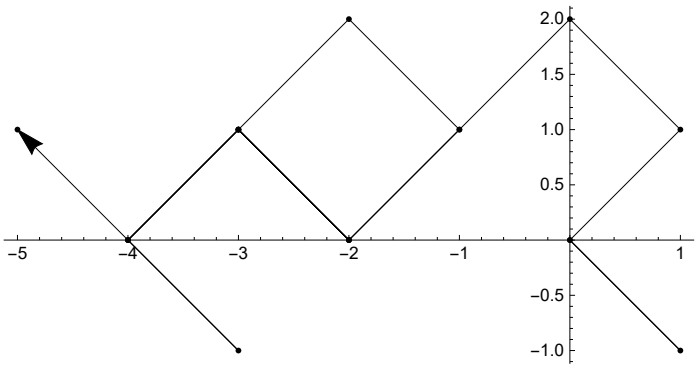
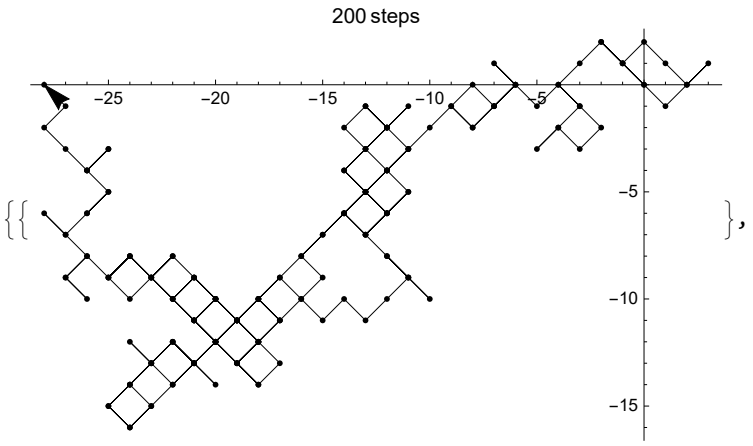
دوبعدي تصادفي ولگشت

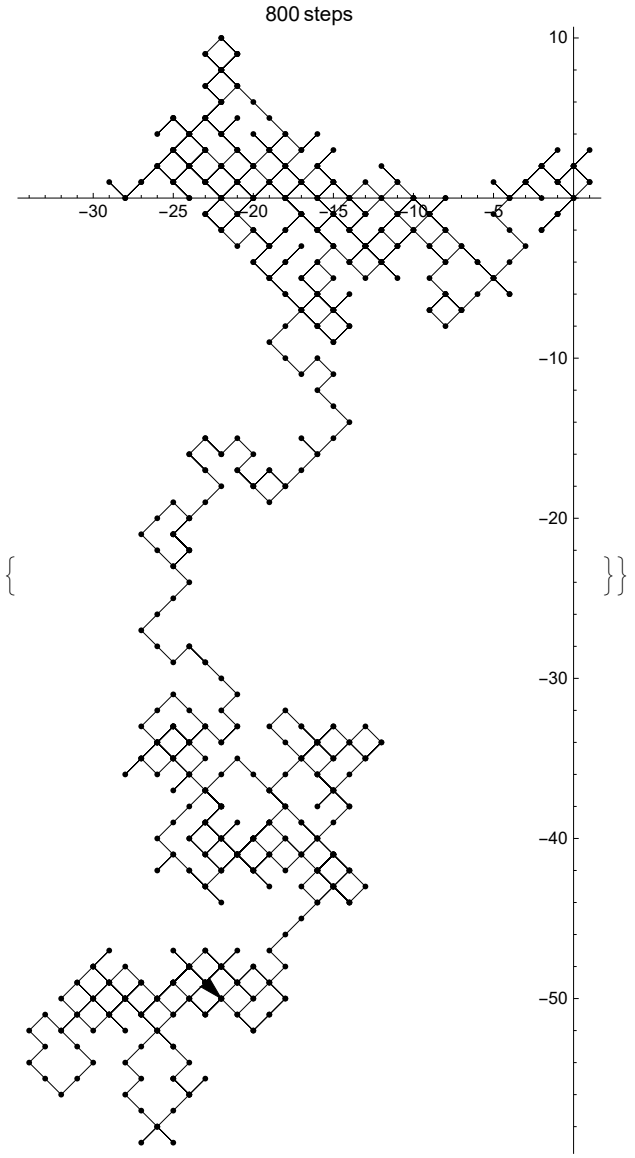
```
step2 := Table[2 (RandomInteger[] - 1/2), {i, 2}];
steps2[m_] := Prepend[Table[step2, {m}], {0, 0}]
mm = 20;
samp = steps2[mm];
RW2 = Table[Sum[samp[[j]], {j, i}], {i, mm}]
Show[Graphics[Arrow[RW2], Axes → True], Graphics[Point[RW2], Axes → True]]
```

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

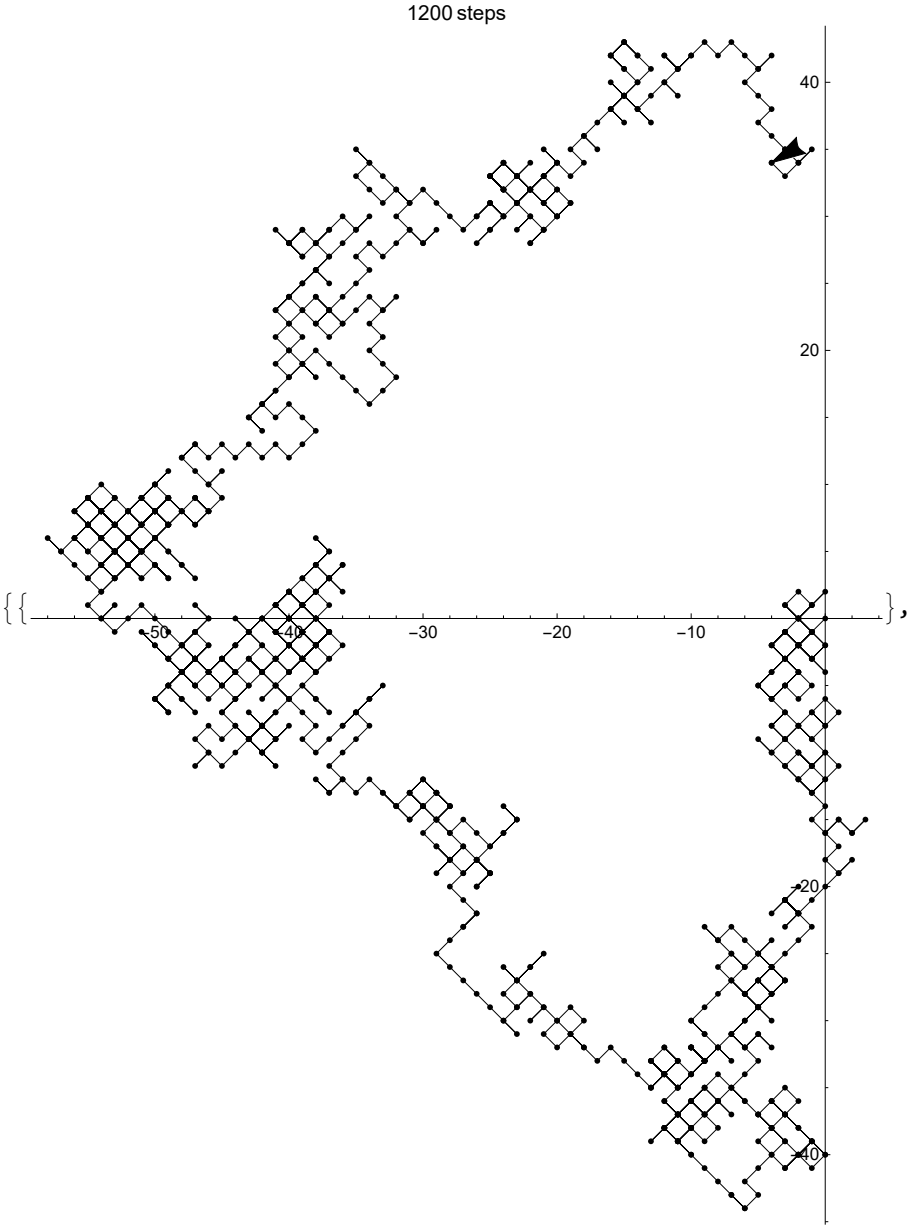


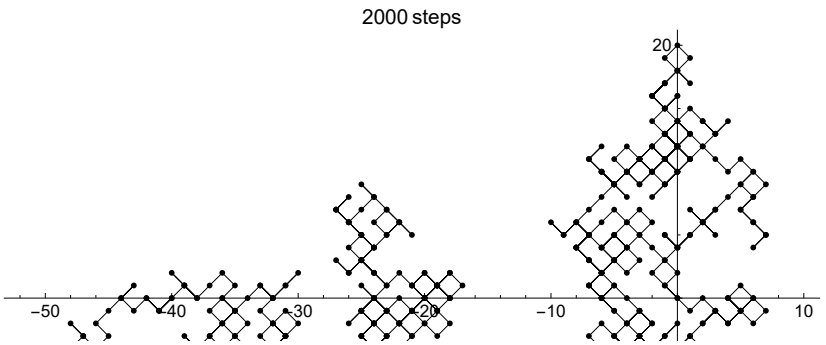

```
step2 := Table[2 (RandomInteger[] - 1/2), {i, 2}];
steps2[m_] := Prepend[Table[step2, {m}], {0, 0}]
Table[{samp = steps2[mm];
  RW2 = Table[Sum[samp[[j]], {j, i}], {i, mm + 1}];
  Show[Graphics[Arrow[RW2], Axes → True, PlotLabel → mm "steps"],
   Graphics[Point[RW2], Axes → True]]}, {mm, {200, 800}}]
```

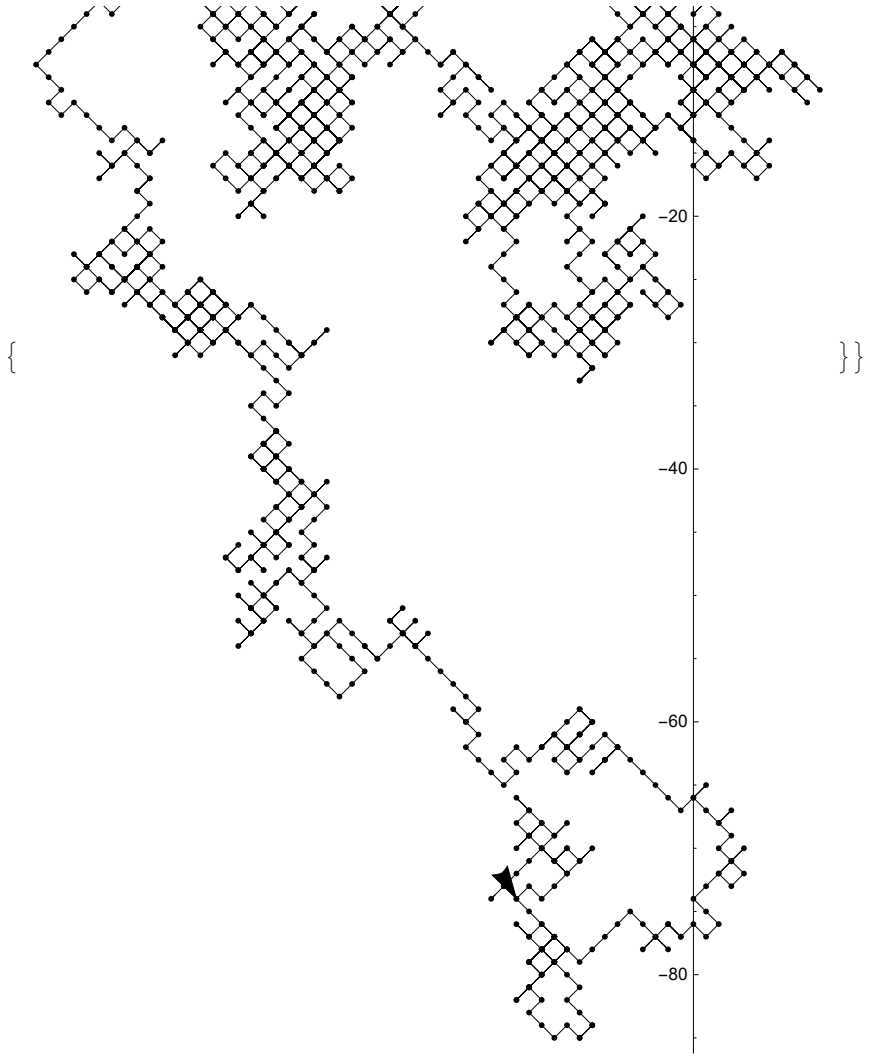

200 steps
−25
−20
−15
−10
−5
−5
−10
−15


800 steps
10
−30
−25
−20
−15
−10
−5
−10
−20
−30
−40
−50

```
step2 := Table[2 (RandomInteger[] - 1/2), {i, 2}];
steps2[m_] := Prepend[Table[step2, {m}], {0, 0}]
Table[{samp = steps2[mm];
  RW2 = Table[Sum[samp[[j]], {j, i}], {i, mm + 1}];
  Show[Graphics[Arrow[RW2], Axes → True, PlotLabel → mm "steps"],
   Graphics[Point[RW2], Axes → True]]}, {mm, {1200, 2000}}]
```







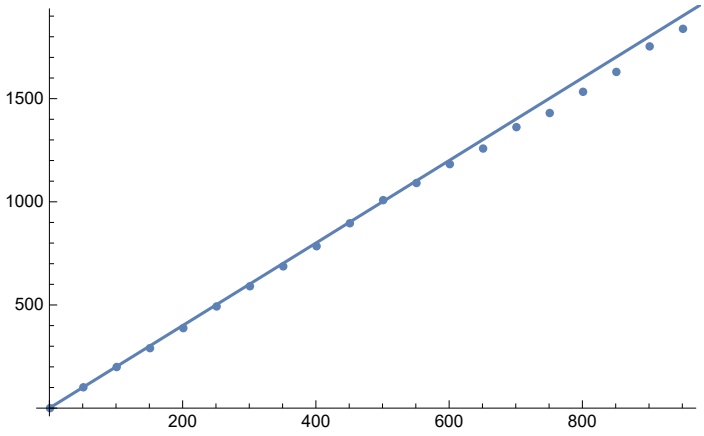
قدمها با فاصله مجذور بستگي :

```
step2 := Table[2 (RandomInteger[] - 1/2), {i, 2}];
steps2[m_] := Prepend[Table[step2, {m}], {0, 0}]
mm = 10;
CollectRW2 = Flatten[Table[{samp2 = steps2[mm];
    RW2 = Table[Sum[samp2[[j]], {j, i}], {i, mm + 1}]}, {5}], 1]
%[[4]][[3]]
```

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

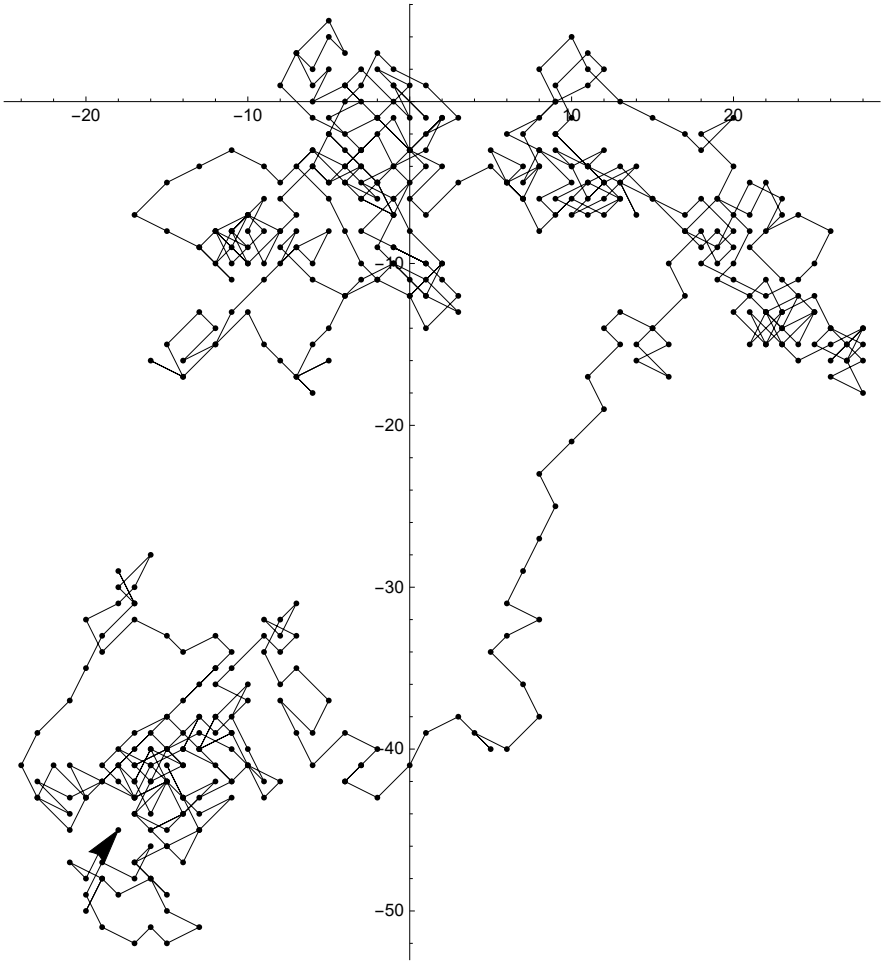
```
{0, -2}
```

```
step2 := Table[2 (RandomInteger[] - 1 / 2), {i, 2}];
steps2[m_] := Prepend[Table[step2, {m}], {0, 0}]
mm = 1000; nsamp = 1000;
CollectRW2 = Flatten[Table[{samp2 = steps2[mm];
      RW2 = Table[Sum[samp2[[j]], {j, i}], {i, mm + 1}]}, {nsamp}], 1];
varR2[n_] :=
  Sum[(CollectRW2[[i]][[n]][[1]]) ^2 + (CollectRW2[[i]][[n]][[2]]) ^2, {i, nsamp}] / nsamp;
(* یادآوري : اینجا در قدمها طول √2 است *)
Show[ListPlot[Table[{n, varR2[n]}, {n, 1, mm, mm / 20}]], Plot[2 n, {n, 1, mm}]]
```

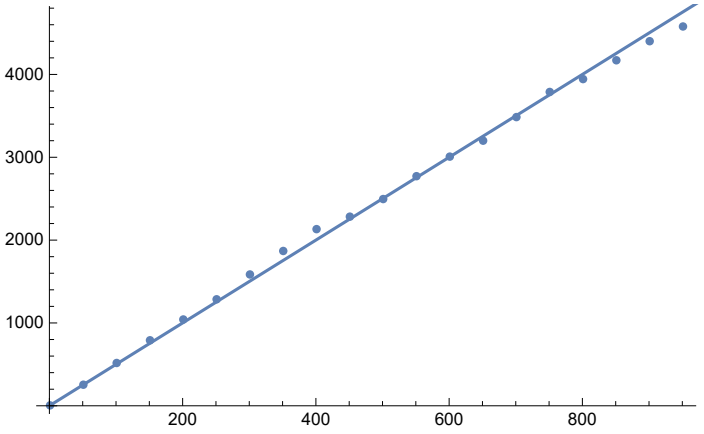


دوبعدی - متفاوت قدمهای طول با ولگشت

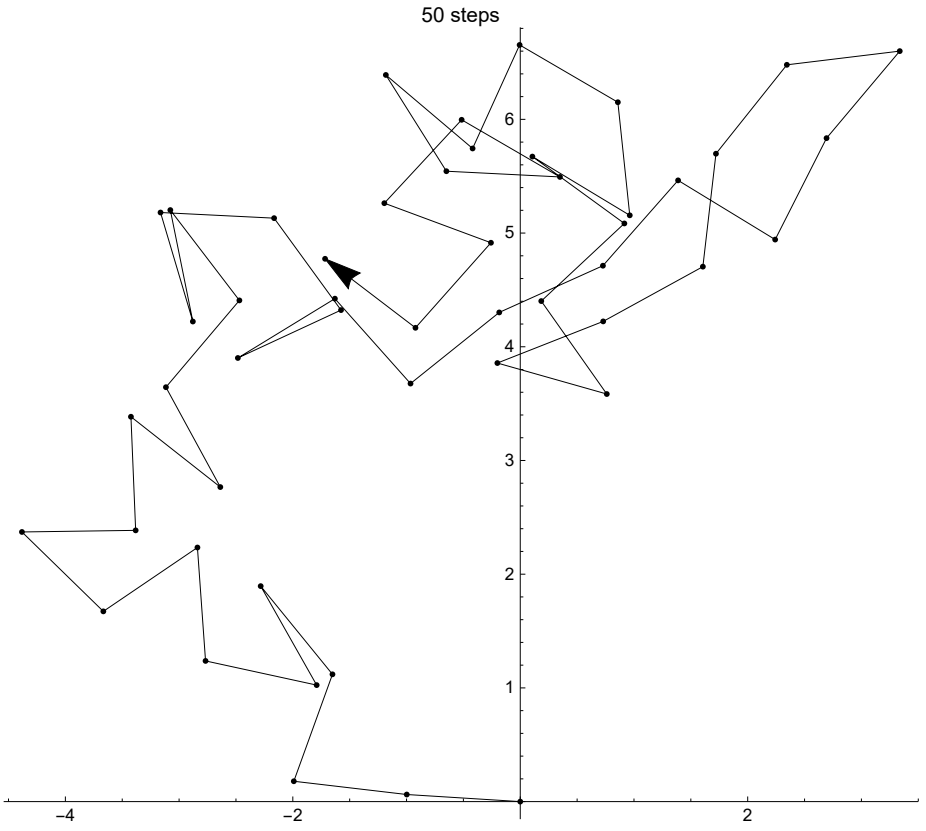
```
steps2[m_] := Table[{RandomChoice[{-2, -1, 1, 2}], RandomChoice[{-2, -1, 1, 2}]}, {m}]
mm = 500;
samp = steps2[mm];
RW2 = Table[Sum[samp[[j]], {j, i}], {i, mm}];
Show[Graphics[Arrow[RW2], Axes → True], Graphics[Point[RW2], Axes → True]]
```



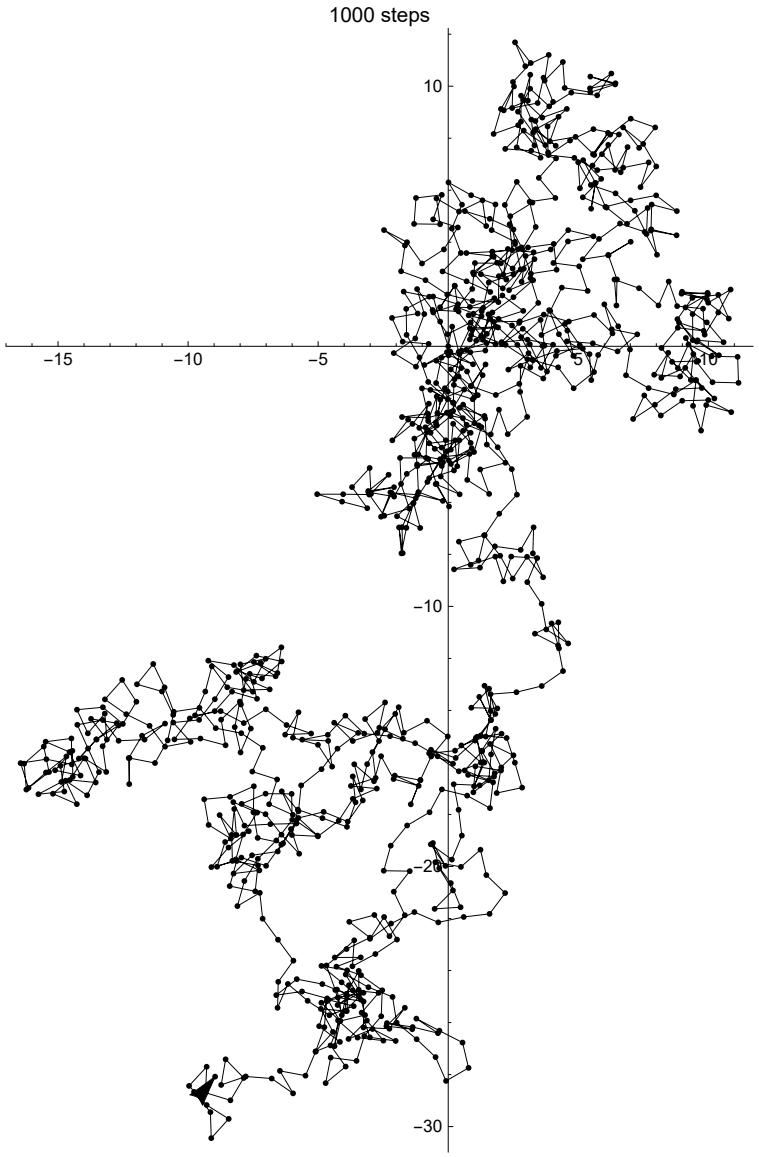
```
steps2[m_] := Table[{RandomChoice[{-2, -1, 1, 2}], RandomChoice[{-2, -1, 1, 2}]}, {m}]
mm = 1000; nsamp = 1000;
CollectRW2 = Flatten[Table[{samp2 = steps2[mm];
      RW2 = Table[Sum[samp2[[j]], {j, i}], {i, mm}]}, {nsamp}], 1];
varR2[n_] :=
  Sum[(CollectRW2[[i]][[n]][[1]])^2 + (CollectRW2[[i]][[n]][[2]])^2, {i, nsamp}]/nsamp;
(* یادآوري : طول قدمها در اینجا √5 است *)
Show[ListPlot[Table[{n, varR2[n]}, {n, 1, mm, mm/20}]], Plot[5 n, {n, 1, mm}]]
```



```
th := RandomReal[{0, 2 Pi}];
steps2[m_] := Prepend[Table[{Cos[a], Sin[a]} /. a → th, {m}], {0, 0}];
mm = 50;
```




200 steps
20
15
10
5
−10
−8
−6
−4
−2
2


1000 steps
10
−15
−10
−5
−10
−30