

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Probability

Sample space diagrams (non-calculator)

v1.0

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. e.g. accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
3.14...	Allow answers which begin 3.14 e.g. 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

Instructions on marking will be given but usually marks are not awarded to students who show no working.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Q1.

- (a) 3 in left column

B1

5 in top row

B1

All products correct

ft their 3 and their 5

B1ft 3 to 10 correctly evaluated products

B2ft

Additional Guidance

If their 3 is 0, 1 or 5, do not consider those products

If their 5 is 0, 2, 3 or 7, do not consider those products

- (b)

their number of square numbers

their number of completed cells

oe fraction

ft their table even if incomplete

B1ft their number of square numbers as a numerator

or their number of completed cells as a denominator

or square numbers identified on their grid or in working

B2ft

Additional Guidance

ft must produce a non-zero probability to score

Ignore attempt to simplify or convert if correct fraction seen

[6]

Q2.

- (a) Fully correct table

14	19	25
19	24	30
25	30	36

B1 for 5 or more correct values in the correct places

B2

- (b) Identifies the square numbers in their completed table

or

lists the square numbers up to at least 36

Any indication

M1

$\frac{3}{9}$ or $\frac{1}{3}$

oe fraction, decimal or percentage

ft their completed table

Accept 0.33...

*Do **not** accept 0.3*

A1ft

Additional Guidance

If there are no square numbers in their completed table

award both marks for an answer of 0 oe

[4]

Q3.

- (a) All values correct

B1 one correct row or one correct column

B2

Additional Guidance

	2	2	3	5
1	2	2	3	5
2	0	0	3	5
4	4	4	4	5
6	6	6	6	6

- (b) $\frac{5}{16}$

*oe fraction, decimal or percentage
ft their table if at least 8 values*

B1ft

Additional Guidance

Answer must match their table, if table blank, accept $\frac{5}{16}$ (oe) for B1
5 out of 16, 5 in 16, 5 : 16

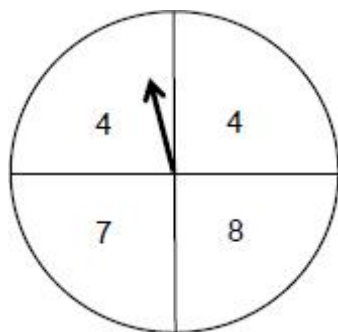
B0

$$\frac{5}{16} \text{ (matches their table)} = \frac{1}{4}$$

B1ft

(ignore further work)

- (c)



*numbers can be in any section
if the spinner is blank, mark the top row of table, where the
numbers must be in the order 4 4 7 8 for B2
B1 for any two or three correct numbers on spinner or, if
spinner is blank, in the correct position in the table*

B2

Additional Guidance

Ignore any other values written in table
Spinner takes precedence over table
eg top row of table is 4 4 7 8 spinner is 2 3 5 8

B0

[5]

Q4.

Alternative method 1

Lists at least 5 correct combinations or at least 5 correct outcomes or constructs correct two-way table

eg

17 and 12 or 29

17 and 23 or 40

17 and 15 or 32

17 and 16 or 33

12 and 23 or 35

12 and 15 or 27

12 and 16 or 28

23 and 15 or 38

23 and 16 or 39

15 and 16 or 31 or

	17	12	23	15	16
17					
12					
23					
15					
16					

outcomes may be seen in the two-way table

ignore additional combinations such as 17 and 17 for M1

ignore any totals in a correctly constructed two-way table

17 and 12 & 12 and 17 are accepted as two different

combinations

M1

Fully correct list or two-way table

eg

29, 40, 32, 33, 35, 27, 28, 38, 39, 31

or 40, 32, 33, 35, 38, 39, 31 or

	17	12	23	15	16
17		29	40	32	33
12	29		35	27	28
23	40	35		38	39
15	32	27	38		31
16	33	28	39	31	

accept ticks/crosses with correct pairs instead of values

in the two-way table, it is acceptable to have only one set of

ten cells completed (top right or bottom left) if all correct

accept ticks and/or crosses in cells

do not accept incorrect combinations such as 17 and 17 for A1

A1

$\frac{7}{10}$ or 0.7 or 70%

oe

ft their list or two-way table with M1 scored and a probability >

0 and < 1

A1ft

Alternative method 2

States that outcomes of 30 or under may only be achieved by using the 12 oe

M1

Lists the three (or six) combinations which give outcomes of 30 or under

12 and 15 (15 and 12)

12 and 16 (16 and 12)

12 and 17 (17 and 12)

or

Lists the three outcomes of 30 or under (may be repeated)

27

28

29

A1

$\frac{7}{10}$ or 0.7 or 70%

oe ft their list with M1 scored and a probability < 0 and > 1
eg if only 27 and 28 found
and
answer 0.8 given
score M1A0A1ft

A1ft

Additional Guidance

Correct answer with no incorrect working

M1A1A1

If work is crossed out, this may be the removal of totals not above 30 and these should still be considered if appropriate

This example shows that the answer 0.7 may not score full marks.

	17	12	23	15	16
17		29	40	32	33
12	29		36	27	28
23	40	36		37	39
15	32	27	37		31
16	33	28	39	31	

and answer of 0.7

M1A0A1ft

This is an example of following through from their table to give A1ft.

	17	12	23	15	16
17		29	40	32	33
12	29		35	27	28
23	40	36		38	39
15	32	27	37		21
16	33	28	39	21	

and answer of 0.6

M1A0A1ft

Ignore use of probability words unless contradictory

[3]

Q5.

- (a) 16 in top row

B1

5 in left column

B1

All totals correct or all totals correct including for their 16 and their 5

B1ft for seven or more correct totals for the given numbers and their 16 and their 5 (if present)

If their 16 is 0, 1, 4 or 9, do not consider those totals

If their 5 is 0, 2, 3 or 7, do not consider those totals

B2ft

Additional Guidance

Fully correct table

+	1	4	9	16
2	3	6	11	18
3	4	7	12	19
5	6	9	14	21
7	8	11	16	23

B4

- (b) their correct number of primes

their number of completed cells

$\frac{6}{16}$ or $\frac{3}{8}$ if (a) fully correct

oe

ft their table even if incomplete but must be attempted

B1ft

Additional Guidance

Correct decimal and percentage values are 0.375 and 37.5%

Do not accept truncated or rounded values unless the correct value has been seen

Do not accept ratios or words

+	1	4	9	
2	3	6	11	
3	4	7	12	
7	8	11	16	

Answer $\frac{4}{9}$

B1ft

[5]

Q6.

(a) $\frac{1}{5}$

oe

B1

Alternative method 1

(b) 25 outcomes for 2 spins

Implied by a probability with denominator 25 or by a 5 by 5 possibility space diagram

M1

All 6 ways of getting a total of 4 identified

eg in a possibility space diagram or in a list

M1

$$\frac{6}{25}$$

oe

No incorrect totals should be seen for this mark

A1

Alternative method 2

$$\frac{2}{5} \times \frac{2}{5} \text{ or } \frac{1}{5} \times \frac{1}{5}$$

oe

M1

$$\frac{2}{5} \times \frac{2}{5} + \frac{1}{5} \times \frac{1}{5} + \frac{1}{5} \times \frac{1}{5}$$

oe

M1

$$\frac{6}{25}$$

oe

A1

[4]

Q7.

(a) Fully correct table

16	25	40
25	34	49
40	49	64

B1 for 6, 7 or 8 correct values in the correct places

B2

(b) Identifies the square numbers in their completed table

or

lists the square numbers up to at least 64

Any indication

M1

$$\frac{6}{9} \text{ or } \frac{2}{3}$$

oe fraction, decimal or percentage

ft their completed table

Accept 0.66... or 0.67

*Do **not** accept 0.6 or 0.7*

A1ft

Additional Guidance

If there are no square numbers in their completed table award both marks for an answer of 0 oe

[4]

Q8.

Alternative method 1

$$45 \times \frac{5}{3} \text{ or } 75$$

75 seen as total of Small column implied by 120 seen as overall total

M1

$$\begin{aligned} &(\text{their } 75 + 45) \div (1 + 3) \\ &\text{or } 120 \div 4 \\ &\text{or } 30 \text{ (Yellow)} \end{aligned}$$

30 seen as total of Yellow row

M1dep

$$\begin{aligned} &\text{their } 30 - 12 \\ &\text{or } 18 \text{ (Large Yellow)} \end{aligned}$$

18 in Large Yellow cell

M1dep

27

Accept 27 in correct cell if answer blank

A1

Alternative method 2

$$45 \times \frac{5}{3} \text{ or } 75$$

75 seen as total of Small column implied by 120 seen as overall total

M1

$$\begin{aligned} &\text{their } 75 - 12 \\ &\text{or } 63 \text{ (Small Green)} \end{aligned}$$

63 in Small Green cell

M1dep

$$\begin{aligned} &(\text{their } 75 + 45) \div (1 + 3) \times 3 \\ &\text{or } 120 \div 4 \times 3 \\ &\text{or } 90 \text{ (Green)} \end{aligned}$$

*dep on first M1
90 seen as total of Green row*

M1dep

27

Accept 27 in correct cell if answer blank

A1

Alternative method 3

$$45 \times \frac{5}{3} \text{ or } 75$$

75 seen as total of Small column implied by 120 seen as overall total

M1

$$\begin{aligned} &\text{their } 75 - 12 \\ &\text{or } 63 \text{ (Small Green)} \end{aligned}$$

63 in Small Green cell

M1dep

$$\begin{aligned} &\text{their } 63 + x = 3(45 - x + 12) \\ &\text{oe } 63 + x = 171 - 3x \end{aligned}$$

M1dep

27

Accept 27 in correct cell if answer blank

A1

Additional Guidance

In alt 2, 90 only implies M1M0M1 – 63 is also needed for M1M1M1

[4]

Q9.

- (a) $0.16 + 0.24 + 0.16 + 0.24$
or $0.8(0)$

M1

0.2

oe

A1

- (b) $0.4(0)$

B1

- (c) **Alternative method 1**

$4 \div 0.16$ or

1 number $\leftrightarrow 0.04$

oe

M1

25

oe

A1

Alternative method 2

0.24

0.16 $\times 4$ or 6 or

their x

0.16 $\times 4$ or 5

oe

Attempt to work out how many prime numbers in the range 361

$\leq n < 390$ or $421 \leq n < 450$ or $331 \leq n < 360$

M1

25

A1

[5]