5.3) Mutually exclusive and independent events

Worked example	Your turn
Events C and D are mutually exclusive and $P(C) = 0.6$ and $P(D) = 0.3$. a) Find $P(C \text{ or } D)$ b) Find $P(D \text{ but not } C)$ c) Find $P(\text{neither } C \text{ nor } D)$	Events A and B are mutually exclusive and $P(A) = 0.2$ and $P(B) = 0.4$. a) Find $P(A \text{ or } B)$ b) Find $P(A \text{ but not } B)$ c) Find $P(\text{neither } A \text{ nor } B)$ a) 0.6 b) 0.2 c) 0.4

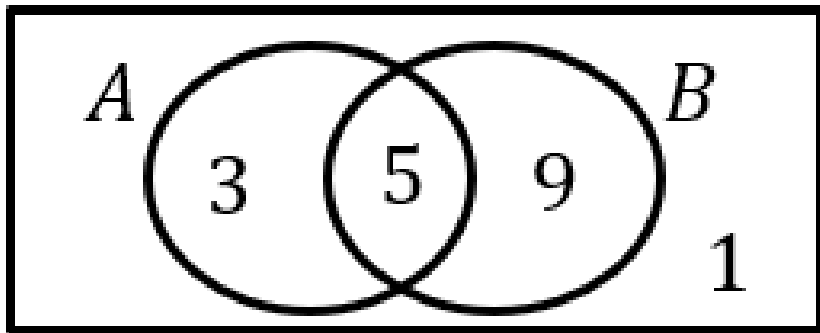| Worked example	Your turn
Events C and D are independent. $P(C) = \frac{5}{7}$ and $P(D) = \frac{3}{8}$. Find $P(C \text{ and } D)$.	Events A and B are independent. $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{5}$. Find $P(A \text{ and } B)$. $$\frac{1}{15}$$

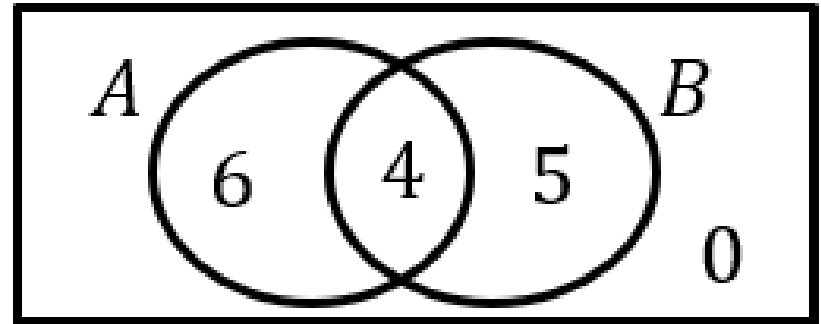| Worked example	Your turn
The Venn diagram shows the number of people who like each of two different books. Determine if A and B are independent.	The Venn diagram shows the number of people who like each of two different colours. Determine if A and B are independent.

$$P(A) = \frac{10}{15} = \frac{2}{3}$$

$$P(B) = \frac{9}{15} = \frac{3}{5}$$

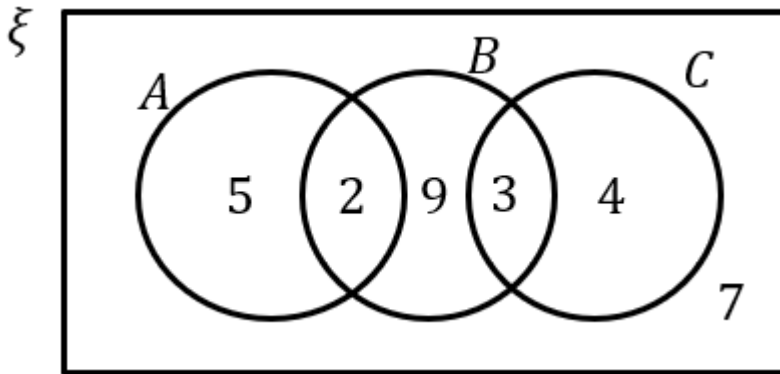$$P(A \text{ and } B) = \frac{4}{15}$$

$$P(A) \times P(B) = \frac{2}{3} \times \frac{3}{5} = \frac{6}{15} \neq \frac{4}{15}$$
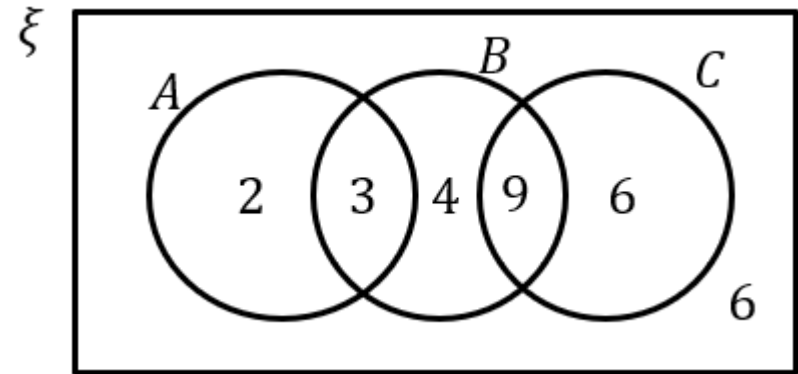
∴ not independent.

Diagrams/Graphs used with permission from DrFrostMaths: https://www.drfrostmaths.com/

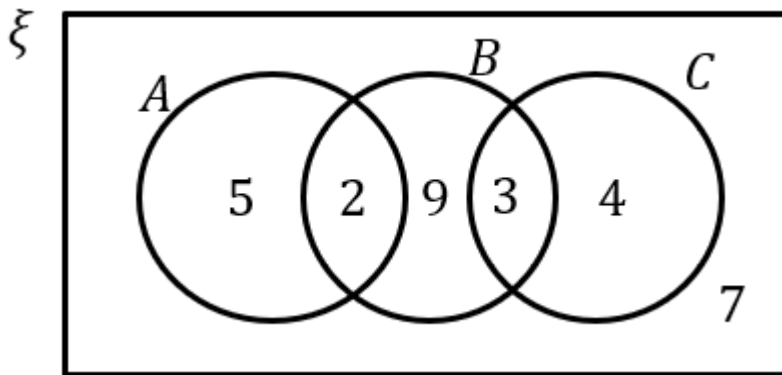| Worked example	Your turn
The Venn diagram shows the number of students in a particular class who watch any of three popular TV programmes. Find the probability that a student chosen at random watches A or B or both.	The Venn diagram shows the number of students in a particular class who watch any of three popular TV programmes. Find the probability that a student chosen at random watches B or C or both.

$$\frac{26}{30} = \frac{13}{15}$$

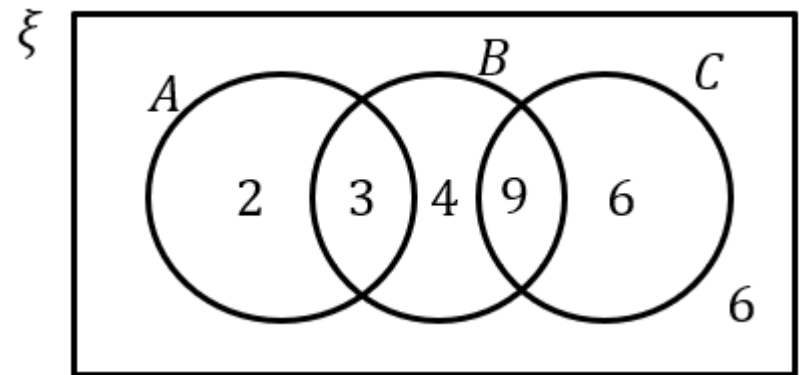| Worked example	Your turn
The Venn diagram shows the number of students in a particular class who watch any of three popular TV programmes. Determine whether watching A and watching B are statistically independent.	The Venn diagram shows the number of students in a particular class who watch any of three popular TV programmes. Determine whether watching A and watching B are statistically independent.

Worked example Venn diagram:

ξ

A: 5, A∩B: 2, B: 9, B∩C: 3, C: 4, outside: 7

Your turn Venn diagram:

ξ

A: 2, A∩B: 3, B: 4, B∩C: 9, C: 6, outside: 6

$$P(A) = \frac{7}{30}$$

$$P(B) = \frac{19}{30}$$

$$P(A \text{ and } B) = \frac{4}{30}$$

$$P(A) \times P(B) = \frac{7}{30} \times \frac{19}{30} = \frac{133}{900} \neq \frac{4}{30}$$

∴ not independent.

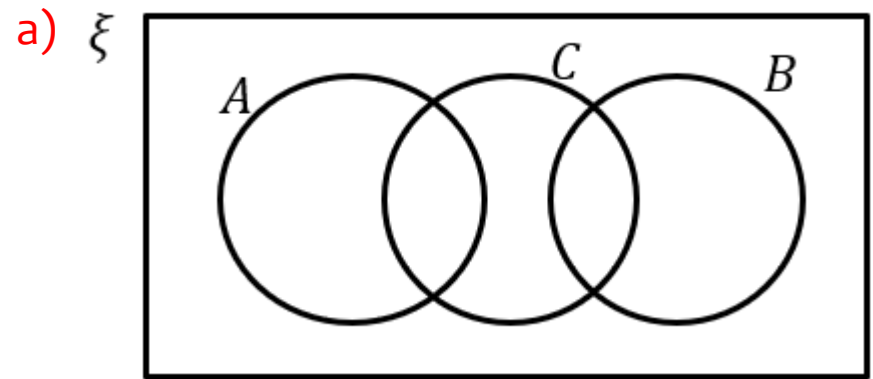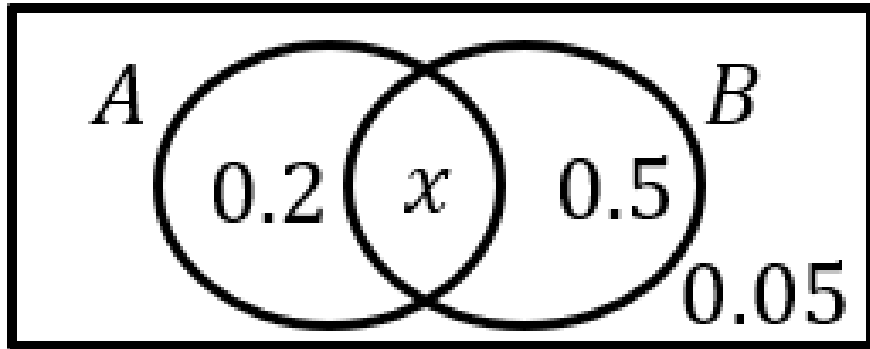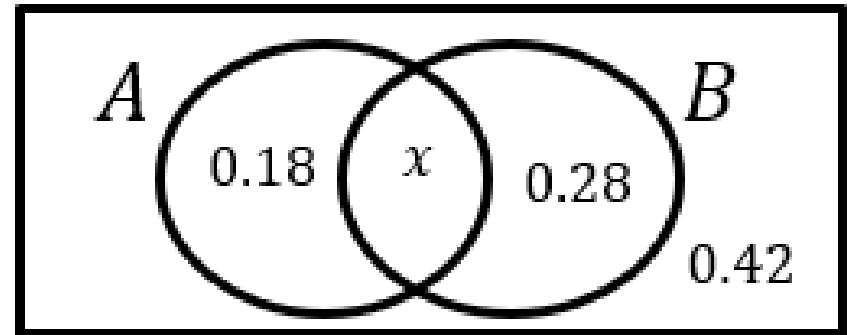| Worked example	Your turn
There are three events D, E, F. The events D and E are mutually exclusive. a) Draw a Venn diagram which represents this information. b) If $P(D) = 0.2$ and $P(E) = 0.7$, determine $P(neither\ D\ nor\ E)$	There are three events A, B, C. The events A and B are mutually exclusive. a) Draw a Venn diagram which represents this information. b) If $P(A) = 0.1$ and $P(B) = 0.6$, determine $P(neither\ A\ nor\ B)$

a) ξ

b) 0.3

Worked example	Your turn
Determine if events A and B are independent.	Determine if events A and B are independent.

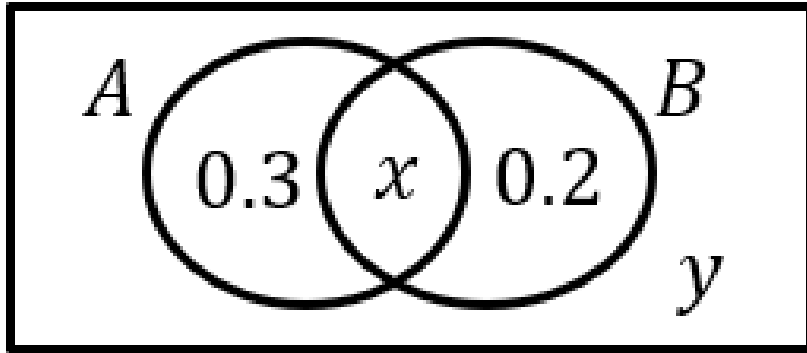$x = 1 - 0.18 - 0.28 - 0.42 = 0.12$

$P(A) = 0.3$

$P(B) = 0.4$

$P(A \text{ and } B) = 0.12$

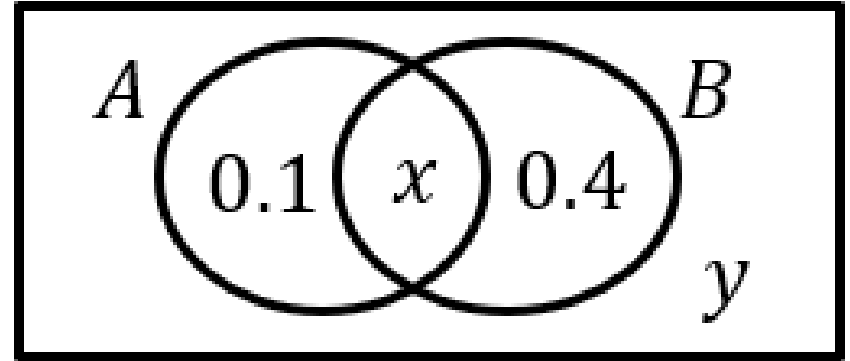$P(A) \times P(B) = 0.3 \times 0.4 = 0.12$

$\therefore$ independent.

Worked example	Your turn
Given that A and B are independent, determine the possible values for x and y	Given that A and B are independent, determine the possible values of x

$x = 0.3, y = 0.2$
$x = 0.2, y = 0.3$