CHAPTER 12

Probability of Single Events

Probability is the chance that som

1) Sample space, S

- List of all possible outcomes (i.e. universal set → sec 4 chap 12)
- Use a { } to enclose the outcomes in your working

Eg: Rolling a 6 sided die
$S = \{1, 2, 3, 4, 5, 6\}$
Number of outcomes = 6

Tossing a coin
$S = \{\text{Heads}, \text{Tails}\}$

Picking a ball from a bag containing 3 yellow and 2 green balls
$S = \{Y_1, Y_2, Y_3, G_1, G_2, G_3\}$

2) Favourable outcomes

- Outcomes that we are interested in.
  Eg: "Rolling a 3" ⟶ {3}

3) Probability (P) : chance of the favourable outcome occurring.

- The probability of an event E occurring is represented by P(E).
- $0 \leq P(E) \leq 1$
- $P(E) = 0$ ⟶ event E will never occur
- $P(E) = 1$ ⟶ event E will definitely occur
- P(E') refers to the probability that event E does not occur.
- $P(E') = P(\text{not } E) = 1 - P(E)$
- $$P(E) = \frac{\text{Number of favourable outcomes for the event E}}{\text{Total number of possible outcomes in the sample space, S}} = \frac{n(E)}{n(S)}$$

→ equally likely outcomes

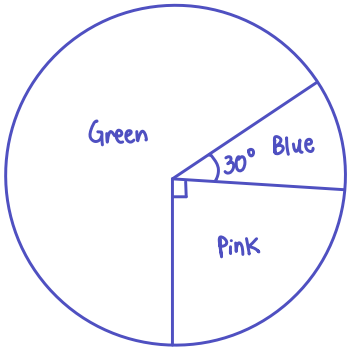
eg: A fair six-sided die is rolled. Find the probability of

(a) rolling a 3
$P(\text{rolling a 3}) = \frac{1}{6}$

(b) rolling a number other than 3
$P(\text{not 3}) = 1 - \frac{1}{6} = \frac{5}{6}$

→ not equally likely outcomes

eg: A spinner is divided into coloured sectors, as shown on the right.
Find the probability that the spinner lands on green.



$$P(\text{green}) = \frac{\text{angle of green sector}}{360^\circ}$$
$$= \frac{360^\circ - 90^\circ - 30^\circ}{360^\circ}$$
$$= \frac{2}{3}$$

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→ not equally likely outcomes (involving algebra)

eg : A box contains 55 flowers. There are 15 red flowers, $2x + 5$ blue flowers and the rest are purple flowers. After removing 3 wilted purple flowers, Mrs Tan took one flower at random. Given that the probability that the flower taken was purple is $\frac{1}{2}$, find the value of x.

purple flowers (at first) $= 55 - 15 - (2x + 5)$

$= 40 - 2x - 5$

$= 35 - 2x$

After removing 3 wilted purple flowers,

$$\frac{35 - 2x - 3}{55 - 3} = \frac{1}{2}$$

$$2(32 - 2x) = 52$$

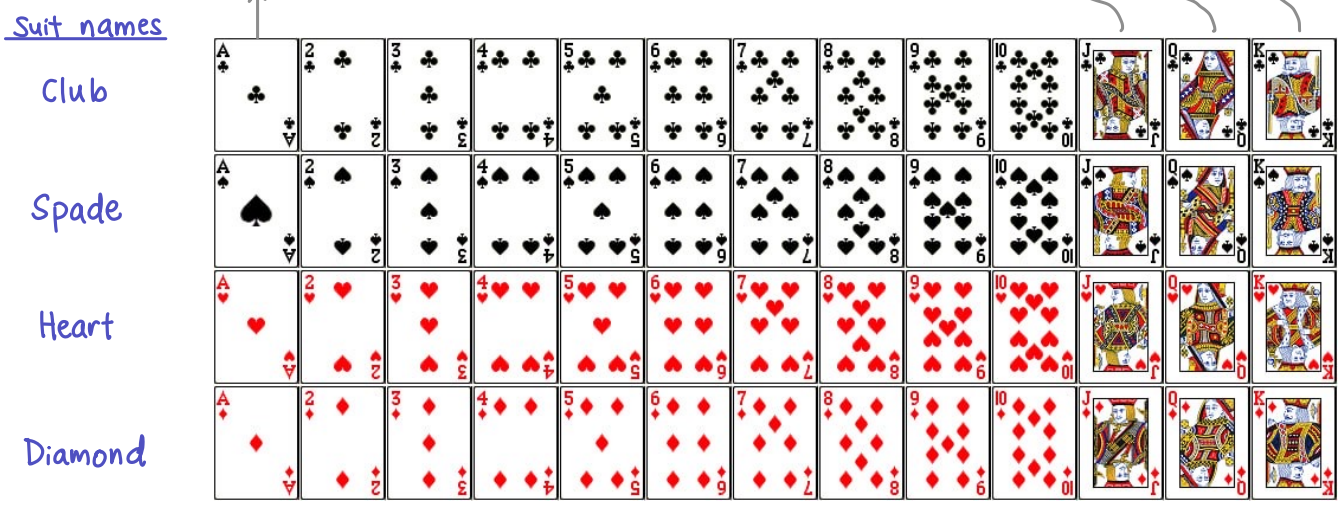
$$64 - 4x = 52$$

$$-4x = -12$$

$$x = 3$$

4) Common examples used in probability questions

- Coin : Head (H) , Tail (T)
- Fair 6-sided die : 1, 2, 3, 4, 5, 6
- Letters : 26 letters ⟶ vowels : A, E, I, O, U (5)
  consonants : All other letters (21)
- Playing cards
  - A deck of playing cards has 52 cards and 4 suits (shapes).
  - There are 26 black cards (clubs & spades) and 26 red cards (hearts & diamonds).
  - Each suit has 13 cards, of which 3 are picture cards (Jack, Queen, King)
  - There are 4 Aces and 12 picture cards in each deck.



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