6.4 Probability foundations

Name: _____ Class: _____ Date: _____ **Total: 19 marks**

KEY WORDS sample space • complement

Probability foundations

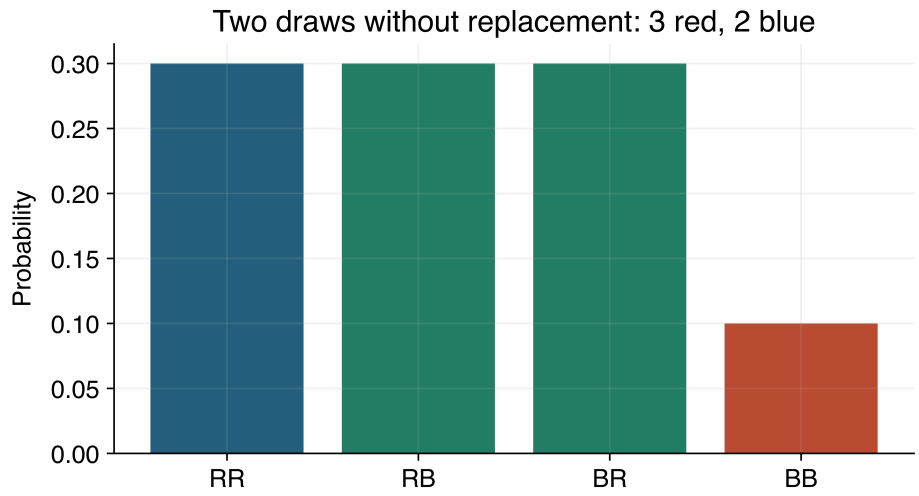
Objective

Use the probability scale, theoretical and experimental probabilities, sample spaces and systematic listing, Venn diagrams with the addition rule, and complements (objectives Foundation 6.3 A–H).

1 Key knowledge and worked examples

Scale and estimates. Probability runs 0 (impossible) to 1 (certain). Theoretical: count equally likely outcomes; experimental: successful trials over total trials. Sample space for two successive events: a grid or systematic list; the complement rule $P(A') = 1 - P(A)$.

Venn diagrams. Regions sum to 1 (or to the total); $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. 30 students, 18 cricket, 15 tennis, 7 both: $P(C \cup T) = 26/30$, $P(\text{neither}) = 4/30 = 2/15$.



Original native-lesson illustration; labels belong to its worked example.

2 Practice

2.1 A spinner lands on red 23 times in 100 spins. Estimate P(red). [1]

2.2 List the sample space for rolling two dice and total the ways to score 8. [2]

2.3 If $P(\text{rain}) = 0.3$, find $P(\text{no rain})$ [1]

2.4 In a class of 25, 14 play football, 11 basketball, 5 both. Draw or describe the Venn regions and find $P(\text{neither})$ [3]

3 Exam-style questions

3.1 *(Original.)* Two fair coins are tossed. (a) List the sample space. (b) Find P(exactly one head). (c) Find P(at least one tail), using the complement. [4]

3.2 *(Original.)* A card is drawn from a standard 52-card deck. Find P(heart), P(king), P(heart or king), showing the overlap subtraction. [4]

3.3 *(Original.)* A survey of 40 people: 22 read paper A, 18 paper B, 7 read both, and 7 read neither. (a) Verify the four Venn regions total 40. (b) A reader of paper A is chosen at random: find the probability they also read B. [4]

Solutions

2.1 $23/100 = 0.23$.

2.2 36 ordered pairs; total 8: $(2,6),(3,5),(4,4),(5,3),(6,2)$ – 5 ways.

2.3 $1 - 0.3 = 0.7$.

2.4 Football only 9, both 5, basketball only 6, neither $25 - 20 = 5$; $P(\text{neither}) = 5/25 = 1/5$.

3.1 (a) HH, HT, TH, TT. (b) 2 of 4: $\frac{1}{2}$. (c) P(no tail) $= \frac{1}{4}$, so P(at least one tail) $= 1 - \frac{1}{4} = \frac{3}{4}$.

3.2 P(heart) $= \frac{13}{52} = \frac{1}{4}$; P(king) $= \frac{4}{52} = \frac{1}{13}$; P(heart or king) $= \frac{13+4-1}{52} = \frac{16}{52} = \frac{4}{13}$ (the king of hearts counted once).

3.3 (a) A only $22-7 = 15$, both 7, B only $18-7 = 11$, neither 7: total $15+7+11+7 = 40$. ✓ (b) $P(B \mid A) = \frac{7}{22}$ – 7 of the 22 A-readers.

Local review guidance: the sample space or Venn regions listed before any fraction; simplified probabilities; complement reasoning stated, not just applied. This is authored classroom guidance.