5.2 – Probability and Odds

Experimental Probability – Probability based purely on actual trials

$$P(A) = \frac{Number\ of\ Times\ Event\ A\ Occurs}{Total\ Number\ of\ Trials}$$

Theoretical Probability – Probability that a certain outcome will occur, based on reasoning or calculation

$$P(A) = \frac{Number\ of\ Favourable\ Outcomes\ for\ Event\ A}{Total\ Number\ of\ Outcomes\ in\ Sample\ Space}$$

Fair Game – when all options are equally likely

Example 1: If 5 red balls and 10 green balls are placed in a bag:

a) What is the probability of drawing a red ball?

$$P(red) = \frac{5}{15} = \frac{1}{3} = 33\%$$

← # red balls

total balls

b) What are the odds of drawing a red?

$$\#red : \#green$$
$$= \quad 5 : 10$$
$$= \quad 1 : 2$$

In general:

Odds In Favour: The ratio of the # of ways that an event will occur to the # ways that it will not occur.

Odds Against: The ratio of the # of ways that an event will not occur to the # ways that it will occur.

Example 2: From a standard 52 card deck:

a) What are the odds in favour of drawing a single card and getting an ace?

$$4 : 48 \qquad = \boxed{1 : 12}$$

4 Aces ↙ ↘ 48 non-Aces

b) What are the odds against drawing an ace, 2 or 3?

$$40 : 12 \qquad = \boxed{10 : 3}$$

40 cards ↙ ↓ 12
not ace, 2, or 3 favourable

c) What is the probability of drawing an ace, 2 or 3?

$$P(Ace, 2, or 3) = \frac{12}{52} = \boxed{\frac{3}{13}}$$

d) What is the probability of NOT drawing an ace, 2 or 3?

$$P(Not\ Ace, 2, or\ 3) = \frac{40}{52} \boxed{\frac{10}{3}}$$

* OR just

$$1 - P(Ace, 2, or 3)$$
$$1 - \frac{3}{13} = \frac{10}{13}$$

Example 3: Research shows that the probability of an expectant mother, selected at random, having twins is $\frac{1}{32}$. → 1 out of 32 have twins

a) What are the odds in favour of an expectant mother having twins?

$$1 : 31$$

one has twins ↙ ↘ 31 don't have twins

b) What are the odds against an expectant mother having twins?

$$31 : 1$$

Example 4: A computer randomly selects a university student's name from the university database to award a $100 gift certificate for the bookstore. The odds against the selected student being male are 57:43. Determine the probability that the randomly selected university student will be male?

$$57 : 43 \Rightarrow \text{total possibilities} = 57 + 43 = 100$$

Not Male (female) Male

so 43 out of 100 students are male.

$$P(winner\ will\ be\ male) = \frac{43}{100} = \boxed{43\%}$$

Assignment: Pg. 310 #1 – 5, 7 – 9, 14 – 16   Extension (#18, 20)