

8300

GCSE MATHEMATICS

Foundation tier – Questions by Topic – Mark Scheme

Probability

Calculating experimental probabilities

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.

Arrow at 0 labelled B

B1

Arrow at $\frac{1}{6}$ labelled C

B1

[2]

Q2.

$\frac{8}{10}$
or $10 - 5 - 3$
or 2

oe

M1

$\frac{2}{10}$

oe

A1

[2]

Q3.

(a) $\frac{3}{5}$

oe

B1

(b) **Alternative method 1**

25 outcomes for 2 spins

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

M1

One way of attaining 8

eg in a possibility space diagram or sight of $4 + 4$ or $1/5$ seen twice

M1

$\frac{1}{25}$

A1

oe

Alternative method 2

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

oe

M1

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

oe

M1

$\frac{1}{25}$

A1

oe

[4]

Q4.

$$\frac{20}{32} \text{ or } \frac{15}{24}$$

oe
0.625 or 62.5%

B1

A correct probability from each bag, with attempt at a comparable form, with at least one correct

eg denominator same for both

$$\frac{60}{96} \text{ twice, } \frac{5}{8} \text{ twice oe}$$

or 0.625 twice
or 62.5% twice

M1

No ticked **AND** both probabilities correct
and in the same format

eg No both the same with the correct value given

A1

Additional Guidance

if same ratio (e.g. 5:3 or 3:5) seen for both and tick NO

B1M1A1

[3]

Q5.

(a) $180 + 170 + 50$ or 400

may be seen as the denominator

M1

$$\frac{50}{400} \text{ oe}$$

A1

(b) **Alternative method 1**

$$16 \times \frac{180 + 170 + 50}{50} \text{ or}$$

$$16 \times \frac{400}{50} \text{ or 2 oe fraction, decimal or percentage } 180 + 170 + 50 \text{ may come from (a)}$$

M1

Yes and 2

A1

Alternative method 2

$$(180 + 170 + 50) \div 16$$

$$\text{or } 400 \div 16$$

$$\text{or } 25$$

and

$$50 \div \text{their } 25$$

$$\text{or } 2 \text{ oe } 180 + 170 + 50 \text{ may come from (a)}$$

M1

Yes and 2

A1

Alternative method 3

$$(180 + 170 + 50) \div 50$$

$$\text{or } 400 \div 50$$

$$\text{or } 8$$

and

$$16 \div \text{their } 8$$

$$\text{or } 2 \text{ oe } 180 + 170 + 50 \text{ may come from (a)}$$

M1

Yes and 2

A1

[4]

Q6.

(a) $\frac{2}{5}$
 or $\frac{30}{5}$
 or $(30 \div 5 =) 6$ or 5×6
oe fraction, decimal or percentage
implied by $2 \times \frac{30}{5}$ or 2×6

M1

12

SC1 18

A1

Additional Guidance

Accept a fully correct ratio build up method:

eg 2 : 5, 4 : 10, 6 : 15, 8 : 20, 10 : 25, 12 : 30 with nothing on answer line

M1A0

eg 2 : 3, 4 : 6, 6 : 9, 8 : 12, 10 : 15, 12 : 18 with nothing on answer line

M1A0

$30 \div 5 = 6$ and $30 \div 3 = 10$ and $30 \div 2 = 15$ (choice)

M0A0

6 must not come from 2×3

(b) $30 + 3$ or $35 - 2$ or 33

or $(1 -) \frac{2}{35}$

oe

M1

$\frac{33}{35}$

oe fraction, decimal or percentage

A1

Additional Guidance

Ignore attempts to simplify or convert a correct fraction

Ignore probability words

Decimals or percentages to 2sf or better

Condone 33 out of 35 or 33 in 35 with a correct fraction, decimal or percentage (together on answer line)

M1A1

but do not accept 33 : 35 with a correct fraction, decimal or percentage (together on answer line)

M1A0

[4]

Q7.

Alternative method 1

$$x + 2x + 2x + 10 \text{ or } 5x + 10$$

$$\text{or } x + 2x + 2x + 10 + 90$$

$$\text{or } 5x + 100 \text{ oe}$$

M1

$$x + 2x + 2x + 10 = 360 - 90$$

$$\text{or } 5x + 10 = 270$$

$$\text{or } x + 2x + 2x + 10 + 90 = 360$$

$$\text{or } 5x + 100 = 360$$

$$\text{or } 5x = 260 \text{ oe}$$

M1dep

$$(x =) 52 \text{ or } 2x = 104$$

$$\text{or } 2x + 10 = 114$$

may be on diagram

A1

$$\frac{114}{360} \text{ or } \frac{57}{180} \text{ or } \frac{38}{120} \text{ or } \frac{19}{60}$$

$$\text{or } 0.31(6..) \text{ or } 0.317 \text{ or } 0.32$$

$$\text{or } 31(.6...) \% \text{ or } 31.7 \% \text{ or } 32 \%$$

$$\text{ft } \frac{2 \times \text{their } 52 + 10}{360}$$

$$\text{or } \frac{\text{their angle for C}}{360}$$

B1ft

Alternative method 2

$$\frac{90}{360} + \frac{x}{360} + \frac{2x}{360} + P(C) = 1$$

$$\text{or } \frac{90}{360} + \frac{x}{360} + \frac{2x}{360} + \frac{2x + 10}{360}$$

$$\text{or } \frac{2x + 10}{5x + 100} \text{ oe}$$

M1

$$\frac{90}{360} + \frac{x}{360} + \frac{2x}{360} + \frac{2x + 10}{360} = 1 \text{ oe}$$

M1dep

$$(x =) 52 \text{ or } 2x = 104$$

$$\text{or } 2x + 10 = 114 \text{ may be on diagram}$$

A1

$$\frac{114}{360} \text{ or } \frac{57}{180} \text{ or } \frac{38}{120} \text{ or } \frac{19}{60}$$

$$\text{or } 0.31(6..) \text{ or } 0.317 \text{ or } 0.32$$

$$\text{or } 31(.6...) \% \text{ or } 31.7 \% \text{ or } 32 \%$$

$$\text{ft } \frac{2 \times \text{their } 52 + 10}{360} \text{ or } \frac{\text{their angle for C}}{360}$$

B1ft

Additional Guidance

Ignore incorrect simplification or conversion after $\frac{114}{360}$ oe

M1M1A1B1

$$\frac{360 - 10 - 90}{5} \text{ oe}$$

M1M1

$$x + 2x + 2x + 10 \text{ followed by } 6x + 10 = 270$$

M1M0

Do not accept decimal within fraction for final answer if correct fraction not seen
The follow through is not available if A1 awarded

[4]

Q8.

Arrow at 0 labelled B

B1

Arrow at $\frac{1}{6}$ labelled C

B1

[2]

Q9.

(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

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

M1

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

M1

$$\frac{6}{25} \text{ oe}$$

A1

[4]

Q10.

$\frac{10}{30}$ or $\frac{8}{20}$ seen. oe
*0.33(...) or 0.4
 or 33(...) % or 40%*

B1

A correct probability from each bag, with attempt at a comparable form, with at least one correct

eg
 $\frac{20}{60}$ and $\frac{24}{60}$ or 0.33(...) and 0.4 or 33(...) % and 40%

M1

No and both probabilities correct

and in the same format *eg Incorrect and* $\frac{20}{60}$ and $\frac{24}{60}$ *seen*
*No and 0.33(...) and 0.4
 No and 33(...) % and 40%*

A1

[3]

Q11.

- (a) 0.4 (relative frequency of carp)
or 1 (bream) *oe*

B1

their roach frequency $\div 10$ (must be less than 1)
or 1 – their carp relative frequency – 0.1
or 0.5 *oe*

M1

Fully correct table *ie*

(4)	1	5
0.4	(0.1)	0.5

oe accept equivalent fractions or percentages for relative frequencies throughout

A1**Additional Guidance**

If table fully correct award 3 marks. If not check for 0.4 **or** 1.
Either scores B1. Then check last column/bottom row. If the
roach relative frequency = roach frequency $\div 10$ **or** if the total
of the relative frequencies is 1 then award M1.

- (b) Increase sample size
Repeat it
Check some more
Catch more fish *oe*

B1**Additional Guidance**

Count it again, catch more fish
Last bit scores

B1

Fish on more days
More implies increased sample

B1

Fish for longer
Longer implies increased sample

B1

Fish on different days
Different does not imply increased sample

B0

Do the estimate twice
Not implying increasing sample

B0

Catch them all
Not a sample

B0

Experiment at different times of day
Not implying increasing sample

B0**[4]****Q12.**

- (a) Cannot say and reason
eg, don't know how many boys and girls there are

B1

- (b) $\frac{7}{30}$

B1**[2]**

Q13.

(a) 56 – 17 or 39

M1

13

A1**Additional Guidance**

M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen in multiple attempts

Ignore any values for blue or white cubes

eg

G B W R

17 13 13 13

With R unambiguously linked with 13

May be seen as a ratio

Unless contradicted on the answer line is awarded M1A1

17 (+) 13 (+) 13 (+) 13 without 13 linked to red

M1A0

13 and answer 13 out of 56

M1A113 and answer $\frac{13}{56}$ **M1A0**

13 and answer 56

M1A0Answer $\frac{13}{56}$ **M1A0**

(b) 56 + 24 or 80

M10.4 × their 80 or 32 oe eg $0.4 \times 56 + 0.4 \times 24$ or $9.6 + 22.4$ **M1dep**

15

A1**Additional Guidance**

M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen in multiple attempts

15 and answer 15 out of 24

M1M1A115 and answer $\frac{15}{24}$ or $\frac{5}{8}$ **M1M1A0**Answer $\frac{15}{24}$ **M1M1A0**

80 seen embedded in a fraction

M1Answer $\frac{3}{8}$ with no other creditworthy work**M0M0A0**Condone $80 \times 40\%$ **M1M1**

40% of 80 is 2nd M0 unless recovered

Build up methods for finding 40% of 80 must be completed to be awarded the M mark

eg 80 followed by $10\% = 8$ and $4 \times 8 = 32$ **M1M1**eg $0.1 \times 80 = 8$ and $4 \times 8 = 32$ **M1M1**eg 80 followed by $10\% = 8$ and $4 \times 8 = 32$ **M1M0****[5]**

Q14.

- (a) $36 \times \frac{4}{9}$ or 16 (Soft) or $36 \times \frac{5}{9}$ or 20 (Hard) or $36 \times \frac{1}{3}$ or 12 (Dark) or $36 \times \frac{2}{3}$ or 24 (Milk) or implied by the numbers in the relevant row or column making the correct total
accept 16 seen in Milk Soft accept 12 in Dark Hard

M1

	Hard	Soft
Milk	13	11
Dark	7	5

A2 two of Milk Soft = 11, Dark Hard = 7 and Milk Hard = 13
A1 Milk Soft = 11 or Dark Hard = 7

A3

Additional Guidance

	Hard	Soft
Milk	10	11
Dark	7	5

M1A2

	Hard	Soft
Milk	10	11
Dark	10	5

M1A1

For M1 the values must be seen outside the table or implied by the table but also accept 16 seen in Milk Soft or 12 in Dark Hard

	Hard	Soft
Milk	10	16
Dark	5	5

M1

(b)

$$\frac{5}{36} \text{ or } 0.13\bar{8} \text{ or } 13.\bar{8}\%$$

oe fraction, decimal or percentage
accept rounding to 2 sf or better

B1

Additional Guidance

Ignore incorrect simplification or conversion attempt to fraction, decimal or percentage (but not ratio) after correct probability seen
Do not allow eg 5 in 36 or 5 out of 36 unless the correct probability seen
Do not allow ratio
Ignore words if correct probability seen

(c)

$$\frac{\text{their } 20}{36} \text{ or } \frac{5}{9} \text{ or } 0.\bar{5} \text{ or } 55.\bar{5}\%$$

oe fraction, decimal or percentage
correct or ft their Hard total from the table
accept rounding to 2 sf or better

B1ft

Additional Guidance

Ignore incorrect simplification or conversion attempt to fraction, decimal or percentage (but not ratio) after correct probability seen
Do not allow eg 20 in 36 or 20 out of 36 unless the correct probability seen
Do not allow ratio
Ignore words if correct probability seen

[6]

Q15.

(a) 0.09×1400

oe

M1

126

A1

Additional Guidance

M1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts

Do not ignore further working after 126 seen

Do not allow a misread of 0.9 for 0.09

$1400 - 126 = 1274$ in working

M1

126

1400 in working

M1

126

1400 on answer line

M1A0

(b) **Alternative method 1**

$0.67 + 0.48 = 1.15$

and

the sum (of the probabilities) is greater than 1

or

$0.67 + 0.48 = 1.15$

and

0.15 study both

or

$0.67 + 0.48 = 1.15$

and

more than the total number of students at school

oe

B1 1.15 oe

or

the sum (of the probabilities) is greater than 1

or

0.15 oe

B2

Alternative method 2

$938 + 672 = 1610$

and

more than the total number of students at school

or

$938 + 672 = 1610$

and

the total (number of students) is greater than 1400

or

938 and 672

and

210 study both

oe

B1 0.67×1400 oe and 0.48×1400 oe

or 938 and 672

or 1610

or the total (number of students) is greater than 1400

or 210

B2

Additional Guidance

B1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts

$$938 + 672 = 1610 \text{ and } 1610 > 1400$$

B2

$$938 + 672 = 1610 \text{ and students doing both as more than the total}$$

B2

$$0.67 + 0.48 = 1.15 \text{ and } 1.15 > 1$$

B2

$$67 + 48 = 115 \text{ and students doing both as over 100}$$

B2

$$67 + 48 = 115 \text{ and } 15\% \text{ doing both}$$

B2

$$67 + 48 = 115 \text{ and } 15 \text{ doing both}$$

B1

$$0.67 + 0.48 = 1.15 \text{ and needs to add to one}$$

B1

$$67 + 48 = 115$$

B1

$$0.67 + 0.48 = 1.15 \text{ and students doing both as over 100 (must be consistent form for comparison)}$$

B1

$$\frac{938}{1400} \text{ and } \frac{672}{1400}$$

B1

$$0.67 + 0.48 \text{ is more than } 1$$

B1**[4]**

Q16.

- (a) (One test) One and a half symbols
allow any orientation for the half circle

B1

(Two tests) Three symbols

B1

(Three tests) Four symbols

SC1 totals seen for either pictogram

ie 12, 16, 6 for group A

or 6, 12, 16 or 1.5, 3, 4 for group B

B1

Additional Guidance

Mark intention eg accept any attempt at circle and half circle symbol (unless obviously intended to be quarter or three-quarter circle) and allow different sizes and symbols such as plain circles

Two half circle symbols are not acceptable for a whole circle (unless joined to make a circle)

Alignment of symbols is not being tested

Apart from the Special Case, ignore numbers given

SC1 may be implied by 6, 12 and 16 symbols

One test	
Two tests	
Three tests	

B1B1B1

- (b) $\frac{17}{25}$ or 0.68 or 68%
or

25 – 17 or 8 seen oe

may be seen in a calculation

eg 1 – $\frac{17}{25}$

M1

$\frac{8}{25}$ or 0.32 or 32% oe

A1

Additional Guidance

Ignore simplification or conversion if correct answer seen

$\frac{8}{25}$ in working or on answer line with 8 on answer line

M1A0

Ignore words if correct answer seen eg $\frac{8}{25}$ unlikely

M1A1

Answer 8 : 25 or 8 : 17 or 17 : 8 (even if correct answer also seen)

M1A0

8 out of 25 without correct answer seen

M1A0

Answer 17 : 25 only

M0A0

eg $\frac{8}{17}$ or $\frac{1}{8}$ or 8% implies 8

M1

[5]

Q17.

$$\frac{7}{10}, 0.705, 72\%$$

with no incorrect conversions

accept in any format

eg 0.7, 0.705, 0.72

B1 correctly converts at least one to a different form which shows at least two in comparable form

eg 0.72 or 70.5(%) or 0.7 or 70(%)

$$\text{or } \frac{72}{100} \text{ and } \frac{70}{100}$$

B2

Additional Guidance

Condone missing percentage signs

Examples of probabilities in the same comparable form

70(%), 70.5(%), (72%)

0.7(00), (0.705), 0.72(0)

$$\left(\frac{7}{10}\right), \frac{7.05}{10}, \frac{7.2}{10} \text{ or } \frac{70}{100}, \frac{70.5}{100}, \frac{72}{100} \text{ or } \frac{700}{1000}, \frac{705}{1000}, \frac{720}{1000}$$

$\frac{7}{10}, 0.705, 72(\%)$ with no working

B2

Award B2 with no incorrect conversions

$$\text{eg1 Answer } \frac{7}{10}, 0.705, 72(\%) \text{ with } \frac{28}{40} \text{ and } \frac{70.5}{100}$$

$$\text{eg2 Answer } \frac{7}{10}, \frac{705}{1000}, \frac{72}{100} \text{ with no incorrect conversions}$$

with no incorrect conversions

B2

Do not award B2 with an incorrect conversion

$$\text{eg } \frac{7}{10}, 0.705, 72(\%) \text{ with } 70(\%) \text{ and } 70.05(\%)$$

B1

$$\frac{72}{100} \text{ and } \frac{705}{1000} \text{ and } \frac{7}{10} \text{ in working (not comparable conversions)}$$

B0

$$\frac{141}{200} \text{ alone without } \frac{140}{200} \text{ or } \frac{144}{200}$$

B0

[2]

Q18.

(a) 1

B1

Additional Guidance

1 with 10 indicated as the greatest frequency eg 1 scores 10

B1

1 (10)

B0

1, 10 is the most

B0

1 and 10

B0

(b) $(0 \times 7 \text{ and}) 1 \times 10 \text{ and } 2 \times 8$
and $3 \times 7 \text{ and } 4 \times 5 \text{ and } 5 \times 3$
or $(0 \text{ and}) 10 \text{ and } 16 \text{ and } 21$
and $20 \text{ and } 15 \text{ or } 82$

allow one error or omission

M1

$$\frac{(0+) 10+16+21+20+15}{40}$$

or $82 \div 40$ or their $82 \div 40$ oe eg $\frac{82}{40}$ or $\frac{41}{20}$ or $2\frac{1}{20}$

M1dep

2.05 *accept 2.1 or 2 with $82 \div 40$ seen*

A1

Additional Guidance

$82 \div 6$ or $82 \div 15$

M1M0

$0 \times 7 + 1 \times 10 + 2 \times 8 + 3 \times 7 + 4 \times 5 + 5 \times 2$ (5×2 is one error)
 $77 \div 40 = 1.925$

M1M1A0

$7 + 10 + 16 + 21 + 20 + 15$ (7 is one error)
 $89 \div 40 = 2.225$

M1M1A0

$10 + 21 + 20 + 15$ (16 missing is one omission)
 $66 \div 40 = 1.65$

M1M1A0

$(0+) 10 + 16 + 21 + 20 + 15 \div 40$ with missing brackets not recovered

M1M0

Correct products or values seen but a different method used is a choice of methods

eg $(0) 10 16 21 20 15$ followed by $40 \div 6$ or $40 \div 15$

M0

(c) $10 + 8 + 7 + 5 + 3$ or 33

or $40 - 7$ or 33 or $\frac{1}{40}$ oe

M1

$$\frac{33}{40} \text{ or } 0.825 \text{ or } 82.5\% \text{ oe accept } 0.83 \text{ or } 83\%$$

A1

Additional Guidance

M1 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts

Ignore conversion attempt after correct answer seen

33 out of 40

M1A0

$33 : 40$

M1A0

[6]

Q19.

Alternative method 1

$$0.49 \times (250 + 50)$$

or

$$0.49 \times 300 \text{ or } 147$$

oe

M1

their 147 – 128 or 19

M1dep

19 : 31

SC2 answer 31 : 19

A1

Alternative method 2

$$(1 - 0.49) \times (250 + 50)$$

or

$$0.51 \times 300 \text{ or } 153$$

oe

M1

their 153 – 122 or 31

M1dep

19 : 31

SC2 answer 31 : 19

A1

Additional Guidance

Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts

147 : 153 or 153 : 147

M1M0A0

0.49 : 0.51

M0M0A0

Beware of 147 and 153 from incorrect working

$$122 + 25 = 147$$

M0

$$128 + 25 = 153$$

M0

[3]

Q20.

(a) $\frac{33}{120}$ or $\frac{11}{40}$ or 0.275 or 27.5%
oe fraction, decimal or percentage

B1

Additional Guidance

Correct answer seen with an answer of 33

B0

Ignore simplification or conversion if correct answer seen

eg1 $\frac{33}{120}$ seen Answer $\frac{3}{10}$

B1

eg2 0.275 seen Answer 0.28

B1

eg3 $\frac{11}{40}$ seen Answer 27.5

B1

Ignore words if correct answer seen

eg1 $\frac{33}{120}$ seen Answer 11 out of 40

B1

eg2 $\frac{33}{120}$, unlikely

B1

Answer given as ratio (even if correct answer also seen)
eg 33 : 120

B0

Answer only in words eg 33 out of 120

B0

Only 27.5 (without %)

B0

Only 27% or 28%

B0

Only 0.27 or 0.28

B0

Only $\frac{1.1}{4}$

B0

(b) $\frac{6}{120} \times 500$

or

$[4.16, 4.17] \times 6$ or $[24.96, 25.02]$

or 4.2×6 or 25.2

or

25 : 500 or $\frac{25}{500}$

oe eg 0.05×500 or $500 \div 20$

M1

25

A1

Additional Guidance

Working and value may be seen by table

24 + 1, Answer 25

M1A1

480 = 24, Answer 25

M1A1

Embedded but not selected as answer eg $137.5 + 337.5 + 25 = 500$

M1A0

Working for Not answered or Answered but sale **not** made is not choice eg
ignore 137.5 and 337.5 seen
25 followed by answer 19

M1A0

If rounded or truncated values are used, the final answer must be exactly 25
eg1 $500 \div 120 = 4.16$, 4.16×6

M1

Answer 25 (may have kept full value on calculator)

A1

eg2 $500 \div 120 = 4.16$, $4.16 \times 6 = 24.96$

M1

Answer 25 (comes from further rounding)

A0

[3]

Q21.

- (a) Valid reason
Any indication that actual outcomes do not always match theoretical probability
eg
It's just chance
Might get more than two of one letter

B1

- (b) $13 + 10 + 7$
or $50 - 20$ or 30 oe

M1

$$\frac{30}{50} \text{ or } \frac{3}{5} \text{ or } 0.6$$

A1

[3]

Q22.

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

B1

[1]

Q23.

- (a) 290 and 113

B1

271

ft their 290 - 19
or 500 - their 113 - 97 - 19

B1ft

- (b) $\frac{97+19}{500}$ or $\frac{97}{500}$ or $\frac{19}{500}$ or $97 + 19$ or 116 oe

M1

$$\frac{116}{500} \text{ or } \frac{58}{250} \text{ or } \frac{29}{125} \text{ or } 0.232 \text{ or } 23.2\%$$

A1

[4]

Q24.

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

B1

$$\frac{2}{6} \text{ or } \frac{1}{3}$$

oe fraction, decimal or percentage
SC1 both fractions correct but given in words

B1

Additional Guidance

1 out of 6 and 1 out of 3

SC1

Accept decimals or percentages rounded or truncated to 2 sf or better

- (b) Both conditions met

eg 3, 4, 4, 4, 6

3, 3, 4, 4, 7

B2

B1 five numbers with one condition met eg 4, 4, 4, 5, 6

Additional Guidance

Allow fractions or decimals with a sum of 9 with three 4's

eg 3.5, 4, 4, 4, 5.5

B2

[4]

Q25.

(a) 0

B1

(b) 4×4 or 16

M1

May be implied from a diagram or as the denominator of a fractional answer

7 (and 7) and 8 or 3

May be shown by exactly three outcomes above 6 in a list, grid or table or as the numerator of a fractional answer

M1

$\frac{3}{16}$

or 0.1875 or 18.75%

oe fraction, decimal or percentage

A1

Additional Guidance

For M1, their (sample space) diagram or table may be blank

A 4×4 grid with correct values for at least the three numbers over 6 seen or implied. This may be ticks or other indication in the right position on a (sample space) diagram

M1M1

[4]

Q26.

(a) Sight of denominator of 6

M1

$\frac{2}{6}$

oe fraction, decimal or percentage correct to 2sf or more.

A1

(b) $\frac{5}{6}$

B1

[3]

Q27.

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

oe fraction, decimal or percentage

B1

Additional Guidance

Decimal or percentage must be correct to at least 2sf

(b) 2, 4 or 6

lists the even numbers

M1

$\frac{1}{2}$

oe fraction, decimal or percentage

A1

[3]

Q28.

(a) $\frac{9}{16}$

or fraction, decimal or percentage eg 0.5625 or 56.25%

B1

Additional Guidance

Ignore incorrect simplification or conversion of a correct probability to a fraction, decimal or percentage but not a ratio

eg1 $\frac{9}{16}$ 0.55

B1

eg2 $\frac{9}{16}$ 9 : 16

B0

Ignore words alongside a correct probability

eg1 $\frac{9}{16}$ unlikely

B1

eg2 9 out of 16 $\frac{9}{16}$

B1

Do not accept answer given in words or as a ratio eg 9 out of 16

B0

- (b) Linear scale starting at 0 and increasing in 1s or 2s on vertical axis
 Vertical axis labelled frequency or f or Number or How many
 Bars or horizontal axis labelled with four types of juice (accept A, G, O, M)
 Four bars with equal widths
 Equal gaps or no gaps between the four bars
 All four heights correct
bar chart could be horizontal
bars may be in any order
B3 for all criteria met
B2 for 4 or 5 criteria met
B1 for 3 criteria met
or a fully correct 2-bar or 3-bar chart

B3

Additional Guidance

Mark intention throughout

If axes and labels do not match the orientation of the bar chart then only criteria 4, 5 and 6 may be awarded

B1 max

All values not needed for axis scale. For example 0 can be implied, but spacing must be linear

Allow words after 'Number' on axis label, eg 'Number chosen' or 'Number of people'

Condone a different gap between the vertical axis and the first bar to the other, equal gaps

If no scale or a non-linear scale is given, bars with heights 6, 1, 4, 5 squares meet the height criterion

Allow heights criterion if their heights match their labels for their nonlinear scale and it is linear between 1 and 6

Points only or vertical lines can score the marks for criteria 1, 2, 3 and 6

B2 max

[4]

Q29.

(a) Any one of

0.24 or 0.19 or 0.22

in the correct cell

oe fraction, decimal or percentage

eg $\frac{36}{150}$ or $\frac{38}{200}$ or $\frac{55}{250}$

implied by any correct point for these three values

M1

At least two of their relative frequencies plotted accurately

$\pm \frac{1}{2}$ square

M1dep

(150, 0.24), (200, 0.19)

and (250, 0.22) plotted

and graph completed with straight lines

$\pm \frac{1}{2}$ square

allow dotted or solid lines

A1

Additional Guidance

Mark intention for straightness of lines

Ignore any continuation of line after the last point or any other lines

drawn on the graph, for example a line of best fit

(b) 0.22

oe fraction, decimal or percentage eg $\frac{55}{250}$

ft their relative frequency for 250 trains (> 0 and < 1) given in table or plotted on graph

B1ft

Additional Guidance

The mark may be awarded for a correct restart or a follow through

from their table or a follow through from their graph

Ignore attempts to convert a correct relative frequency once seen in

(b)

$\frac{166}{750}$

NB $\frac{166}{750} = 0.2213...$ is incorrect (unless it is given as their relative frequency for 250 trains)

B0ft

[4]

Q30.

Alternative method 1

40

May be implied

eg $\frac{2}{40}$

B1

$2 + x + 2x + 5 =$ their 40

or $3x + 7 =$ their 40

or $(\text{their } 40 - 2 - 5) \div 3$ or $33 \div 3$

oe equation e.g. $3x + 5 = 38$ (scores B1M1)

their 40 must be an integer

M1

$(x =) 11$

ft B0M1

Does not have to be an integer

Accept answer rounded or truncated to at least 2 sf

A1ft

$\frac{27}{40}$ or 0.675 or 67.5%

Only ft evaluation of $\frac{2 \times \text{their integer } x + 5}{40}$

and $0 < \text{answer} < 1$

Denominator must be 40 (may subsequently be simplified)

B1ft

Alternative method 2

$\frac{2}{2 + x + 2x + 5} = \frac{1}{20}$ or $\frac{x + 2x + 5}{2 + x + 2x + 5} = \frac{19}{20}$

oe equation

M2

$(x =) 11$

A1

$\frac{27}{40}$ or 0.675 or 67.5%

Only ft evaluation of $\frac{2 \times \text{their integer } x + 5}{40}$

and $0 < \text{answer} < 1$

Denominator must be 40 (may subsequently be simplified)

B1ft

Alternative method 3

$3x \rightarrow 100\% - 5\% - 12.5\%$ or $3x \rightarrow 82.5\%$

Using $2 \rightarrow 5\%$ and $5 \rightarrow 12.5\%$

oe

M1

$x \rightarrow 82.5\% \div 3$ or $x \rightarrow 27.5\%$

oe

M1dep

$2x + 5 \rightarrow 2 \times 27.5\% + 12.5\%$

oe

M1dep

$\frac{27}{40}$ or 0.675 or 67.5%

A1

Alternative method 4

$$3x \rightarrow 1 - \frac{1}{20} - \frac{2.5}{20} \text{ or } 3x \rightarrow \frac{16.5}{20}$$

$$\text{Using } 2 \rightarrow \frac{1}{20} \text{ and } 5 \rightarrow \frac{2.5}{20}$$

oe

M1

$$x \rightarrow \frac{16.5}{20} \div 3 \text{ or } x \rightarrow \frac{5.5}{20}$$

oe

M1dep

$$2x + 5 \rightarrow 2 \times \frac{5.5}{20} + \frac{2.5}{20} \text{ or } 2x + 5 \rightarrow \frac{13.5}{20}$$

oe

M1dep

$$\frac{27}{40} \text{ or } 0.675 \text{ or } 67.5\%$$

A1**Additional Guidance**

(Alt 1) $x = 6$ (no working) Answer $\frac{17}{40}$ (first B1 implied)

B1M0A0B1ft

(Alt 1) $2 + x + 2x + 5 = 20$

B0M1

$x = \frac{13}{3}$ Answer $\frac{13.666}{20}$

A1ftB0ft

Answer $\frac{13.5}{20}$

B1M1A1B0

11 by inspection or T & I scores the first 3 marks

Answer $\frac{2x+5}{40}$

B1M0A0B0

Answer $\frac{2x+5}{3x+7}$

Zero

Ratio eg 27 : 40

B1M1A1B0

Expressed only in words e.g. 27 out of 40

B1M1A1B0

27 out of 40 and $\frac{27}{40}$

B1M1A1B1

$\frac{27}{40}$ seen with incorrect change of form or incorrect cancelling

eg $\frac{27}{40}$ and answer 0.27

B1M1A1B1

Ignore chance words if $\frac{27}{40}$ seen

eg $\frac{27}{40}$ and answer Unlikely

B1M1A1B1**[4]**

Q31.

(a) $\frac{2}{3} \times 720$ or $\frac{3}{5} \times 700$ oe Accept use of 0.66... or 0.67

M1

480 or 420

A1

900 Ignore fw

A1

Additional Guidance

900 with no working

M1A1A1

900 out of 1420 or $\frac{900}{1420}$ (ignore fw)

M1A1A1

$\frac{480}{720}$ (480 boys out of 720) or $\frac{420}{1420}$ (420 girls out of 1420 students)

M1A1A0

(b) **Alternative method 1**

720 + 700 or 1420 or 720 + 700 – their 900 or 520 oe

M1

$\frac{520}{1420}$ or $\frac{26}{71}$ oe fraction, decimal or percentage
0.36(6...) or 0.37
36.(6...) % or 37%
ft their part (a)
Ignore fw

A1ft

Alternative method 2

720 + 700 or 1420

or $\frac{1}{3} \times 720$ or 240 or $\frac{2}{5} \times 700$ or 280

or 240 + 280 or 520 oe

M1

$\frac{520}{1420}$ or $\frac{26}{71}$ oe fraction, decimal or percentage
0.36(6...) or 0.37
36.(6...) % or 37%
Ignore fw

A1

Alternative method 3

720 + 700 or 1420 or $\frac{900}{1420}$ or $\frac{45}{71}$ or $\frac{\text{their } 900}{1420}$ oe fraction, decimal or percentage
0.63... or 0.63
63.(...) % or 63%

M1

$\frac{520}{1420}$ or $\frac{26}{71}$
oe fraction, decimal or percentage
0.36(6...) or 0.37
36.(6...) % or 37%
ft their part (a)
Ignore fw

A1ft

Additional Guidance

$\frac{520}{1420}$ followed by incorrect simplification of fraction

M1A1

[5]

Q32.

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

Any unambiguous indication

B1

[1]

Q33.

(a) 90 and 213

B1

71

*ft their 90 – 19
or 400 – their 213 – 97 – 19*

B1ft

(b) $\frac{97 + 19}{400}$ or $\frac{97}{400}$ or $\frac{19}{400}$
or 97 + 19 or 116
oe

M1

$$\frac{116}{400} \text{ or } \frac{58}{200} \text{ or } \frac{29}{100}$$

or 0.29

or 29%

A1

Additional Guidance

oe example $\frac{310}{400} \times \frac{97}{310} + \frac{90}{400} \times \frac{19}{90}$

M1

(c) $97 + 19 \times 2$
or $97 + 38$
or 135

M1

(their 135 + 25) ÷ 400 or 0.4

or 40

M1dep

£0.40 or 40p

Must have correct units and correct money notation

£0.40p M1M1A0

A1

[7]

Q34.

(a) $\frac{4}{6}$ or $\frac{2}{3}$

B1

$\frac{2}{6}$ or $\frac{1}{3}$

B1

oe fraction, decimal or percentage
SC1 both fractions correct but given in words

Additional Guidance

2 out of 3 and 1 out of 3

SC1

Accept decimals or percentages rounded or truncated to 2 sf or better

(b) All conditions met

eg 3, 3, 4, 5, 6

B1 five numbers with two conditions met

eg 3, 3, 6, 6, 6

3, 3, 4, 4, 7

3, 3, 3, 6, 6

B2

Additional Guidance

Allow fractions or decimals

eg 3, 3, 4.5, 4.5, 6

B2

3, 3, 4, 5, 6 is the only correct answer using only integers

B2

[4]

Q35.

(a) 0.8

B1

(b) $\frac{2}{6}$

B1

[2]

Q36.

(a) Two of $\frac{6}{50}$ $\frac{28}{100}$ $\frac{34}{150}$

oe fraction, decimal, percentage

B1 One of $\frac{6}{50}$ $\frac{28}{100}$ $\frac{34}{150}$

with at most one incorrect answer

B2

(b) Chooses their probability from the larger number of trials
 and reason given that more trials are involved

Must have two probabilities in (a)

B1ft

[3]

Q37.

- (a) Box A $\rightarrow p(3) = \frac{1}{6}$ and
 Box B $\rightarrow p(3) = \frac{1}{3}$ and
 Box C $\rightarrow p(3) = \frac{2}{5}$ and
 Box D $\rightarrow p(3) = \frac{2}{4}$ or $\frac{1}{2}$
Allow one incorrect probability

(Box) D and all probabilities correct

- (b) (Box) A and (Box) B

M1

A1

B1

[3]

Q38.

$9 + 3x + x - 5 + 2x$
 or $6x + 4$
 or $3x + x - 5 + 2x$
 or $6x - 5$ oe

Their $(6x + 4) = 100$
 or their $6x - 5 = 91$
 or $6x = 96$ oe

$$\frac{9}{\text{their } (6x + 4)} = \frac{9}{100}$$

$$x = 16$$

$$\frac{11}{100}$$

ft their 16

M1

M1

A1

B1ft

[4]

Q39.

- (a)
- | | | | |
|---|----|----|----|
| | | 9 | |
| | 9 | 10 | |
| 9 | 10 | 11 | |
| 9 | 10 | 11 | 12 |

- (b) 7

ft a completed table

- (c) Denominator of 36
 or

Numerator of 5 (or their 5)
36 choices identified

$$\frac{5}{36} \text{ or } 0.138(\dots) \text{ or } 0.139$$

or $13.8(\dots)\%$ or 13.9%

correct or ft their 8s from a complete table

B1

B1ft

M1

A1ft

[4]

Q40.

(a) Usually get a different outcome

B1

(b) More trials

B1

[2]

Q41.

(a) (i) B

B1

(ii) C

B1

(iii) D

B1

(iv) A

B1

(b) 3×5 or 1×2 or 6×1 or 15
Attempt at fx

M1

$(3 \times 5) + (1 \times 2) + (6 \times 1)$
Attempt at total frequency

M1

23 and Ben

A1

[7]

Q42.

(a) 0.05

B1

(b) 150×0.92

M1

138

SC1 for 12

A1

[3]

Q43.

(a) LPM
PLM
PML
MLP
MPL
Any order

B1 for at least two more correct orders

B2

(b) $\frac{2}{6}$

oe $\frac{1}{3}$

ft their (a) if at least one extra order given

B1ft

[3]

Q44.

- (a) $200 \div 5$ or $\frac{1}{5}$ seen
oe

40

M1

A1

- (b) Valid statement

e.g.

Not (approximately) equal amounts on each number

Should all be (around) 40

3 is (more than) double 4

Only 2 is near expected value

Biased towards 3

M1

No or Cannot tell

May be implied by comment

A1

[4]

Q45.

- (a) (i) White or W

B1

- (ii) $\frac{1}{4}$ or (0).25 or 25%

B1 sight of $\frac{1}{8}$ or $\frac{25}{100}$
B1 1 out of 4 or 1 in 4

B2

- (b) All labelled red or R

B1

- (c) 1 white, 1 green, 4 red, 4 blue

B1 all four colours used and 2 of other 3 criteria met
eg 2W 2G 3R 3B

B2

[6]

Q46.

- (a) **B** marked at three parts

0 - - B 1

B1

C marked at 0

B1

- (b) $60(^{\circ})$ or $\frac{1}{6}$ seen
 ± 2 or 60 walk or 50 cycle or 90 bus

B1

$\frac{360}{\text{their } 60} \times 40$
 oe their 6×40 or $5 \times 40 + 40$

M1

240

Accept integer answer in range [232, 249]
 SC2 Non-integer in range [232, 249]

A1 ft

- (c) $\frac{90}{360} (\times 252)$ or $\frac{1}{4} (\times 252)$
 oe

M1

63

A1

Alternative method

$40 \times \frac{90}{\text{their } 60} + \frac{252 - \text{their } 240}{4}$

M1

63

A1

[7]

Q47.

- (a) Never true

B1

Never true

B1

Always true

B1

- (b) 0.3 or $30(\%)$ *Ticks or any clear indication*

B2

$33(\%)$ or 0.33
 $\frac{1}{3}$ or 0.3 or $0.333(\dots)$ or $33\frac{1}{3}(\%)$ or $33.3(\dots)(\%)$
 B1 one value in correct position

[5]

Q48.

(a) $\frac{8}{16}$

oe

B1 $\frac{n}{16}$ where $1 \leq n \leq 15$ and n an integer

B1 $\frac{8}{n}$ where $n > 8$ and n an integer

SC1 evens, even chance, even, 8 out of 16, 8 in 16

B2

(b) Any two multiples of 3

3, 6, 9, 12, ... (not 0)

B1 one multiple of 3

SC1 two or more correct lists of counters with no totals

SC1 two different fractions both equivalent to $\frac{1}{3}$.

B2

(c) Any two multiples of 4 greater than 10

12, 16, 20, 24, ...

B1 one multiple of 4 greater than 10

SC1 4 **and** 8

SC1 two or more correct lists of counters with no totals

B2

[6]

Q49.

$\frac{20}{5} \times 1.5 (= 6)$

or $20 \times 0.5 (= 10)$

or $20 \times 50 (= 1000)$

M1

their 6 – their 10

or their 10 – their 6

M1 dep

4

SC2 £2 (from $16 \times 50p - 4 \times £1.50$)

A1

[3]