1. [Edexcel, 2009] Probability (Compound Events) **[5 Marks]**

Each time Jeni plays a computer game the probability that she will win is $\frac{2}{3}$

Jeni plays the computer game 3 times.

Calculate the probability that Jeni will win

(a) all 3 games,

$$P(WWW) = \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \quad \text{M1}$$

$$= \frac{8}{27} \quad \text{A1}$$

(b) exactly 2 out of the 3 games.

$$P(WWL) = \frac{2}{3} \times \frac{2}{3} \times \frac{1}{3} = \frac{4}{27}$$

$$P(WLW) = \frac{2}{3} \times \frac{1}{3} \times \frac{2}{3} = \frac{4}{27}$$

$$P(LWW) = \frac{1}{3} \times \ldots = \frac{4}{27}$$

TOTAL $= \frac{12}{27}$ A1

M1 THREE OUTCOMES

M1 MULTIPLYING

2. [Edexcel, 2008] Probability (Compound Events) **[5 Marks]**

There are 9 counters in a bag.
7 of the counters are red and 2 of the counters are white.

Ajit takes at random two counters from the bag without replacement.

PROBABILITIES CHANGE

(a) Calculate the probability that the two counters are red.

$P(R,R) = \frac{7}{9} \times \frac{6}{8} = \frac{42}{72}$

M1

$\frac{7}{12}$ A1

(2)

(b) Calculate the probability that the two counters have different colours.

M1

$P(R,W) = \frac{7}{9} \times \frac{2}{8} = \frac{14}{72}$

$P(W,R) = \frac{2}{9} \times \frac{7}{8} = \frac{14}{72}$

$\frac{28}{72}$

M1

$\frac{7}{18}$ A1

(3)

Naveed has two bags of tiles, bag **A** and bag **B**.

There are 10 tiles in bag **A**.
7 of these tiles are red.
The other 3 tiles are white.

There are 8 tiles in bag **B**.
5 of these tiles are red.
The other 3 tiles are white.

Naveed takes at random one tile from each bag.

(a) Work out the probability that the tiles are the same colour.

$$\left.\begin{aligned} P(R,R) &= \frac{7}{10} \times \frac{5}{8} = \frac{35}{80} \quad \text{B1} \\ P(W,W) &= \frac{3}{10} \times \frac{3}{8} = \frac{9}{80} \quad \text{B1} \end{aligned}\right\} \text{TOTAL} = \frac{44}{80} \quad \text{A1}$$

$\frac{11}{20}$
(3)

All 18 tiles are put in a box.
Naveed takes at random one tile from the box.
He does not replace the tile. PROBABILITES CHANGE!
Naveed then takes at random a second tile from the box.

(b) Work out the probability that both tiles are red.

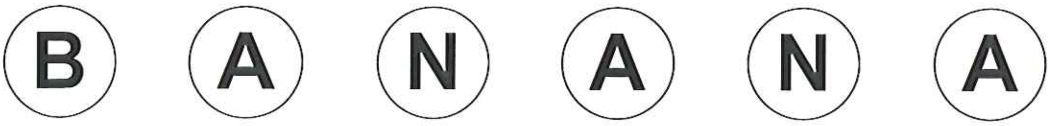
$$P(R,R) = \frac{12}{18} \times \frac{11}{17} \quad \text{M1}$$

$$= \frac{22}{51} \quad \text{A1}$$

[ACCEPT EQUIVALENTS!]

4. [Edexcel, 2005] Probability (Compound Events) **[6 Marks]**

The diagram shows six counters.



Each counter has a letter on it.

Bishen puts the six counters into a bag.
He takes a counter at random from the bag.
He records the letter which is on the counter and replaces the counter in the bag.
He then takes a second counter at random and records the letter which is on the counter.

PROBABILITIES STAY THE SAME

(a) Calculate the probability that the first letter will be A and the second letter will be N.

$$P(A,N) = \frac{3}{6} \times \frac{2}{6} = \frac{6}{36}$$

M1

$\frac{1}{6}$ A1

(2)

(b) Calculate the probability that both letters will be the same.

$$P(B,B) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$ M1

$$P(A,A) = \frac{3}{6} \times \frac{3}{6} = \frac{9}{36}$$ M1

$$P(N,N) = \frac{2}{6} \times \frac{2}{6} = \frac{4}{36}$$ M1

$$\text{TOTAL} = \frac{14}{36}$$

$\frac{7}{18}$ A1

(4)

A box contains 7 good apples and 3 bad apples. $P(G) = \frac{7}{10}$ $P(B) = \frac{3}{10}$

Nick takes two apples at random from the box, **without** replacement.

PROBABILITIES CHANGE

(a) (i) Calculate the probability that both of Nick's apples are bad.

$$P(B,B) = \frac{3}{10} \times \frac{2}{9} = \frac{6}{90}$$

M1

$\frac{1}{15}$ A1

(ii) Calculate the probability that at least one of Nick's apples is good.

$P(G,B) = \ldots$

$P(B,G) = \ldots$

$P(G,G) = \ldots$

* SHORTCUT *

$1 - P(B,B)$ M1

$\frac{14}{15}$ A1

(4)

Another box contains 8 good oranges and 4 bad oranges. $P(G) = \frac{8}{12}$, $P(B) = \frac{4}{12}$

Crystal keeps taking oranges at random from the box one at a time, **without** replacement, until she gets a good orange.

(b) Calculate the probability that she takes exactly three oranges.

$$P(B,B,G) = \frac{4}{12} \times \frac{3}{11} \times \frac{8}{10}$$ M1

$$= \frac{96}{1320}$$

$\frac{4}{55}$ A1

(2)

6. [Edexcel, 2006] Probability (Compound Events) **[4 Marks]**

The sides of a fair six-sided dice are numbered from 1 to 6
The dice is thrown three times.
Find the probability that it shows a 1 at least twice.

$$\left.\begin{aligned}
P(1,1,\bar{1}) &= \frac{1}{6}\times\frac{1}{6}\times\frac{5}{6} = \frac{5}{216}\\
P(1,\bar{1},1) &= \frac{1}{6}\times\frac{5}{6}\times\frac{1}{6} = \frac{5}{216}\\
P(\bar{1},1,1) &= \frac{5}{6}\times\frac{1}{6}\times\frac{1}{6} = \frac{5}{216}\\
P(1,1,1) &= \underbrace{\frac{1}{6}\times\frac{1}{6}\times\frac{1}{6}}_{\text{M2}} = \frac{1}{216}
\end{aligned}\right\} \frac{16}{216} \quad \text{A1}$$

$\frac{2}{27}$ A1

Younis spins a biased coin twice.
The probability that it will come down heads both times is 0.36

Calculate the probability that it will come down tails both times.

LET $P(H) = x$

$\therefore P(H,H) = x \times x = x^2$

AND $x^2 = 0.36$

$\Rightarrow x = 0.6$ B1

$\therefore P(T) = 1 - 0.6$

$= 0.4$ M1

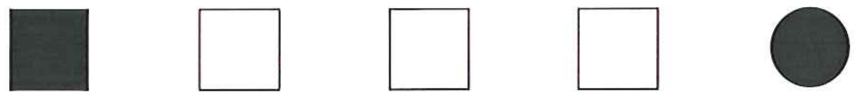
AND

$P(T,T) = 0.4 \times 0.4$

$= \underline{\underline{0.16}}$ A1

8. [Edexcel, 2007] Probability (Compound Events) **[8 Marks]**

Here are five shapes.



Four of the shapes are squares and one of the shapes is a circle.
One square is black.
Three squares are white.
The circle is black.
The five shapes are put in a bag.

(a) Jasmine takes a shape at random from the bag 150 times.
She replaces the shape each time.

Work out an estimate for the number of times she will take a white square.

$P(\text{WHITE SQUARE}) = \frac{3}{5}$ M1

$E(\text{WHITE SQUARE}) = \frac{3}{5} \times 150$ M1

90 A1

(3)

(b) Alec takes a shape at random from the bag and does **not** replace it.
Bashir then takes a shape at random from the bag.

PROBABILITIES CHANGE

Work out the probability that

(i) they both take a square,

$P(S,S) = \frac{4}{5} \times \frac{3}{4} = \frac{12}{20}$

M1

0.6 A1

(ii) they take shapes of the same colour.

$P(B,B) = \frac{2}{5} \times \frac{1}{4} = \frac{2}{20}$

$P(W,W) = \frac{3}{5} \times \frac{2}{4} = \frac{6}{20}$

TOTAL $= \frac{8}{20}$

0.4 A1

(5)

M1 M1

BOTH OUTCOMES

MULTIPLYING

9. [Edexcel, 2011] Probability (Compound Events) **[5 Marks]**

Here are seven counters.
Each counter has a number on it.

7 COUNTERS

1 2 4 4 5 5 5

Ali puts the seven counters in a bag.
He takes, at random, a counter from the bag and does **not** replace the counter.
He then takes, at random, a second counter from the bag.

ONLY 6 COUNTERS FOR SECOND PICK

Calculate the probability that

(i) the number on the second counter is 2 more than the number on the first counter,

$$P(2,4) = \frac{1}{7} \times \frac{2}{6} = \frac{2}{42}$$

(M1)

$$= \frac{1}{21}$$

$\frac{1}{21}$ (A1)

(ii) the number on the second counter is 1 more than the number on the first counter.

$$P(1,2) = \frac{1}{7} \times \frac{1}{6} = \frac{1}{42} \quad \text{(M1)}$$

$$P(4,5) = \frac{2}{7} \times \frac{3}{6} = \frac{6}{42} \quad \text{(M1)}$$

$$\text{TOTAL} = \frac{7}{42}$$

$$= \frac{1}{6}$$

$\frac{1}{6}$ (A1)

10. [Edexcel, 2014] Probability (Compound Events) **[9 Marks]**

A box contains 20 nails.
The table shows information about the length of each nail.

Length of nail (mm)	25	30	40	50	60
Number of nails	1	8	4	5	2

(a) Viraj takes at random one nail from the box.

Find the probability that the length of the nail he takes is

(i) 50 mm or 60 mm,

M1 $\frac{5+2}{20} = \frac{7}{20}$

A1 0.35

(ii) less than 35 mm.

M1 $\frac{1+8}{20} = \frac{9}{20}$

A1 0.45

(4)

(b) Jamila puts all 20 nails into a bag.
She takes at random one of the nails and records its length.
She $\boxed{\text{replaces}}$ the nail in the bag.
She then takes at random a second nail from the bag and records its length.

Calculate the probability that the two nails she takes

(i) each have a length of 60 mm,

$P(60,60) = \frac{2}{20} \times \frac{2}{20}$ M1

A1 0.01

(ii) have a total length of 80 mm.

M1 [MULTIPLY]

$$\left.\begin{aligned} P(40,40) &= \frac{4}{20} \times \frac{4}{20} = \frac{16}{400} \\ P(30,50) &= \frac{8}{20} \times \frac{5}{20} = \frac{40}{400} \\ P(50,30) &= \frac{5}{20} \times \frac{8}{20} = \frac{40}{400} \end{aligned}\right\} \text{TOTAL} = \frac{96}{400}$$

A1

$= \underline{\underline{0.24}}$

M1 [THREE POSSIBILITIES]

Two bags contain discs.

Bag **A** contains 12 discs.
5 of the discs are red, 6 are blue and 1 is white. $\} P(R) = \frac{5}{12}, P(B) = \frac{6}{12}, P(W) = \frac{1}{12}$

Bag **B** contains 25 discs.
n of the discs are red and the rest are blue. $\} P(R) = \frac{n}{25}, P(B) = \frac{25-n}{25}$

James takes at random a disc from Bag **A**.
Lucy takes at random a disc from Bag **B**.

Given that the probability that James and Lucy both take a red disc is $\frac{2}{15}$

(i) find the value of n, the number of red discs in Bag **B**.

$$P(RR) \quad \frac{5}{12} \times \frac{n}{25} = \frac{2}{15} \quad \text{M1}$$

$$\Rightarrow \frac{5n}{300} = \frac{2}{15} \Rightarrow n = \frac{2}{15} \times \frac{300}{5}$$

$n =$ 8 A1

(ii) Hence calculate the probability that James and Lucy take discs of different colours.

$$P(BB) = \frac{6}{12} \times \frac{(25-8)}{25}$$

$$= \frac{17}{50} \quad \text{M1}$$

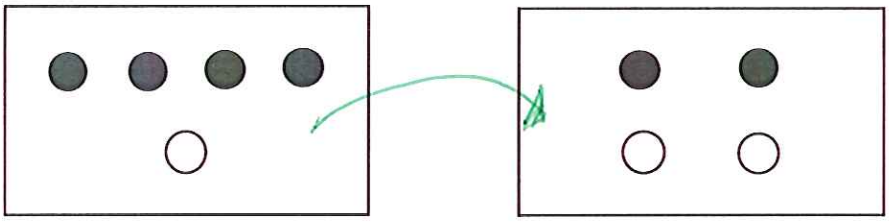
$$\therefore P(\text{SAME COLOUR}) = \frac{2}{15} + \frac{17}{50}$$

$$= \frac{71}{150} \quad \text{M1}$$

$$\therefore P(\text{DIFFERENT COLOURS}) = 1 - \frac{71}{150}$$

$$= \underline{\underline{\frac{79}{150}}} \quad \text{A1}$$

12. [Edexcel, 2013] Probability (Compound Events) **[5 Marks]**



Box X Box Y

In Box X, there are 4 black discs and 1 white disc.
In Box Y, there are 2 black discs and 2 white discs.

Vikram takes at random a disc from Box X and puts it in Box Y.
He then takes at random a disc from Box Y.

(a) Calculate the probability that the disc he takes from Box X and the disc he takes from Box Y will both be black discs.

$P(BB) = \frac{4}{5} \times \frac{3}{5}$ M1

$= \frac{12}{25}$

$\frac{12}{25}$ A1
(2)

(b) Calculate the probability that the disc he takes from Box Y will be a white disc.

$P(BW) = \frac{4}{5} \times \frac{2}{5} = \frac{8}{25}$

M1 EITHER

$P(WW) = \frac{1}{5} \times \frac{3}{5} = \frac{3}{25}$

$\frac{11}{25}$ A1

M1 FOR ADDING.

$\frac{1}{3}$ of the people in a club are men.

The number of men in the club is n.

(a) Write down an expression, in terms of n, for the number of people in the club.

$$\frac{1}{3} \times p = n \longrightarrow p = 3n$$ A1

(1)

Two of the people in the club are chosen at random.

The probability that both these people are men is $\frac{1}{10}$

(b) Calculate the number of people in the club.

$$\frac{n}{p} \times \frac{n-1}{p-1} = \frac{1}{10}$$ M1 [AN APPROPRIATE EQUATION]

$$\Rightarrow \frac{n^2 - n}{p^2 - p} = \frac{1}{10}$$

$$\Rightarrow 10n^2 - 10n = p^2 - p$$ M1 [QUADRATIC WITHOUT DENOMINATORS]

$$\Rightarrow 10n^2 - 10n = 9n^2 - 3n$$

$$\Rightarrow 10n - 10 = 9n - 3$$ M1 [LINEAR EQUATION]

$$\Rightarrow 10n - 9n = -3 + 10$$

$$n = 7$$ A1 [FINDING n]

$$\therefore p = 3 \times 7$$

$$= \underline{\underline{21}}$$ A1

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Note that some questions contain the words 'show that', 'show your working out', or similar. These questions require working out to be shown. Failure to show sufficient working out is likely to result in no marks being awarded, even if the final answer is correct.

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