MATHEMATICS · GRADES 10-12

Tree diagrams

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you list every possible outcome of a process with stages, like flipping coins, choosing outfits, or drawing cards, so you can see each path and its chance. Each branch is one choice, and each path from the start to the end is one complete outcome. Drawing every path means nothing is missed, and you can count the paths to work out a chance. That is how you handle a game, a draw, or a set of choices where the outcome depends on several steps in a row.



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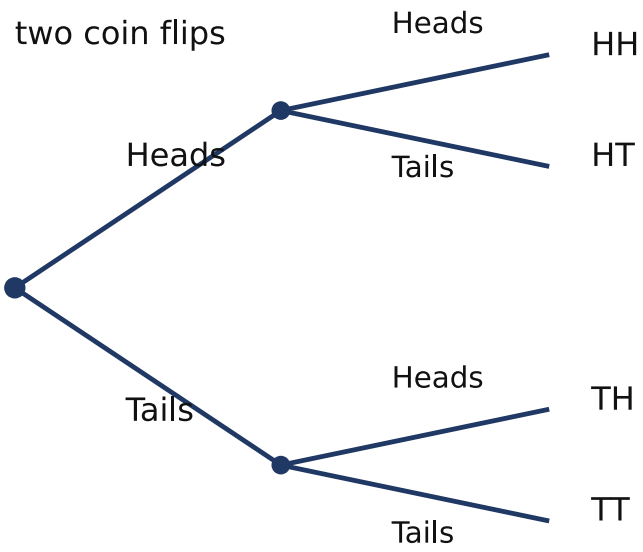
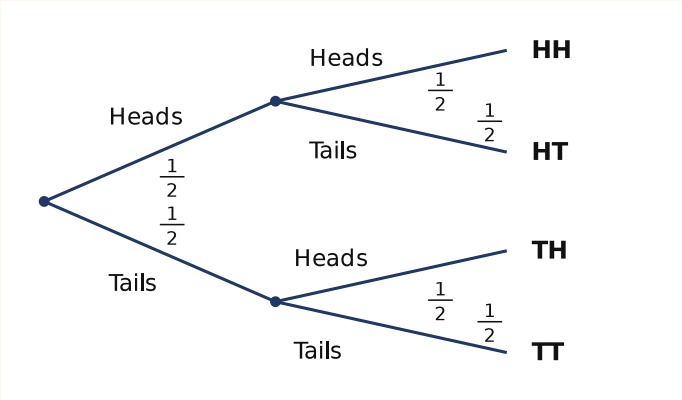


Rule

Tree diagrams: each branch is one choice, and each path from start to finish is one complete outcome.

The chance of one path is P(path) = $P_1 \times P_2 \times \ldots$, the probabilities along it multiplied together, and the chance of several paths is P = P(path 1) + P(path 2) + …, those chances added together.



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Worked examples

EXAMPLE 1

Q A coin is tossed twice. Draw the tree and find the chance of two heads.

SOLUTION

First toss: two branches, heads and tails, each $\frac{1}{2}$.

Second toss: each branch splits again, each $\frac{1}{2}$.

Path heads-heads: $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

EXAMPLE 2

Q A coin is tossed twice. Find the chance of exactly one head.

SOLUTION

Paths with exactly one head: heads-tails and tails-heads.

Each path: $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Total: $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$

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Practice questions

1. Toss a coin three times. Sketch the tree and find the chance of exactly two heads.

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2. Flip a coin three times. Sketch the tree and find the chance of at least two heads.

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3. A coin is tossed twice. Sketch the tree and find the chance of no heads.

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4 **Heads then tails: toss a coin twice, sketch the tree, and find the chance of heads then tails.**

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5 **A coin is tossed three times. Sketch the tree and find the chance of three heads.**

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6 **Toss a coin twice and sketch the tree. What is the chance of at least one head?**

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7 Flip a coin twice and sketch the tree. How many paths are in it?

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8 A coin is tossed three times. Sketch the tree. How many paths are in it?

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9 A die is rolled twice. Sketch the tree. How many paths are in it?

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10

A tree has branch chances on each branch. How is the chance of one path found?

A Add the branch chances along the path

B Multiply the branch chances along the path

C Add the number of branches

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ANSWER KEY

1. $\frac{3}{8}$

2. $\frac{1}{2}$

3. $\frac{1}{4}$

4. $\frac{1}{4}$

5. $\frac{1}{8}$

6. $\frac{3}{4}$

7. 4

8. 8

9. 36

10. Multiply the branch chances along the path

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