

GCSE Mathematics (1MA1)

Themed papers – Probability

Compiled from student-friendly mark schemes

Please note that this mark scheme is not the one used by examiners for making scripts. It is intended more as a guide to good practice, indicating where marks are given for correct answers. As such, it doesn't show follow-through marks (marks that are awarded despite errors being made) or special cases.

It should also be noted that for many questions, there may be alternative methods of finding correct solutions that are not shown here – they will be covered in the formal mark scheme.

NOTES ON MARKING PRINCIPLES

Guidance on the use of codes within this mark scheme

M1 – method mark. This mark is generally given for an appropriate method in the context of the question. This mark is given for showing your working and may be awarded even if working is incorrect.

P1 – process mark. This mark is generally given for setting up an appropriate process to find a solution in the context of the question.

A1 – accuracy mark. This mark is generally given for a correct answer following correct working.

B1 – working mark. This mark is usually given when working and the answer cannot easily be separated.

C1 – communication mark. This mark is given for explaining your answer or giving a conclusion in context supported by your working.

Some questions require all working to be shown; in such questions, no marks will be given for an answer with no working (even if it is a correct answer).

Question 1 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$1 - 0.2 = 0.8$	P1	This mark is given for a method to solve the inequality
	0.4, 0.4	A1	This is mark is given for two correct answers (equivalent fractions acceptable)
(b)	$12 \div 0.2$	P1	This mark is given for a process to find the number of blue cubes in the box
	60	A1	This mark is given for the correct answer only

Question 2 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$1 - (0.2 + 0.35 + 0.4) = 0.05$	1	This mark is given for the correct answer only
(b)	20	1	This mark is given for stating that (at least) 20 counters are required
	The number of counters of each colour must be a whole number	1	This mark is given for a correct explanation

Question 3 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$1 - 0.17 - 0.18 - 0.09 - 0.15 - 0.1 = 0.31$	P1	This mark is given for a process to find the probability of throwing a 1
	$0.31 \times 200 = 62$ $0.18 \times 200 = 36$	P1	This mark is given for process to find an estimate of the number of 1s and 3s expected from 200 throws
	$62 + 36 = 98$	A1	This mark is given for the correct answer only

Question 4 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$1 - 0.45 - 0.25 = 0.3$	P1	This mark is given for a process to find the sum of the unknown probabilities
	$2x + x = 0.3$ $x = 0.1$ $P(\text{red}) = 0.2, P(\text{white}) = 0.1$	P1	This mark is given for a process to find the probabilities of taking red and white counters
	Number of counters in the bag = $\frac{18}{0.45} = 40$ Number of red counters = 40×0.2	P1	This mark is given for a process to find the number of red counters
	8	A1	This mark is given for the correct answer only
(b)	0.5 multiplied by an odd number will never be a whole number of counters, so there must be an even number of marbles in the box	C1	This mark is given for a correct explanation

Question 5 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	Median = 13th dress in order smallest to largest Size 12	B1	This mark is given for the correct answer only
(b)	No, categories are not mutually exclusive (a woman could be in both categories)	C1	This mark is given for a correct statement

Question 6 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{7}{9} \times \frac{2}{8} = \frac{14}{72}$	P1	This mark is given for a process to find the probability of choosing a green counter followed by a blue counter
	$\frac{2}{9} \times \frac{7}{8} = \frac{14}{72}$	P1	This mark is given for a process to find the probability of choosing a blue counter followed by a green counter
	$\frac{14}{72} + \frac{14}{72}$	P1	This mark is given for a process to find the probability of choosing one counter of each colour
	$\frac{28}{72} (= \frac{7}{18})$	A1	This mark is given for the correct answer only

Question 7 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	3 + 17 represents 80% of the counters	P1	This mark is given for using $1 - 0.2 = 0.8$
	3 : 17 : 5	P1	This mark is given for a process to find the ratio of purple counters
	$\frac{3}{25}$	A1	This mark is given for a correct answer only (or decimal equivalent)

Question 8 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$B : Y = 2 : 1$	1	This mark is given for a correct ratio for the blue and yellow cubes
	$B : Y : G = 2 : 1 : 8$	1	This mark is given for a correct ratio for the blue, yellow and green cubes
	$\frac{1}{2+1+8} = \frac{1}{11}$	1	This mark is given for the answer shown or an equivalent fraction

Question 9 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	Mel's results will give the best estimate since she drops the greatest number of drawing pins	1	This mark is given for a correct comment
(b)	$\frac{100}{150} \times \frac{50}{150} = \frac{2}{3} \times \frac{1}{3}$	1	This mark is given for a probability of point down multiplied by the probability of point up
	$\frac{2}{9}$	1	This mark is given for the correct answer only

Question 10 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$0.65 \times (1 - 0.65) + 0.65 \times (1 - 0.65)$	M1	This mark is given for a method to find the probability that counters of different colours are found
	0.455	A1	This mark is given for a correct answer only
(b)	$78 \div 0.65 = 120$	M1	This mark is given for a method to find the total number of counters
	$120 - 78 = 42$	A1	This mark is given for a correct answer only

Question 11 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{g}{r+g} = \frac{3}{7}$	P1	This mark is given for a process to find an initial relationship between r and g
	$\frac{g+3}{r+2+g+3} = \frac{6}{13}$	P1	This mark is given for a process to find a second relationship between r and g
	$7g = 3(r+g) = 3r + 3g$ $4g = 3r$ $13(g+3) = 6(r+g+5)$ $13g + 39 = 6r + 6g + 30$ $7g + 9 = 6r$	P1	This mark is given for simplifying the expressions for the relationships found
	$4g = 3r$ $7g + 9 = 6r$ $7g + 9 = 8g$	P1	This mark is given for a process to form simultaneous equations to be solved
	$g = 9$ $r = 12$	A1	This mark is given for the correct answer only (12 red, 9 green)

Question 12 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{4}{12} \times \frac{3}{11} \times \frac{2}{10}$	1	This mark is given for a method to find the probability of taking 3 red counters
	$\frac{1}{55}$	1	This mark is given for the answer shown or an equivalent fraction
(b)	$\frac{5}{15} \times \frac{4}{14} \times \frac{3}{13}$	1	This mark is given for calculating a relevant probability
	$= \frac{2}{91}$, so more likely since $0.022 > 0.018$	1	This mark is given for a correct conclusion supported by working

Question 13 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{5}{9} \times \frac{4}{8} = \frac{20}{72}$	P1	This mark is given for a process to find the probability that the product is an odd number
	$1 - \frac{20}{72}$	P1	This mark is given for a process to find the probability that the product is an even number
	$\frac{52}{72}$	A1	This mark is given for the correct answer only

Question 14 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\sqrt[4]{\frac{16}{81}} = \frac{2}{3}$	M1	This mark is given for a method to find the probability of throwing one head
	Probability of getting 4 tails = $\left(1 - \frac{2}{3}\right)^4 = \frac{1}{81}$	A1	This mark is given for the correct answer only

Question 15 (Total 6 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Let x be the number of green pens in the box The probability of taking two green pens is $\frac{x}{2x+3} \times \frac{x-1}{2x+2}$ The probability of taking two blue pens is $\frac{x+3}{2x+3} \times \frac{x+2}{2x+2}$	P1	This mark is given for a process to find the probability of taking two green pens or the probability of taking two blue pens
	The probability of taking two pens of the same colour is $\frac{x}{2x+3} \times \frac{x-1}{2x+2} + \frac{x+3}{2x+3} \times \frac{x+2}{2x+2} = \frac{27}{55}$	P1	This mark is given for forming an equation for the probability Simon takes two pens of the same colour
	$55(x(x-1) + (x+3)(x+2)) = 27(2x+3)(2x+2)$	P1	This mark is given for a process to eliminate fractions from the algebraic expression
	$55(2x^2 + 4x + 6) = 27(4x^2 + 10x + 6)$ $110x^2 + 22x + 330 = 108x^2 + 270x + 162$ $2x^2 - 50x + 168 = 0$ $x^2 - 25x + 84 = 0$	P1	This mark is given for reducing the expression to a quadratic equation
	$(x-21)(x-4) = 0$	P1	This mark is given for finding a method to solve the quadratic equation
	21	A1	This mark is given for the correct answer only

Question 16 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{6}{10} \times \frac{8}{11}$ or $\frac{4}{10} \times \frac{7}{11}$	P1	This process mark is given for finding an expression to represent a black counter being drawn from bag A followed by a black counter being drawn from bag B or for finding an expression to represent a white counter being drawn from bag A followed by a black counter being drawn from bag B
	$\left(\frac{6}{10} \times \frac{8}{11}\right) + \left(\frac{4}{10} \times \frac{7}{11}\right)$	P1	This process mark is given for adding the two expressions to find the probability that there are now more black counters than white counters in bag C
	$\frac{76}{110}$	A1	This accuracy mark is given for the correct answer only (or an equivalent fraction)

Question 17 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{7}{x+7}$ or $\frac{x}{x+6}$	P1	This mark is given for a process to start to solve problem
	$\frac{7}{x+7} \times \frac{x}{x+6} = \frac{21}{80}$	P1	This mark is given for a process to find the correct product
	$\frac{7x}{x^2 + 13x + 42} = \frac{21}{80}$ $21x^2 + 273x + 882 = 560x$ $21x^2 - 287x + 882 = 0$	P1	This mark is given for a process to rearrange and arrive at correct quadratic equation = 0
	$\frac{287 \pm 91}{42}$ or $7(3x - 14)(x - 9) = 0$	P1	This mark is given for a correct substitution into the quadratic formula or factorisation of the quadratic expression
	= 4.6667 and 9, so 9 counters	A1	This mark is given for the correct answer only

Question 18 (Total 5 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$P(OOO) = \frac{6}{9} \times \frac{5}{8} \times \frac{4}{7} = \frac{120}{504}$	P1	This mark is given for a process to find the probability of one combination of counters that give an odd number
	$P(OEE) = \frac{6}{9} \times \frac{3}{8} \times \frac{2}{7} = \frac{36}{504}$	P1	This mark is given for a process to find the probability of a second combination of counters that give an odd number
	$P(EOE) = \frac{3}{9} \times \frac{5}{8} \times \frac{2}{7} = \frac{36}{504}$	P1	This mark is given for a process to find the probability of a third combination of counters that give an odd number
	$P(EEO) = \frac{3}{9} \times \frac{6}{8} \times \frac{2}{7} = \frac{36}{504}$	P1	This mark is given for a process to find the probability of all four combinations of counters that give an odd number
	$P(\text{odd}) = \frac{120}{504} + \frac{36}{504} + \frac{36}{504} + \frac{36}{504}$ $= \frac{228}{504}$	A1	This mark is given for the correct answer only

Mark scheme for 1MA1 Higher themed papers: Probability

Performance data:

Q	Taken from			Total Marks available	TOPIC	Spec Ref	AO	% Mean marks	Edexcel mean averages Marks of candidates who achieved grade:										
	Q	Series	Paper						ALL	9	8	7	6	5	4	3	2	1	U
1a	1a	June 2019	1H	2	Probability	P4	1	98	1.96	1.99	1.98	1.97	1.97	1.96	1.95	1.87	-	-	1.60
1b	1b	June 2019	1H	2	Probability	P4	1	93	1.85	1.98	1.96	1.92	1.88	1.83	1.68	1.33	-	-	0.90
2a	10a	Nov 2017	3H	1	Probability	P4	1	82	0.82	1	0.97	0.99	0.99	0.96	0.89	0.76	-	-	0.55
2b	10b	Nov 2017	3H	2	Probability	P1	2	14	0.29	1.38	1.18	1.09	1	0.59	0.24	0.07	-	-	0.03
3	1	June 2017	2H	3	Probability	P2 P4	3	76	2.29	2.8	2.66	2.51	2.37	2.17	1.84	1.27	-	-	0.76
4a	6a	June 2018	3H	4	Probability	P4, A21, R6	3	76	3.04	3.84	3.64	3.42	3.17	2.83	2.34	1.68	-	-	1.06
4b	6b	June 2018	3H	1	Probability	P4	2	46	0.46	0.77	0.67	0.57	0.47	0.38	0.27	0.14	-	-	0.06
5a	3a	June 2017	3H	1	Statsitics	S4	1	73	0.73	0.95	0.89	0.81	0.75	0.67	0.55	0.38	-	-	0.25
5b	3b	June 2017	3H	1	Probability	P8	2	9	0.09	0.2	0.09	0.07	0.07	0.08	0.08	0.05	-	-	0.03
6	17	June 2017	1H	4	Probability	P8	3	63	2.5	3.87	3.68	3.3	2.72	1.94	1.04	0.39	-	-	0.14
7	16	June 2018	1H	3	Probability	P4	3	46	1.39	2.85	2.41	1.88	1.39	0.93	0.46	0.11	-	-	0.03
8	4	Nov 2017	2H	3	Ratio	R8 P7 R6	3	43	1.28	1.88	2.26	2.59	2.3	1.97	1.33	0.94	-	-	0.56
9a	8a	Nov 2017	3H	1	Probability	P5	3	33	0.33	0.88	0.79	0.66	0.54	0.44	0.37	0.24			0.18
9b	8b	Nov 2017	3H	2	Probability	P8, S2	2	9	0.17	1.62	1.44	1.01	0.81	0.32	0.07	0.02			0.00
10a	16a	Nov 2018	2H	2	Probability	P9	1	27	0.54	1.9	1.56	1.38	1.17	0.83	0.33	0.11	-	-	0.04
10b	16b	Nov 2018	2H	2	Probability	P9	1	42	0.84	1.9	1.85	1.61	1.52	1.14	0.75	0.28	-	-	0.17
11	22	June 2019	1H	5	Probability	P8, A19	3	12	0.62	3.61	1.37	0.52	0.23	0.11	0.04	0.01	-	-	0.01
12a	21a	Nov 2017	2H	2	Probability	P8 P9	1	7	0.14	1.25	1.59	1.08	0.6	0.25	0.05	0.01	-	-	0
12b	21b	Nov 2017	2H	2	Probability	P8	2	3	0.05	0.38	0.85	0.42	0.2	0.06	0.01	0	-	-	0
13	16	Nov 2019	2H	3	Probability	P6, P9	3	6	0.19	1.78	1.22	0.61	0.4	0.17	0.05	0.03	-	-	0.01
14	21	Nov 2019	3H	2	Probability	P7, P8	3	5	0.09	1.56	0.76	0.52	0.17	0.02	0.01	0	-	-	0

15	22	Nov 2018	1H	6	Probability	P9, A19, A21	3	1	0.04	2.80	0.67	0.21	0.04	0.02	0.00	0.00	-	-	0.00
16	24	Mock Set 1	1H	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	25	Mock Set 2	2H	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	20	Mock Set 3	3H	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				67						41.19	34.49	29.14	24.76	19.67	14.35	9.69	-	-	6.38