Probability assumptions

Explain and critique the assumptions behind theoretical probability: fair devices, equally likely outcomes, and randomness.

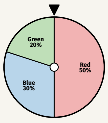
Name ______________________________ **Date** ______________________________

Three core assumptions

Theoretical probability (favourable ÷ total) only works when a device is FAIR, its outcomes are EQUALLY LIKELY, and the process is RANDOM (uncontrolled). If any assumption fails, you need extra information – the actual proportions, or experimental data – before you can state a probability.

Worked example

Can you say $P(\text{Red}) = \frac{1}{3}$ for this spinner? Explain, and give the correct $P(\text{Red})$.



No – the 3 sectors are not equally sized, so counting sectors doesn't give the probability.
$P(\text{Red}) = 50\% = 0.5$, read directly from its share.

1. What does "fair" mean when we describe a coin or a die?

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2. This fair die shows Face 4. What is $P(\text{rolling a } 4)$?

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3. Why must a device be fair before we use $\frac{\text{favourable}}{\text{total}}$ to find a probability?

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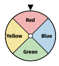
4. This spinner has 4 equal sectors. Are all four colours equally likely? State $P(\text{Red})$.



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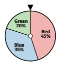
5. Can you use $\frac{1}{3}$ for the largest sector here? What should you use instead?



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6. When is it reasonable to treat outcomes as equally likely?

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7. A coin lands Heads 7 times in 10 tosses. Does this prove it is unfair? Explain.

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8. Compare 7 heads in 10 tosses with 700 heads in 1000 tosses. Which is more convincing evidence of bias, and why?

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9. Why must a probability experiment be RANDOM, not just possible to repeat?

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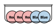
Probability assumptions (continued)

Explain and critique the assumptions behind theoretical probability: fair devices, equally likely outcomes, and randomness.

Name ______________________________ **Date** ______________________

10. 3 red, 2 blue. WITH replacement, does $P(\text{red})$ change next draw?



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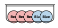
11. WITHOUT replacement, 1st draw is red. Does $P(\text{red})$ change next? Explain.



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12. Why does replacement matter for the independence assumption?

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13. A game advertises a "1 in 4 chance of winning." What must be true about the 4 outcomes for that claim to make sense?

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14. A student says "It hasn't rained for 5 days, so rain is now more likely." What mistake are they making?

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15. Give one real-world reason a physical coin or die might not be perfectly fair.

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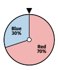
16. A carnival game says "each colour has an equal chance." Is this true for this spinner? Justify using the sector sizes.



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17. Why might experimental probability be a better guide than theoretical probability for a device you suspect is biased?

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18. Describe one simple experiment to test whether a spinner is biased, and what result would convince you.

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