"Full Coverage": Probability

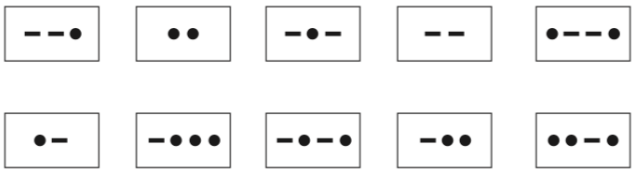
This worksheet is designed to cover one question of each type seen in past papers, for each GCSE Higher Tier topic. This worksheet was automatically generated by the DrFrostMaths Homework Platform: students can practice this set of questions interactively by going to www.drfrostmaths.com/homework, logging on, *Practise → Past Papers/Worksheets* (or *Library → Past/Past Papers* for teachers), and using the 'Revision' tab.

Question 1

Categorisation: Calculate probabilities by the number of matching outcomes divided by the number of total outcomes.

[Edexcel IGCSE Jan2014(R)-3H Q8a Edited]

Morse Code uses dots and dashes to represent each letter of the alphabet.
Here are 10 cards.
Each card has the Morse Code for a letter on it.



Kelly takes at random one of the cards.
Find the probability that she takes a card with 2 dots or a card with 3 dots.

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Question 2

Categorisation: Calculate probabilities from an ungrouped frequency table.

[Edexcel IGCSE Jan2014-3H Q13aii]

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

Viraj takes at random one nail from the box.

Find the probability that the length of the nail he takes is less than 35 mm.

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Question 3

Categorisation: Calculate probabilities from a grouped frequency table.

[Edexcel IGCSE May2014-3H Q11b]

The table gives information about the speed, in km/h, of 180 vehicles passing a speed checkpoint.

Speed (v km/h)	Frequency
$40 < v \leqslant 50$	4
$50 < v \leqslant 60$	52
$60 < v \leqslant 70$	60
$70 < v \leqslant 80$	34
$80 < v \leqslant 90$	18
$90 < v \leqslant 100$	12

Work out an estimate for the probability that the next vehicle passing the speed checkpoint will have a speed of 60 km/h or less.

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Question 4

Categorisation: Calculate probabilities from a two-way table.

[Edexcel GCSE June2010-2F Q14b]

The two-way table gives information about the subjects studied by 50 students.

	Law	Engineering	Medicine	Total
Male	6	15	4	25
Female	5	6	14	25
Total	11	21	18	50

One of these students is chosen at random.
Find the probability that this student is male and studies Law.

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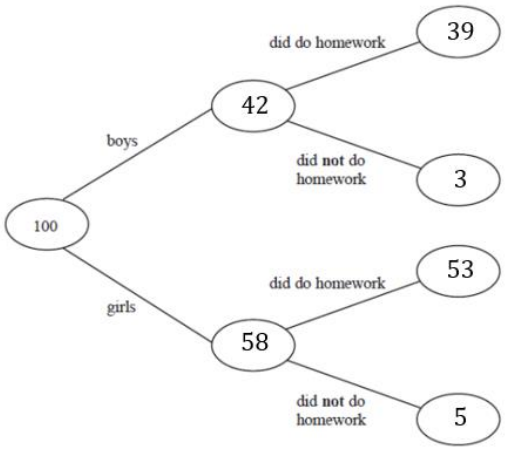
Question 5

Categorisation: [Foundation only?] Calculate probabilities from a 'frequency tree'.

[Edexcel New SAMs Paper 1F Q17b]

100 students had some homework. The following **frequency tree** shows which children and boys and girls and who did their homework.



One of the girls is chosen at random.

Work out the probability that this girl did **not** do her homework.

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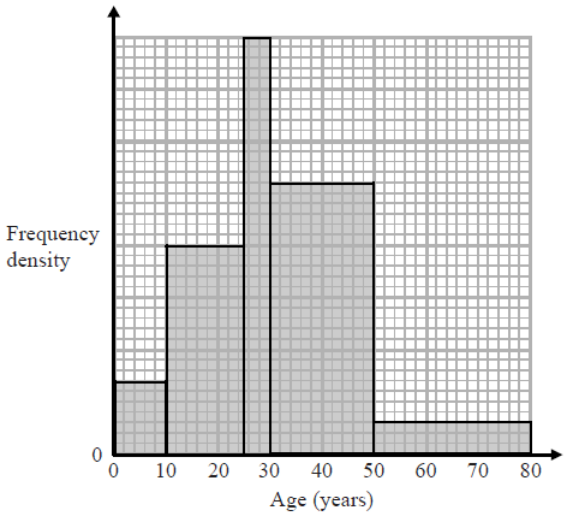
Question 6

Categorisation: Determine a probability from a histogram.

[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 - 1H Q23]

The histogram shows information about the ages of the members of a football supporters club.



There are 20 members aged between 25 and 30.
One member of the club is chosen at random.

What is the probability that this member is more than 30 years old?

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Question 7

Categorisation: Determine the total number of items or items of a given type using a combination of frequencies and probabilities.

[Edexcel GCSE Nov2013-2F Q16b, Nov2013-2H Q3]
Bill has some counters in a bag.

3 of the counters are red. 7 of the counters are blue.
The rest of the counters are yellow.

Bill takes at random a counter from the bag.
The probability that he takes a yellow counter is $\frac{2}{7}$.
How many yellow counters are in the bag before Bill takes a counter?

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Question 8

Categorisation: Deal with changes to frequencies (e.g. counters added/removed)

[Edexcel GCSE March2012-1F Q18b, March2012-3H Q5b Edited]

There are only red counters, blue counters and green counters in a bag.
There are 5 red counters. There are 6 blue counters. There is 1 green counter.

Jim puts some more green counters into the bag.
The probability of taking at random a red counter is now $\frac{1}{3}$
Work out the number of green counters that are now in the bag.

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Question 9

Categorisation: Determine the estimated frequency of an outcome.

[Edexcel IGCSE May2014-4H Q2b]

Sarah has a biased 4-sided spinner.
The spinner can land on 1, 2, 3 or 4.

The probability that the spinner will land on 1, 2 or 4 is given in the table.

Number	1	2	3	4
Probability	0.4	0.35		0.1

Ryan is going to spin the spinner 80 times.

Work out an estimate for the number of times he should expect the spinner to land on 2.

..... times

Question 10

Categorisation: Same as Question 7, but using frequencies to establish and unknown probability.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 2F Q21]

There are 300 seeds in a packet of flower seeds.
Each seed will grow into a white flower or a yellow flower or a red flower.

The probability of a seed growing into a white flower is 0.62
45 of the seeds are expected to grow into yellow flowers.

One of the seeds is chosen at random from the packet.

What is the probability that this seed will grow into a red flower?

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Question 11

Categorisation: Work out an expected value given repeated trials.

[Edexcel GCSE Jan2016(R)-1F Q15bii, Jan2016(R)-3H Q4bii]

Maisie plays a game.
Each time she plays, she can win a prize of $1 or $5 or $10.
When she does not win one of these prizes, she loses.
The table gives the probability of winning each of the prizes.

Prize	Probability
$1	0.50
$5	0.15
$10	0.05

Maisie plays the game 40 times

Work out an estimate for the total value of the prizes she wins.

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Question 12

Categorisation: As above.

[Edexcel GCSE Jun2015-1H Q11b]
Karl wants to raise money for charity. He designs a game for people to play.

Karl uses a fair 10-sided dice for the game. The dice is numbered from 1 to 10.

Each person will roll the dice once. A person wins the game if the dice lands on a multiple of 4.

Each person pays 30p to play the game once. The prize for a win is £1.
Karl thinks that the game will be played 100 times.

Work out an estimate for how much money Karl will raise for charity.

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Question 13

Categorisation: Appreciate the probability of mutually exclusive outcomes (the span all possibilities) is equal to 1.

[Edexcel GCSE Nov2005-3I Q13aii]

A school snack bar offers a choice of four snacks.
The four snacks are burgers, pizza, pasta and salad.
Student can choose **one** of these four snacks.

The table shows the probability that a student will choose burger or pizza or salad.

Snack	burger	pizza	pasta	salad
Probability	0.35	0.15		0.2

One student is chosen at random from the students who use the snack bar.
Work out the probability that the student chose pasta.

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Question 14

Categorisation: Multiply probabilities from independent events.

[Edexcel IGCSE Jan2014-3H Q13bi]

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

Jamila puts all 20 nails into a bag. She takes at random one of the nails and records its length. She 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 each have a length of 60 mm.

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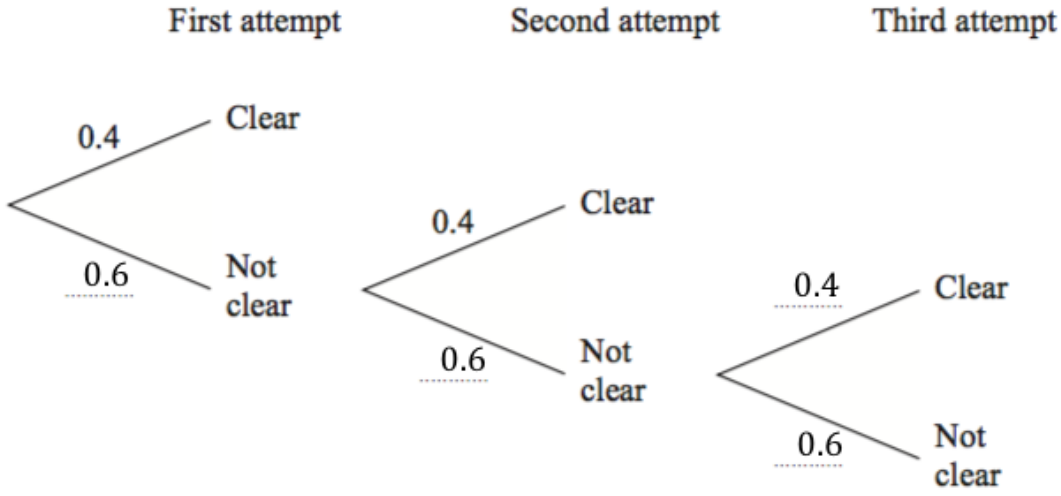
Question 15

Categorisation: Deal with a single sequence of outcomes but involving multiple independent events.

[Edexcel IGCSE Jan2014(R)-4H Q17b Edited]

Hugo competes in the high jump at a school athletics competition.
He has up to 3 attempts to clear the bar at each height.
When he clears the bar, he does not have another attempt at that height.

When the bar is set at a height of 1.60 metres, the probability that Hugo will clear the bar on any attempt is 0.4.
The probability tree diagram shows the possible outcomes of Hugo's attempts at 1.60 metres.



Work out the probability that Hugo does not clear the bar on his first two attempts and then does clear the bar on his third attempt at 1.60 metres.

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Question 16

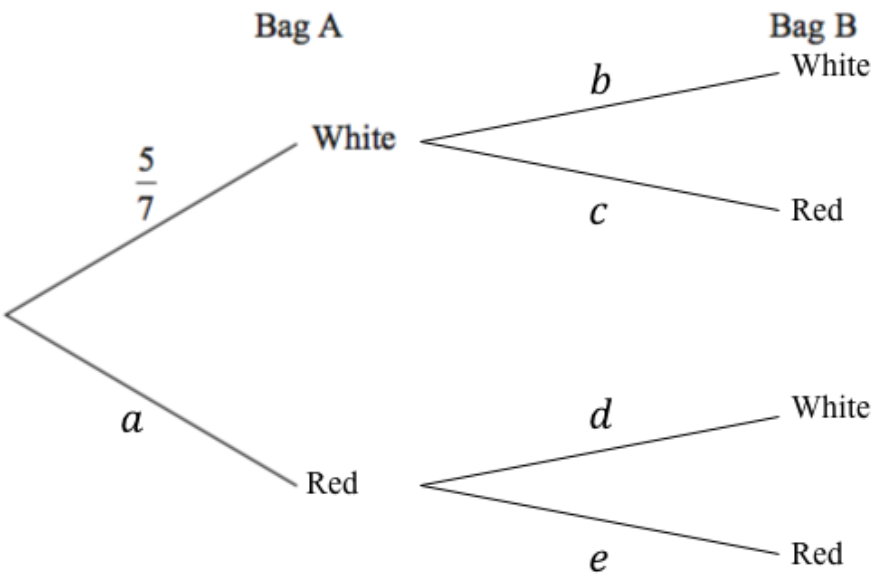
Categorisation: Fill in a probability tree using independent events.

[Edexcel IGCSE May2014(R)-4H Q15a Edited]

Maria has two bags.
In bag A, there are 5 white counters and 2 red counters.
In bag B, there are 3 white counters and 2 red counters.

Maria is going to take at random one counter from bag A and one counter from bag B.

Complete the probability tree diagram.



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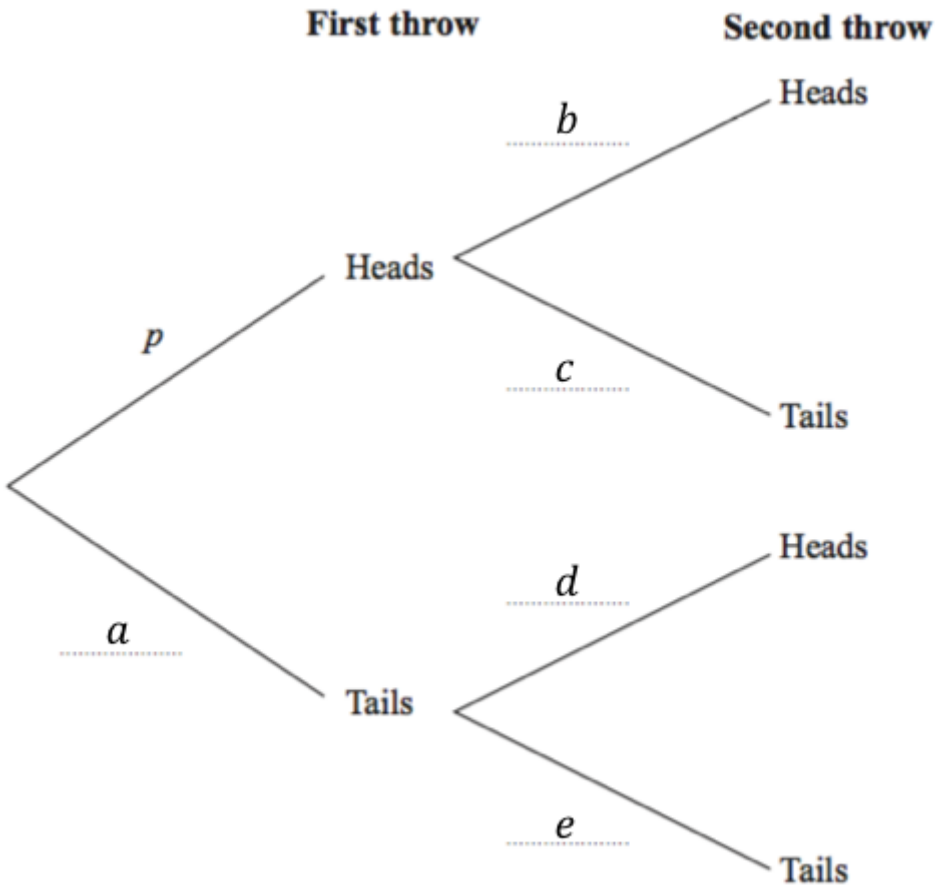
Question 17

Categorisation: Fill in a probability tree, but with algebraic probabilities.

[Edexcel IGCSE Jan2015(R)-4H Q13a Edited]

Jim has a biased coin. The probability that Jim will throw Heads on any throw is p .
Jim throws the coin twice.

Complete the probability tree diagram.
Give your probabilities in terms of p .



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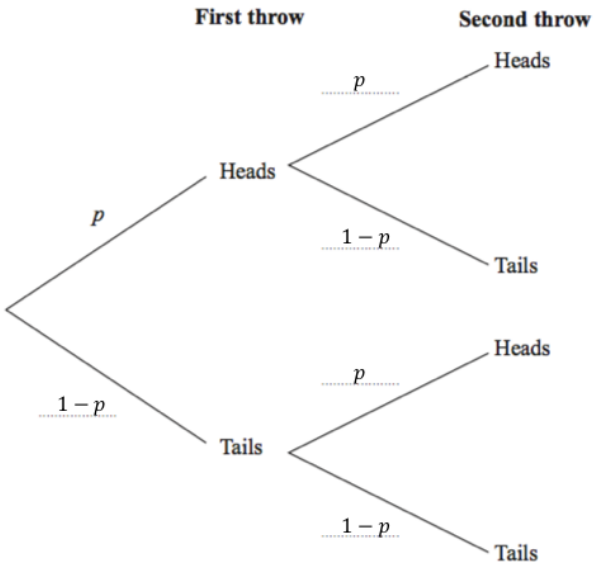
Question 18

Categorisation: Determine an algebraic expression for a probability using a tree.

[Edexcel IGCSE Jan2015(R)-4H Q13b Edited]

Jim has a biased coin. The probability that Jim will throw Heads on any throw is p .
Jim throws the coin twice.



Find an expression, in terms of p , for the probability that Jim will throw two Heads.

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Question 19

Categorisation: Determine a probability involving the sum, different or product of two outcomes.

[Edexcel IGCSE Jan2014-3H Q13bii]

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

Jamila puts all 20 nails into a bag. She takes at random one of the nails and records its length. She 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 each have a total length of 80 mm.

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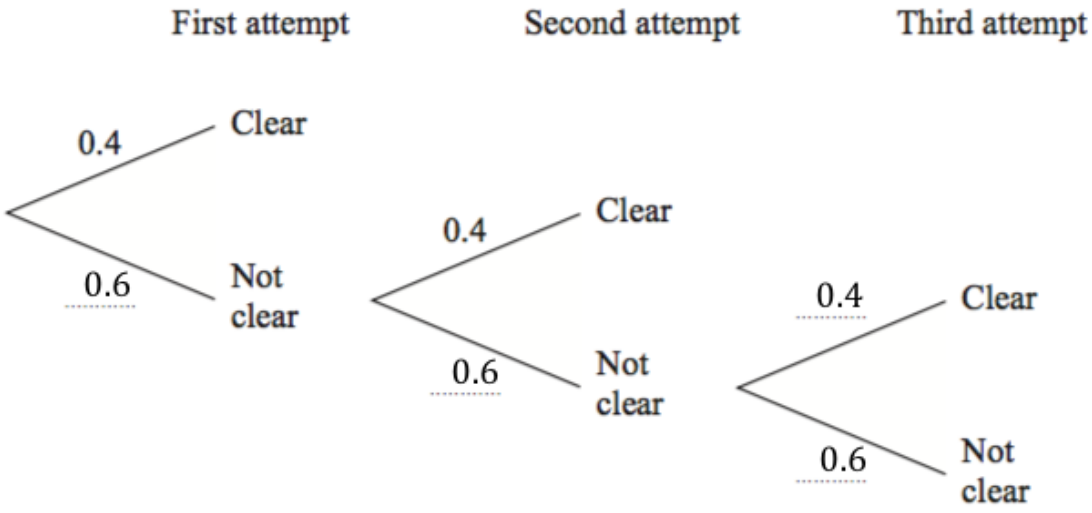
Question 20

Categorisation: Deal with multiple different chains of independent events, potentially of different chain lengths, e.g. "Win", "Lose-Win", "Lose-Lose-Win".

[Edexcel IGCSE Jan2014(R)-4H Q17c Edited]

Hugo competes in the high jump at a school athletics competition.
He has up to 3 attempts to clear the bar at each height.
When he clears the bar, he does not have another attempt at that height.

When the bar is set at a height of 1.60 metres, the probability that Hugo will clear the bar on any attempt is 0.4.
The probability tree diagram shows the possible outcomes of Hugo's attempts at 1.60 metres.



Hugo clears the bar at 1.60 metres and the height is raised to 1.65 metres.
He has up to three attempts to clear the bar at 1.65 metres.

When the bar is set at a height of 1.65 metres, the probability that Hugo will clear the bar on any attempt is 0.3.

Find the probability that Hugo clears the bar at 1.65 metres.

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Question 21

Categorisation: Deal with multiple chains of independent events without the aid of a tree.

[Edexcel IGCSE May2015(R)-4H Q16]

When a fair dice is thrown the probability of scoring 6 is $\frac{1}{6}$

Arun throws four fair dice.

Work out the probability that he scores 6 with at least one of the four dice.

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Question 22

Categorisation: Form and solve algebraic equations involving independent events.

[Edexcel IGCSE May2015(R)-3H Q17i]

Two bags contain discs.

Bag **A** contains 12 discs.

5 of the discs are red, 6 are blue and 1 is white.

Bag **B** contains 25 discs. n of the discs are red and the rest are blue.

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 $\frac{2}{15}$, find the value of n, the number of red discs in Bag **B**.

$n =$ .....

Question 23

Categorisation: Deal with independent events involving matching/different colours (very common!)

[Edexcel GCSE June2007-6H Q24]

Martin has a pencil case which contains 4 blue pens and 3 green pens.
Martin picks a pen at random from the pencil case.
He notes its colour, and then replaces it.

He does this two more times.

Work out the probability that when Martin takes three pens, exactly two are the same colour.

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Question 24

Categorisation: Appreciate that $P(A \text{ and } B) = P(A)P(B)$ for independent events can be rearranged to $P(A) = P(A \text{ and } B) \div P(B)$

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 3H Q20]

Azmol rolls a biased dice and spins a biased coin.

The probability that the coin will land on Heads is 0.55
The probability that the dice will land on 6 and the coin will land on Heads is 0.11

Work out the probability that the dice will land on 6 and the coin will land on Tails.

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Question 25

Categorisation: Deal with sampling without replacement.

[Edexcel IGCSE May2014(R)-3H Q17b]

The table shows information about the 40 coins in Karam's money box.

	Bronze coins		Silver coins			
Value of coin (pence)	1	2	5	10	20	50
Number of coins	6	8	12	7	3	4

Karam shakes his money box until a coin falls out at random.
He does not replace the coin in the money box.
Karam shakes his money box again until a second coin falls out at random.

Work out the probability that the total value of the two coins that fall out is 60 pence or more.

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Question 26

Categorisation: Deal with sampling without replacement involving matching/non-matching items.

[Edexcel GCSE Nov2015-2H Q25]

Nomusa has 30 sweets. She has

18 fruit sweets
7 aniseed sweets
5 mint sweets

Nomusa is going to take at random two sweets.

Work out the probability that the two sweets will **not** be the same type of sweet.
You must show all your working.

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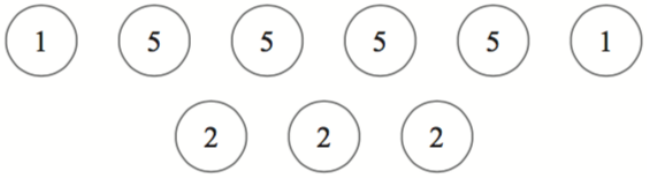
Question 27

Categorisation: Deal with sampling without replacement involving sums/products/differences of outcomes.

[Edexcel IGCSE May2014-3H Q20b]

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



The counters are turned over to hide their numbers and are then mixed up.

Susan takes at random a counter and turns it over to reveal its number.
She takes at random a second counter, from the remaining eight counters, and turns it over to reveal its number.

Calculate the probability that the sum of the numbers on the two counters Susan takes is divisible by 3.

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Question 28

Categorisation: Appreciate that is sometimes more efficient to keep the events as "odd" and "even" rather than considering specific combinations of outcomes.

[Edexcel IGCSE Jan2015-3H Q16b]

Gemma has 9 counters. Each counter has a number on it.

Gemma puts the 9 counters into a bag. She takes at random a counter from the bag and does not replace the counter. She then takes at random a second counter from the bag. Work out the probability that the number on the first counter added to the number on the second counter gives an odd number.

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Question 29

Categorisation: Deal with sampling without replacement involving some other numerical relationship between the outcomes.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 3H Q16]

Here are 8 cards.
There is a number on each card.

Erin puts the 8 cards in a bag.
She takes at random a card from the bag and does not replace it.
Erin then takes at random a second card from the bag.

Calculate the probability that the number on the second card is double the number on the first card.

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Question 30

Categorisation: Sampling without replacement, involving algebraic probabilities.

[Edexcel GCSE Jun2015-1H Q19a Edited]

There are n sweets in a bag. 6 of the sweets are orange.
The rest of the sweets are yellow.

Hannah takes at random a sweet from the bag. She eats the sweet.

Hannah then takes at random another sweet from the bag. She eats the sweet.

The probability that Hannah eats two orange sweets is $\frac{1}{3}$.

It can be shown that $n^2 + an + b = 0$, where a and b are integers. Determine the values of a and b.

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Question 31

Categorisation: Sampling without replacement involving algebraic probabilities, but where no variable is explicitly given.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 2H Q25]

There are some red counters and some white counters in a bag.
At the start, 7 of the counters are red, the rest of the counters are white.

Alfie takes at random a counter from the bag.
He does not put the counter back in the bag.
Alfie then takes at random another counter from the bag.

The probability that the first counter Alfie takes is white and the second counter Alfie takes is red is $\frac{21}{80}$

Work out the number of white counters in the bag at the start.

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Answers

Question 1

$\frac{6}{10}$

Question 2

$\frac{9}{20}$

Question 3

$\frac{56}{180}$

Question 4

$\frac{6}{50}$

Question 5

$\frac{5}{58}$

Question 6

$\frac{61}{118}$

Question 7

4

Question 8

4

Question 9

28 times

Question 10

0.23

Question 11

$ 70

Question 12

£ 10

Question 13

0.3

Question 14

$\frac{4}{400}$

Question 15

0.144

Question 16

$a = \frac{2}{7}, b = \frac{3}{5}, c = \frac{2}{5}, d = \frac{3}{5}, e = \frac{2}{5}$

Question 17

$a = 1 - p, b = p, c = 1 - p, d = p, e = 1 - p$

Question 18

p^2

Question 19

$\frac{96}{400}$

Question 20

0.657

Question 21

$\frac{671}{1296}$

Question 22

$n =$ 8

Question 23

$\frac{252}{343}$

Question 24

0.09

Question 25

$\frac{23}{390}$

Question 26

$\frac{502}{870}$

Question 27

$\frac{7}{18}$

Question 28

$\frac{5}{9}$

Question 29

$\frac{8}{56}$

Question 30

$a = -1$, $b = -90$

Question 31

9