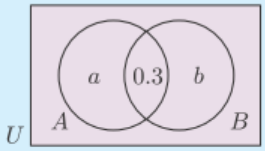
Example 22 Self Tutor

If $P(A) = 0.6$, $P(A \cup B) = 0.7$, and $P(A \cap B) = 0.3$, find $P(B)$.

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$\therefore \quad 0.7 = 0.6 + P(B) - 0.3$$
$$\therefore \quad P(B) = 0.4$$

or



Using a Venn diagram with the probabilities on it,

$a + 0.3 = 0.6$ and $a + b + 0.3 = 0.7$

$\therefore \quad a = 0.3$ $\therefore \quad a + b = 0.4$

$\therefore \quad 0.3 + b = 0.4$

$\therefore \quad b = 0.1$

$\therefore \quad P(B) = 0.3 + b = 0.4$

Example 23 Self Tutor

Of the 31 people on a bus tour, 7 were born in Scotland (S), and 5 were born in Wales (W).

a Are S and W mutually exclusive events?

b If a member of the tour is chosen at random, find the probability that he or she was born in:

i Scotland **ii** Wales **iii** Scotland or Wales.

a A person cannot be born in both Scotland and Wales, so S and W are mutually exclusive.

b **i** $P(S) = \frac{7}{31}$ **ii** $P(W) = \frac{5}{31}$

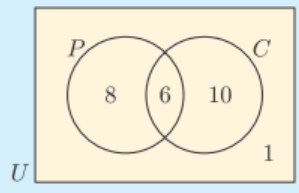
iii $P(S \cup W) = P(S) + P(W)$ {mutually exclusive events}

$= \frac{7}{31} + \frac{5}{31} = \frac{12}{31}$

Example 24 Self Tutor

In a class of 25 students, 14 like pizza and 16 like iced coffee. One student likes neither and 6 students like both. One student is randomly selected from the class. What is the probability that the student:

a likes pizza **b** likes pizza given that he or she likes iced coffee?



The Venn diagram of the situation is shown.

a Of the 25 students, 14 like pizza.

$\therefore \quad P(\text{pizza}) = \frac{14}{25}$

b Of the 16 who like iced coffee, 6 like pizza.

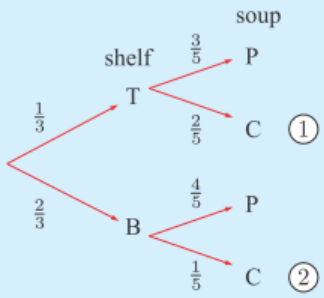
$\therefore \quad P(\text{pizza} \mid \text{iced coffee}) = \frac{6}{16}$

Example 26 Self Tutor

The top shelf in a cupboard contains 3 cans of pumpkin soup and 2 cans of chicken soup. The bottom shelf contains 4 cans of pumpkin soup and 1 can of chicken soup.

Lukas is twice as likely to take a can from the bottom shelf as he is from the top shelf. Suppose Lukas takes one can of soup without looking at the label. Determine the probability that it:

a is chicken **b** was taken from top shelf given that it is chicken.



a P(soup is chicken)

$= \frac{1}{3} \times \frac{2}{5} + \frac{2}{3} \times \frac{1}{5}$ {paths (1) and (2)}

$= \frac{4}{15}$

b P(top shelf | chicken)

$= \dfrac{\text{P(top shelf and chicken)}}{\text{P(chicken)}}$

$= \dfrac{\frac{1}{3} \times \frac{2}{5}}{\frac{4}{15}}$ ← path (1)

$= \frac{1}{2}$