

MATH 242 — 1 May 2026

1D Random Walks

1D Random walks always return to the origin

Proof sketch: prob. that rw is at the origin at step $2n$
is asymptotically $\frac{1}{\sqrt{\pi n}}$

Sum: $\sum_{n=1}^{\infty} \frac{1}{\sqrt{\pi n}}$ DIVERGES

Expected num. returns to origin is ∞

1D Random walks: avg distance from the origin at
 n steps is \sqrt{n}

Eventually visits every integer position on the number line.

[1D Random walks visit every integer position
infinitely many times. (prob. 100%)]

2D: How is this same or different than 1D?

- Average distance from the origin is still \sqrt{n}
- Average diameter is still \sqrt{n}
- Do 2D simple symmetric always return to the origin?

