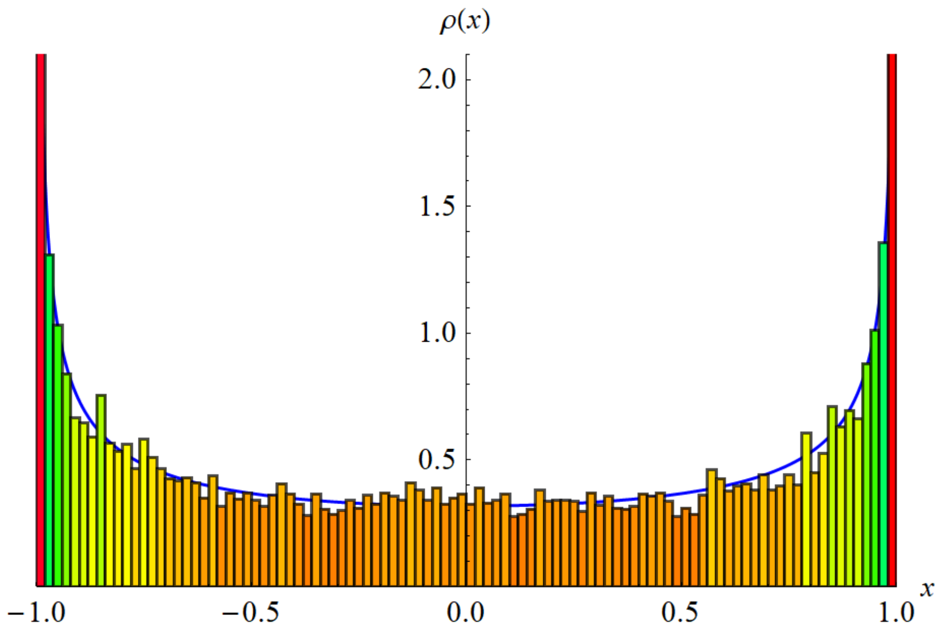
Making the histogram with 10,000 points yields the following graph.



Recall from Problem 1.11 that the probability distribution is $\rho(x) = 1/(\pi\sqrt{A^2 - x^2})$. Take $A = 1$.



Finally, superimpose the two graphs.



This experiment seems to be in agreement with the result from Problem 1.11.