يكبعدي تصادفي ولگشت :

```
n = 20;
try = Table[2 (RandomInteger[] - 1 / 2), {n}]
mean = N[Total[try] / n]
Mean[try] // N
N[Mean[try^2] - Mean[try]^2]
Variance[try] * (n - 1) / n // N
```

```
{1, 1, 1, -1, -1, -1, -1, 1, -1, -1, 1, -1, -1, 1, 1, -1, 1, -1, 1, -1}
```

```
-0.1
```

```
-0.1
```

```
0.99
```

```
0.99
```

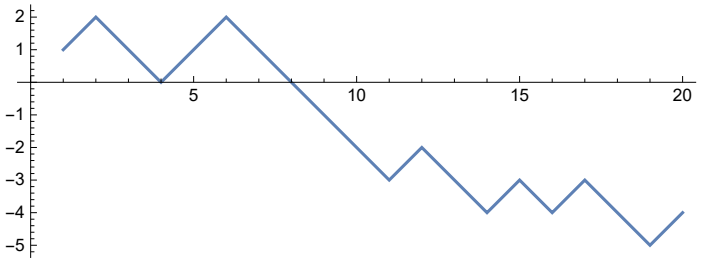
```
step1 := 2 (RandomInteger[] - 1 / 2);
steps1[m_] := Table[step1, {m}]
mm = 20;
samp1 = steps1[mm]
RW1 = Table[Sum[samp1[[j]], {j, i}], {i, mm}]
```

```
{1, 1, -1, -1, -1, 1, 1, -1, -1, -1, 1, 1, 1, -1, 1, 1, -1, -1, 1, 1}
```

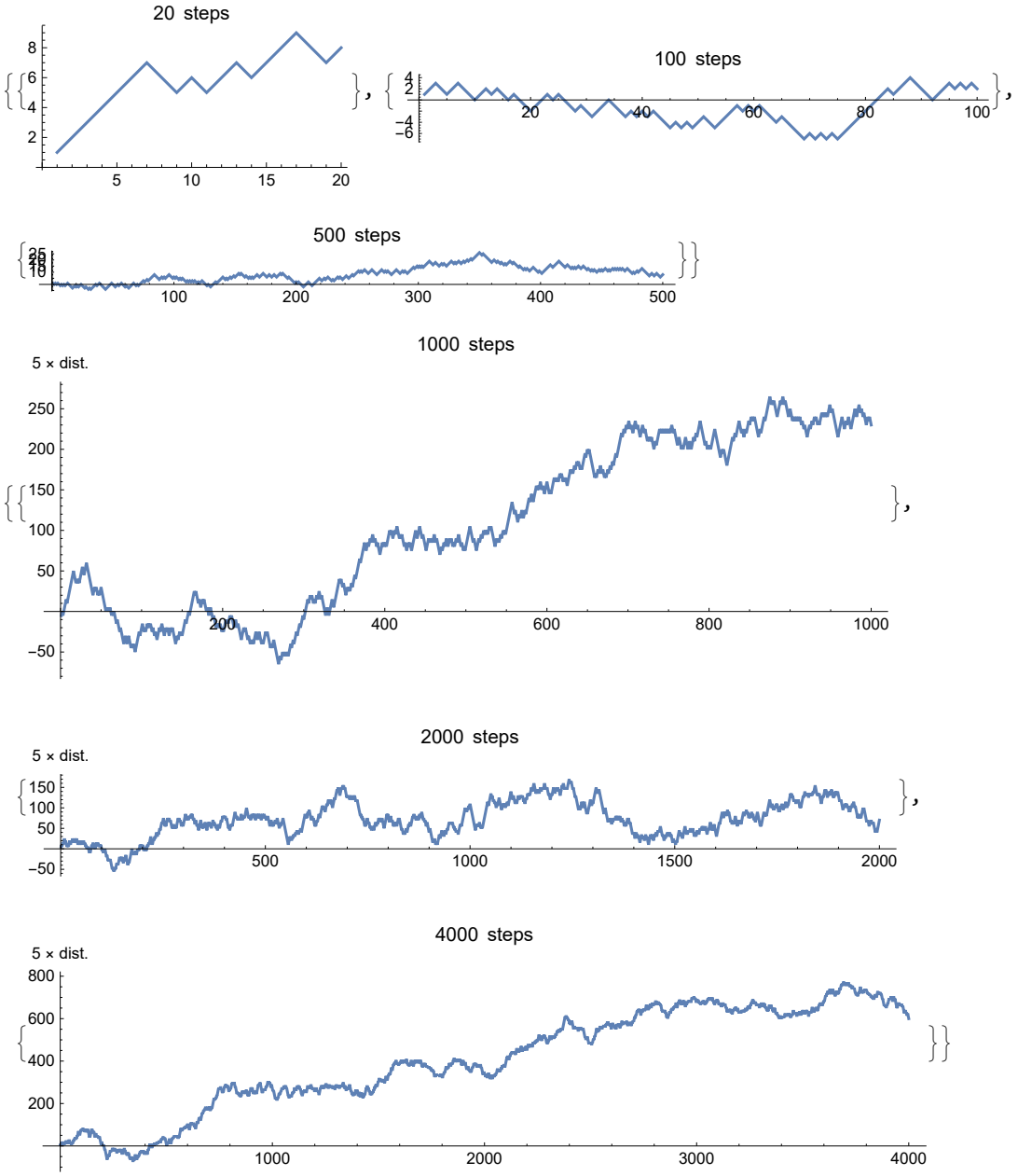
```
{1, 2, 1, 0, -1, 0, 1, 0, -1, -2, -1, 0, 1, 0, 1, 2, 1, 0, 1, 2}
```

```
step1 := 2 (RandomInteger[] - 1 / 2);
steps1[m_] := Table[step1, {m}]
mm = 20;
samp1 = steps1[mm]
ListPlot[Table[Sum[samp1[[j]], {j, i}], {i, mm}], Joined → True, AspectRatio → Automatic]
```

```
{1, 1, -1, -1, 1, 1, -1, -1, -1, -1, -1, 1, -1, -1, 1, -1, 1, -1, -1, 1}
```



```
step1 := 2 (RandomInteger[] - 1 / 2);
steps1[m_] := Table[step1, {m}]
Table[{
  samp1 = steps1[mm];
  ListPlot[Table[Sum[samp1[[j]], {j, i}], {i, mm}], Joined → True,
   AspectRatio → Automatic, PlotLabel → mm " steps"]}, {mm, {20, 100, 500}}]
(* The plot below 5 × dist. are given *)
Table[{
  samp1 = steps1[mm];
  ListPlot[Table[Sum[5 samp1[[j]], {j, i}], {i, mm}], Joined → True, AspectRatio → Automatic,
   PlotLabel → mm " steps", AxesLabel → "5 × dist."]}, {mm, {1000, 2000, 4000}}]
```



Random Walk

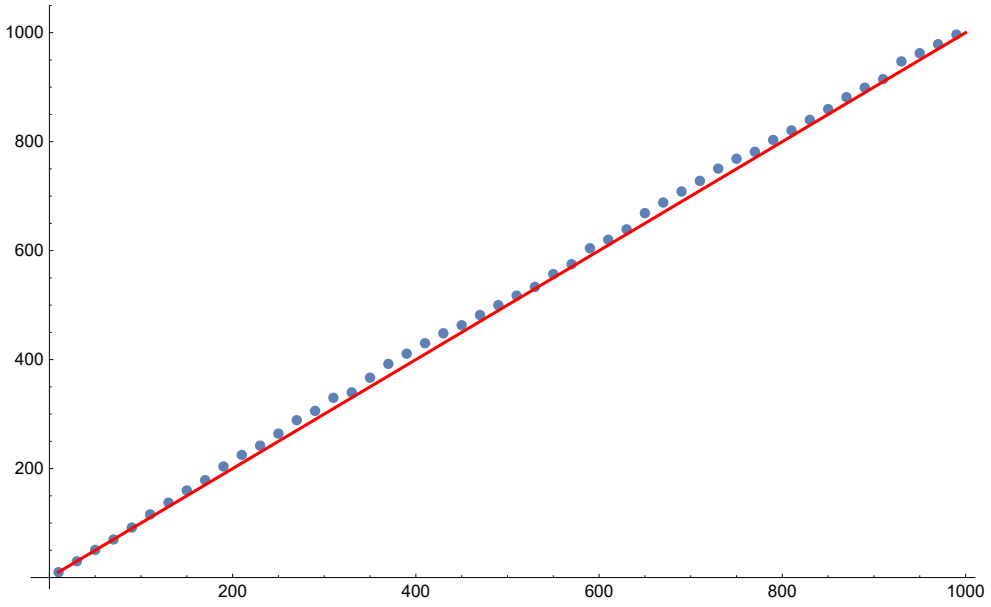
قدمها با فاصله مجذور بستگي :

```
step1 := 2 (RandomInteger[] - 1 / 2);
steps1[m_] := Table[step1, {m}]
mm = 10;
CollectRW1 = Flatten[
  Table[{
    samp1 = steps1[mm];
    RW1 = Table[Sum[samp1[[j]], {j, i}], {i, mm}]
   }, {i, 5}], 1]
%[[4]][[3]]
```

```
{{1, 2, 1, 2, 3, 4, 3, 4, 5, 6}, {-1, -2, -3, -2, -1, 0, 1, 0, 1, 0}, {1, 0, 1, 0, 1, 2, 1, 2, 3, 4},
 {1, 0, 1, 0, -1, 0, -1, -2, -3, -4}, {1, 0, 1, 0, 1, 2, 1, 0, -1, -2}}
```

```
1
```

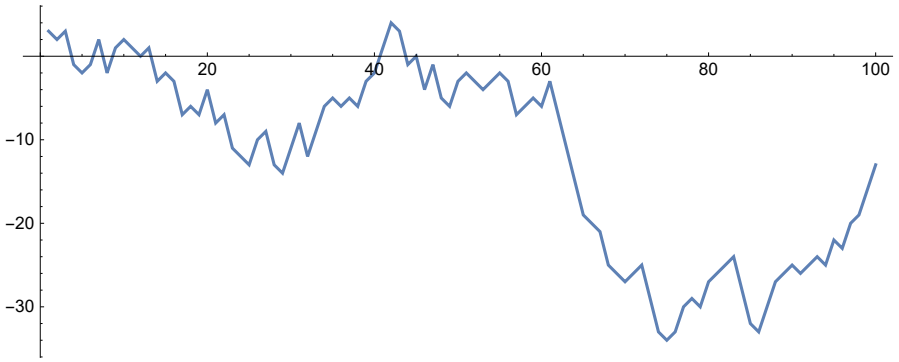
```
step1 := 2 (RandomInteger[] - 1 / 2);
steps1[m_] := Table[step1, {m}]
mm = 1000; nsamp = 2000;
CollectRW1 = Flatten[
   Table[{
     samp1 = steps1[mm];
     RW1 = Table[Sum[samp1[[j]], {j, i}], {i, mm}]
    }, {nsamp}], 1];
varxp2[n_] := Sum[(CollectRW1[[i]][[n]])^2, {i, nsamp}]/nsamp -
   (Sum[CollectRW1[[i]][[n]], {i, nsamp}]/nsamp)^2;
Show[ListPlot[Table[{n, varxp2[n]}, {n, 10, mm, mm/50}]], Plot[n, {n, 10, mm}, PlotStyle → Red]]
```



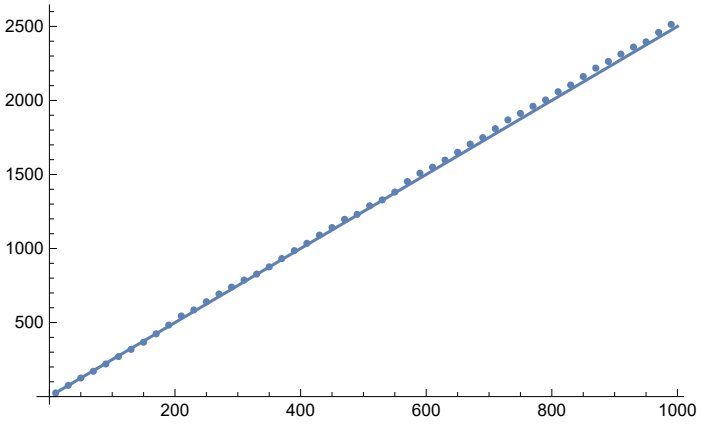
یکبعدی - متفاوت قدمهای طول با ولگشت

```
steps1[m_] := Table[RandomChoice[{-4, -1, 1, 3}], {m}]
mm = 100;
samp1 = steps1[mm]
ListPlot[Table[Sum[samp1[[j]], {j, i}], {i, mm}], Joined → True, AspectRatio → Automatic]
```

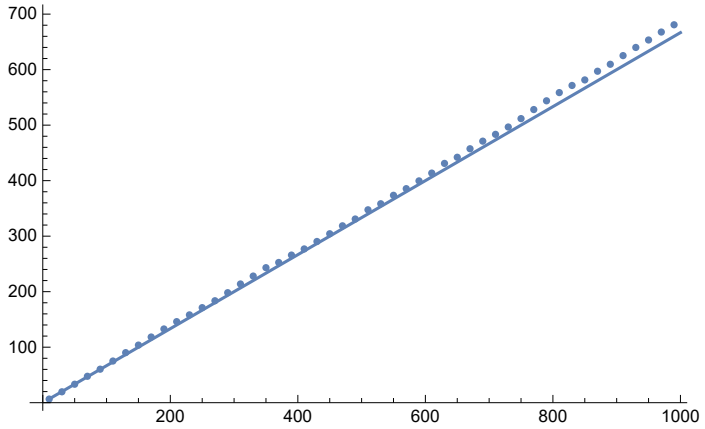
```
{3, -1, 1, -4, -1, 1, 3, -4, 3, 1, -1, -1, 1, -4, 1, -1, -4, 1, -1, 3, -4, 1, -4, -1,
 -1, 3, 1, -4, -1, 3, 3, -4, 3, 3, 1, -1, 1, -1, 3, 1, 3, 3, -1, -4, 1, -4, 3, -4, -1,
 3, 1, -1, -1, 1, 1, -1, -4, 1, 1, -1, 3, -4, -4, -4, -4, -1, -1, -4, -1, -1, 1, 1, -4,
 -4, -1, 1, 3, 1, -1, 3, 1, 1, 1, -4, -4, -1, 3, 3, 1, 1, -1, 1, 1, -1, 3, -1, 3, 1, 3, 3}
```



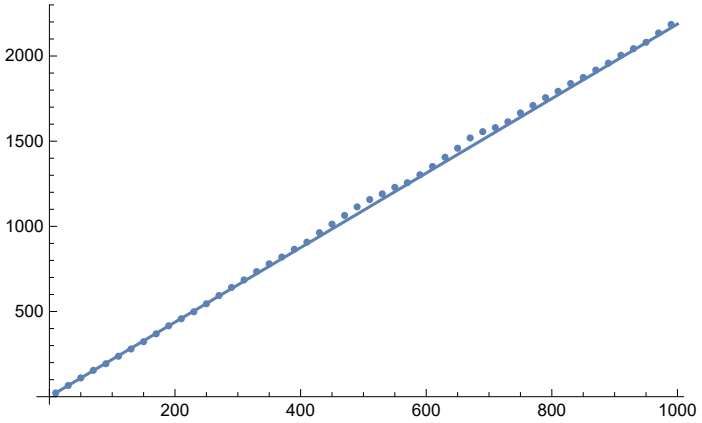

```
steps1[m_] := Table[RandomChoice[{-2, -1, 1, 2}], {m}]
mm = 1000; nsamp = 4000;
CollectRW1 = Flatten[
    Table[{
      samp1 = steps1[mm];
      RW1 = Table[Sum[samp1[[j]], {j, i}], {i, mm}]
     }, {nsamp}], 1];
varxp2[n_] := Sum[(CollectRW1[[i]][[n]])^2, {i, nsamp}]/nsamp -
    (Sum[CollectRW1[[i]][[n]], {i, nsamp}]/nsamp)^2;
Show[ListPlot[Table[{n, varxp2[n]}, {n, 10, mm, mm/50}]], Plot[2.5 n, {n, 10, mm}]]
```



```
(*step1:=2(RandomInteger[]-1/2);*)
steps1[m_] := Table[RandomChoice[{-1, 0, 1}], {m}]
mm = 1000; nsamp = 4000;
CollectRW1 = Flatten[
    Table[{
      samp1 = steps1[mm];
      RW1 = Table[Sum[samp1[[j]], {j, i}], {i, mm}]
     }, {nsamp}], 1];
varxp2[n_] := Sum[(CollectRW1[[i]][[n]])^2, {i, nsamp}]/nsamp -
    (Sum[CollectRW1[[i]][[n]], {i, nsamp}]/nsamp)^2;
Show[ListPlot[Table[{n, varxp2[n]}, {n, 10, mm, mm/50}]], Plot[2/3 n, {n, 10, mm}]]
```

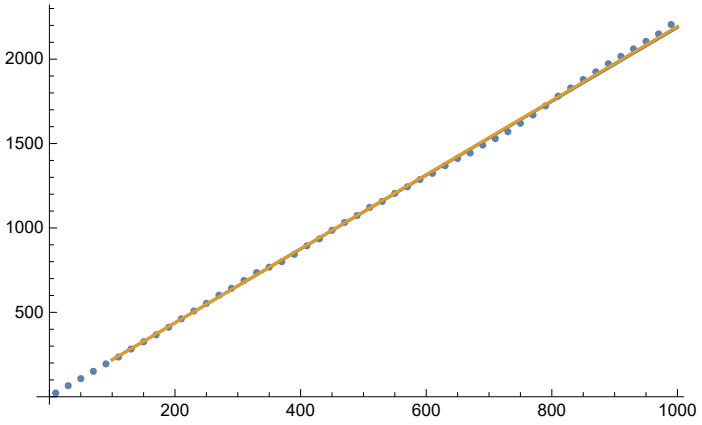


```
(*step1:=2(RandomInteger[]-1/2);*)
steps1[m_] := Table[RandomChoice[{-1, 1, 2, 3}], {m}]
mm = 1000; nsamp = 4000;
CollectRW1 = Flatten[
    Table[{
      samp1 = steps1[mm];
      RW1 = Table[Sum[samp1[[j]], {j, i}], {i, mm}]
     }, {nsamp}], 1];
varxp2[n_] := Sum[(CollectRW1[[i]][[n]])^2, {i, nsamp}]/nsamp -
    (Sum[CollectRW1[[i]][[n]], {i, nsamp}]/nsamp)^2;
Show[ListPlot[Table[{n, varxp2[n]}, {n, 10, mm, mm/50}]], Plot[35/16 n, {n, 10, mm}]]
```



```
steps1[m_] := Table[RandomChoice[{-1, 1, 2, 3}], {m}]
mm = 1000; nsamp = 4000;
CollectRW1 =
  Table[{
    samp1 = steps1[mm];
    RW1 = Table[Sum[samp1[[j]], {j, i}], {i, mm}]
   }, {nsamp}];
varxp2[n_] := Sum[(CollectRW1[[i]][[1]][[n]])^2, {i, nsamp}]/nsamp -
   (Sum[CollectRW1[[i]][[1]][[n]], {i, nsamp}]/nsamp)^2;
fitdata = Table[{n, varxp2[n]}, {n, 10, mm, 20}] // N;
fit = FindFit[fitdata, aa n, {aa}, n]
Show[ListPlot[fitdata], Plot[{35/16 n, aa n /. fit}, {n, 100, mm}]]
```

```
{aa → 2.19409}
```




```
35/16 // N
```

```
2.1875
```