

8300

GCSE MATHEMATICS

Foundation tier – Questions by Topic – Mark Scheme

Probability

Frequency trees

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) 80 children
and
40 adults

B1

45 left (children)
and
35 right (children)

B1

30 left (adults)

ft 75 – their 45, where their 45 is an integer ≥ 0 and answer an integer ≥ 0

B1ft

10 right (adults)

ft their 40 – their 30, where both integers are ≥ 0 and answer an integer ≥ 0

B1ft

Additional Guidance

Use of relative frequency or probability for an answer is B0 for that answer
Ignore working outside the frequency tree

- (b)

$$\frac{9}{16}$$

ft their 45 and/or ft their 80

their 45

B1ft their 80 not fully simplified

or

correct simplification of their fraction, using numbers from their tree

B2ft

Additional Guidance

B2ft can only be awarded if their numbers can be simplified, otherwise B1ft

Do not ignore further work for B2 after correct answer seen

$$\frac{9}{16} = \frac{3}{4}$$

B1

[6]

Q2.

Total for Screen 2 is 261

B1

Total is 348

ft 87 + their 261

B1ft

Full price for Screen 1 is 72

B1

Child price for Screen 2 is 53

B1

Full price for Screen 2 is 208

ft if their full price value for Screen 2 and their child price value for Screen 2 sum to their total for Screen 2

or

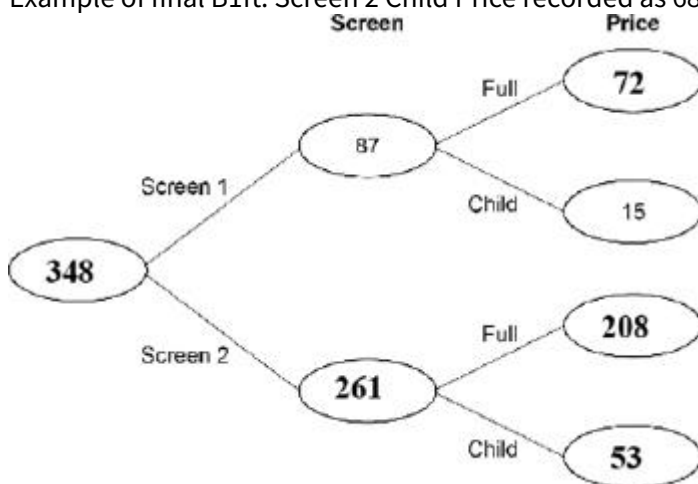
their two full price values and their two child price values sum to their overall total

B1ft

Additional Guidance

Mark the diagram, but if diagram completely blank, accept answers in working only if absolutely clear which entry is being referenced

Example of final B1ft: Screen 2 Child Price recorded as 68, leads to 193 as Screen 2 full price



B5

[5]

Q3.

(a) 450 in Drink coffee Yes

B1

50 in Drink coffee No

ft 500 - their 450

B1ft

90 in At least three cups Yes

ft their 450 ÷ 5

B1ft

360 in At least three cups No

ft their 450 - their 90

B1ft

Additional Guidance

For 90 ft, their $450 \div 5$ must be truncated or rounded up to the nearest whole number

For 360 ft, their $450 - \text{their } 90$ must give a positive integer

Accept unambiguous values elsewhere but diagram values take precedence

Correct relative frequencies seen, withhold first B1 that would have been awarded

eg $\frac{400}{500}, \frac{100}{500}, \frac{80}{400}, \frac{320}{400}$

B0 B0ft B1ft B1ft

eg $\frac{400}{500}, \frac{100}{500}, \frac{80}{500}, \frac{320}{500}$

B0 B0ft B0ft B0ft

Do not accept probabilities

eg $\frac{9}{10}, \frac{1}{10}, \frac{4}{5}, \frac{1}{5}$

B0

eg 0.9, 0.1, 0.8, 0.2

B0

(b) **Alternative method 1**

$\frac{\text{their } 90}{500}$ (or partially simplified)

oe e.g. decimal ft or correct

B1ft

$\frac{9}{50}$

ft their unsimplified fraction fully simplified $\frac{9}{50}$ scores B1B1

B1ft

Alternative method 2

$\frac{9}{10} \times \frac{1}{5}$

oe e.g. 0.9×0.2 or 0.18

M1

$\frac{9}{50}$

A1

Additional Guidance

$\frac{90}{500} = \frac{18}{100}$

B1B0

$\frac{80}{500} = \frac{4}{25}$ (with 80 in part (a) then ft)

B1ftB1ft

$\frac{80}{500} = \frac{4}{25}$ (with 80 not in part (a) so not ft but then simplest form correct)

B0B1ft

$\frac{80}{500} = \frac{8}{50}$ (with 80 not in part (a) so not ft and simplest form not correct)

B0B0

$\frac{45}{250}$

B1B0

80 in (a), $\frac{8}{50}$ here

B1B0

$\frac{90}{400} = \frac{9}{40}$

B0B1ft

$\frac{500}{90} = \frac{50}{9}$

B0B1ft

Do not accept 18% for first mark

[6]

Q4.

1550 in Away

B1

1370 in Home Yes

B1

5480 in Home No

*ft 6850 – their 1370
their 1370 must be less than 6850*

B1ft

949 in Away Yes

*ft 2319 – their 1370
their 1370 must be less than 2319*

B1ft

601 in Away No

*ft their 1550 – their 949
their 1550 must be greater than their 949*

B1ft

Additional Guidance

If Away oval is blank then condone an indication of 1550 as Away

If Home Yes oval is blank then condone an indication of 1370 as Home Yes

ft values must be from ovals

[5]

Q5.

25 in W only

B1

53 in the intersection

B1

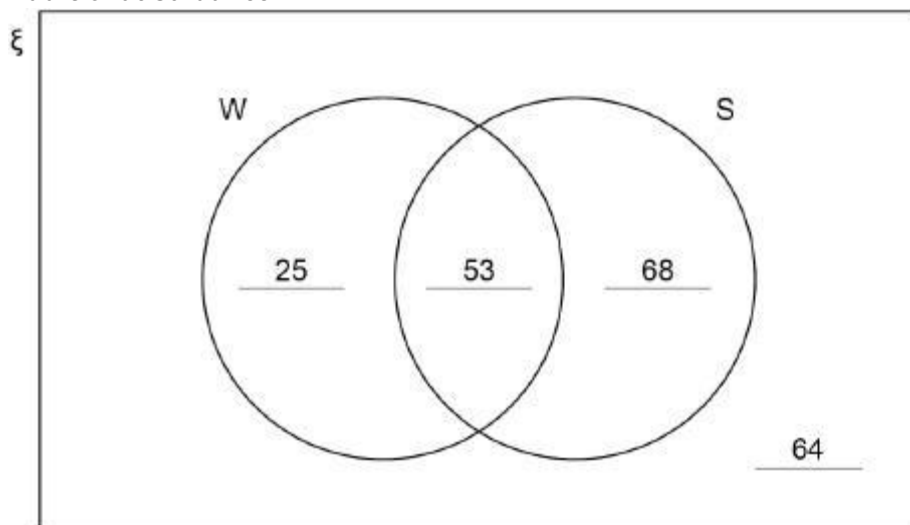
68 in S only

B1

64 outside the circles

B1

Additional Guidance



B1B1B1B1

[4]

Q6.

(a) 45 in No (Played)

B1

36 in No (More than one game played?)

B1

12 in Yes (More than one game played?)

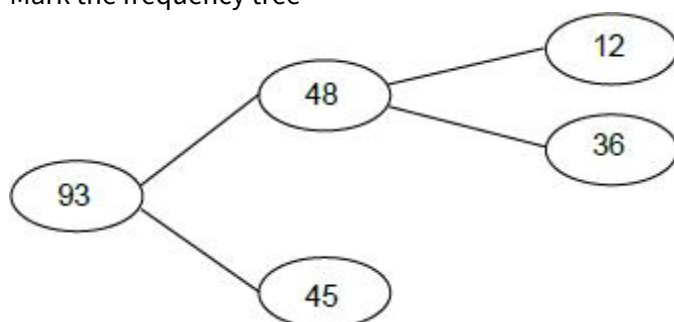
ft 48 – their 36

their 36 must be a positive integer less than 48

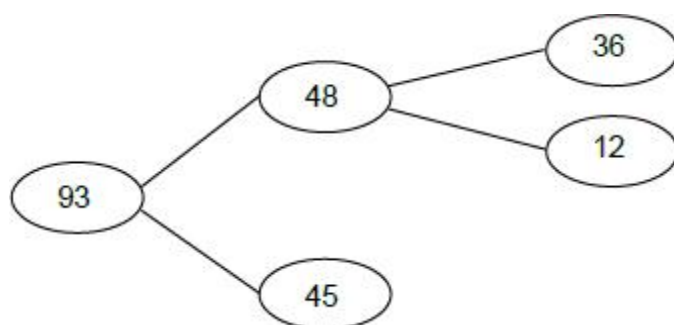
B1ft

Additional Guidance

Mark the frequency tree



B1B1B1



B1B0B1ft

(b) **Alternative method 1**

0.68×93 or $63.2(4)$. *oe*

M1

64

A1

Alternative method 2

63

$\frac{63}{93} = 0.67(\dots)$

or

64

$\frac{64}{93} = [0.68, 0.69]$ *other trials can be ignored*

M1

64

A1

Additional Guidance

Answer only 64

M1A1

0.69×93 or $64.1(7)$ or 64.2 with answer 64

(without seeing 0.68×93 or $63.2(4)$)

M0A0

For 0.68×93 , accept $68\% \times 93$ but do not accept 68% of 93 unless recovered

[5]

Q7.

96 in Eat sushi Yes

B1

384 in Eat sushi No

ft 480 – their 96 if giving a value > 0

B1ft

64 in At least once a month Yes

ft their $96 \div 3 \times 2$

truncated to the nearest integer

or rounded up to the nearest integer

B1ft

32 in At least once a month No

ft their 96 – their 64 if giving a value > 0. or their $96 \div 3$

truncated to the nearest integer

or rounded up to the nearest integer

B1ft

Additional Guidance

Mark the four given diagram ovals only

240 240 160 80

B0B1ft

B1ftB1ft

Follow through values may be rounded up or down to whole numbers provided the total is correct

eg 80 400 53 27 (53 is $\frac{2}{3}$ of 80 rounded down)

B0B1ft

B1ftB1ft

Follow through decimal values, withhold first B1, if applicable, at first use of decimal

eg1 105.6 374.4 70.4 35.2 (105.6 is incorrect and first use of decimal)

B0B1ft

B1ftB1ft

eg2 80 400 53.3 26.7 (53.3 is correct ft and first use of decimal)

B0B1ft

B0ftB1ft

eg3 96 384 63.36 32.64 (63.36 is incorrect and first use of decimal)

B1B1

B0B1ft

Correct or ft relative frequencies shown out of 480 seen in appropriate places, withhold first B1 that would have been awarded

eg1 $\frac{96}{480}$ $\frac{384}{480}$ $\frac{64}{480}$ $\frac{32}{480}$

B0B1

B1B1

eg2 $\frac{45}{480}$ $\frac{435}{480}$ $\frac{30}{480}$ $\frac{15}{480}$

B0B0ft

B1ftB1ft

eg3 $\frac{90}{480}$ $\frac{390}{480}$ $\frac{30}{480}$ $\frac{60}{480}$

B0B0ft

B0ftB1ft

[4]

Q8.

- (a) 8 in Time exercising Less than 1 hour

B1

23 in Exercise taken No

B1

58 in Total number of students

ft 35 + their 23 or 27 + their 8 + their 23

B1ft

Additional Guidance

8 in Time exercising Less than 1 hour

B1

47 in Exercise taken No

B0

82 in left-hand oval

B1ft

7 in Time exercising Less than 1 hour

B0

25 in Exercise taken No

B0

59 in Total number of students

B1ft

- (b) $\frac{27}{35}$ or 0.77(...) or 77(. ...)%
oe fraction

B1

Additional Guidance

Ignore attempts to simplify or convert after correct fraction seen

eg1 $\frac{27}{35}$ seen, answer $\frac{5}{7}$

B1

eg2 $\frac{27}{35}$ seen, answer 7.7%

B1

Ignore words if correct answer seen

$\frac{27}{35}$ answer 27 out of 35

B1

eg2 77%, unlikely

B1

Answer given as ratio (even if correct answer also seen)

eg 27 : 35

B0

Answer only in words

eg 27 out of 35

B0

Only 77 (without %)

B0

[4]

Q9.

- (a) 20 home and 20 away

B1

8 home losses

ft their $20 \times \frac{2}{5}$ rounded to the nearest whole number

B1ft

2 away wins

ft their $20 \times \frac{1}{10}$ rounded to the nearest whole number

B1ft

5 home draws

and

6 away draws

ft their 8 and their 2

condone their 8 and their 2 as zero or non-integers

award if total of home games is their 20

and *total of away games is their 20*

and *total number of games is 40*

B1ft

Additional Guidance

Mark the cells in the frequency tree

- (b) Any two of

(home wins =) 7×6 or 42

or

(home draws =) their 5×3 or 15

or

(away wins =) their 2×6 or 12

or

(away draws =) their 6×3 or 18

may be implied by one of (total points for their wins) 54

or

(total points for their draws) 33

or

(total points for their home) 57

or

(total points for their away) 30

M1

87

ft their frequency tree with positive integers in all relevant sections

A1ft

Additional Guidance

Using non-integers

MOA0

[6]

Q10.

280 or 30 in correct position

B1

500 – 280 or 220

M1

0.8(0) × their 280 or 224
or 0.2(0) × their 280 or 56
oe

M1

their 220 – their 30 or 190

or

280 – their 224

or

280 – their 56

or

0.8(0) × their 280 or 224 and

0.2(0) × their 280 or 56

M1

Fully correct frequency tree

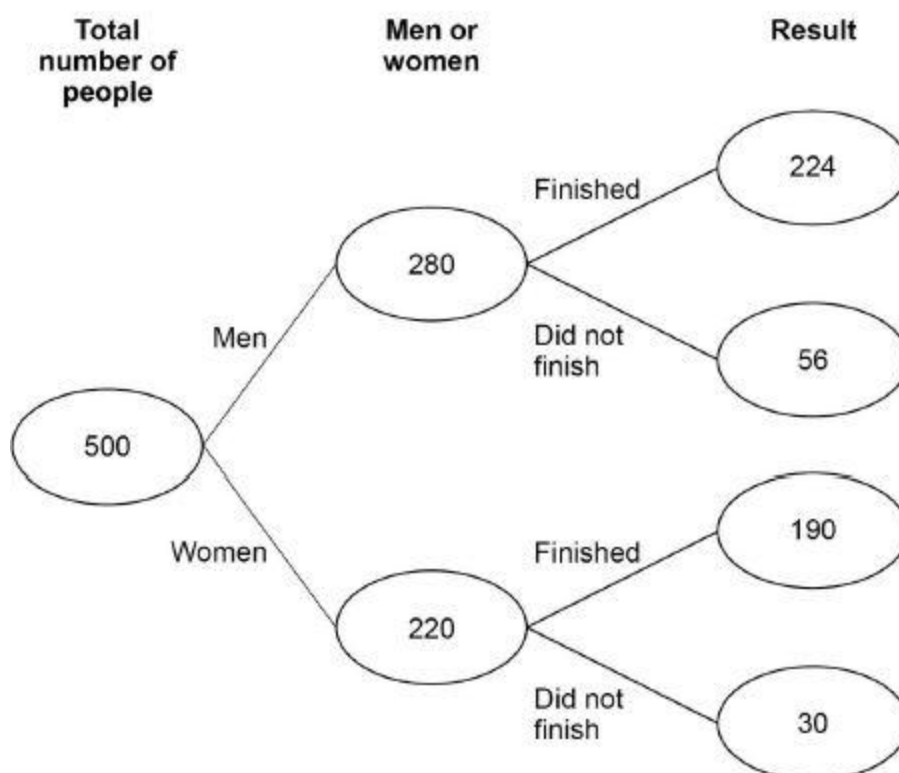
A1

Additional Guidance

Allow relative frequencies with denominator of 500 for B1 or M marks

Mark the diagram first, values in diagram have priority over working

Correct values may be incorrectly placed for method marks



[5]

Q11.

Alternative method 1

$$56 \times 24.5 \text{ or } 1372$$

or

$$21 \times 27.5 \text{ or } 577.5$$

or

$$(14 + 8) \times 18 \text{ or } 22 \times 18$$

$$\text{or } 14 \times 18 + 8 \times 18 \text{ or } 252 + 144$$

$$\text{or } 396$$

amount for basic

or

amount for sports

or

amount for movies

oe

M1

Any **two** of 56×24.5 or 1372

or

$$21 \times 27.5 \text{ or } 577.5$$

or

$$(14 + 8) \times 18 \text{ or } 22 \times 18$$

$$\text{or } 14 \times 18 + 8 \times 18 \text{ or } 252 + 144$$

$$\text{or } 396$$

*any **two** of the above implies M2*

M1dep

$$56 \times 24.5$$

+

$$21 \times 27.5$$

+

$$(14 + 8) \times 18 \text{ or } 22 \times 18$$

$$\text{or } 14 \times 18 + 8 \times 18 \text{ or } 252 + 144$$

or

$$1372 + 577.5 + 396$$

$$\text{or } 2345.5$$

*full method that would lead to 2345.5 if evaluated correctly
implies M3*

M1dep

$$2345.50$$

A1

Alternative method 2

$14 \times (24.5 + 27.5 + 18)$ or 14×70
or 980

or

$7 \times (24.5 + 27.5)$ or 7×52 or 364

or

$8 \times (24.5 + 18)$ or 8×42.5 or 340

or

27×24.5 or 661.5

*amount for all 3 packages
or amount for basic + sports
or amount for basic + movies
or amount for basic only*

M1

Any **two** of $14 \times (24.5 + 27.5 + 18)$ or 14×70
or 980

or

$7 \times (24.5 + 27.5)$ or 7×52 or 364

or

$8 \times (24.5 + 18)$ or 8×42.5 or 340

or

27×24.5 or 661.5

*any **two** of the above implies M2*

M1dep

$14 \times (24.5 + 27.5 + 18)$ or 14×70

+

$7 \times (24.5 + 27.5)$ or 7×52

+

$8 \times (24.5 + 18)$ or 8×42.5

+

27×24.5

or

$980 + 364 + 340 + 661.5$

or 2345.5

*full method that would lead to 2345.5 if evaluated correctly
implies M3*

M1dep

2345.50

A1

Alternative method 3

$56 \times (24.5 + 27.5 + 18)$ or 56×70
 or 3920
 or
 35×27.5 or 962.5
 or
 $(27 + 7) \times 18$ or 34×18
 or $27 \times 18 + 7 \times 18$ or $486 + 126$
 or 612

amount if everyone has all 3 packages
or amount for not having sports
or amount for not having movies

M1Any **two** of

$56 \times (24.5 + 27.5 + 18)$ or 56×70
 or 3920
 or
 35×27.5 or 962.5
 or
 $(27 + 7) \times 18$ or 34×18
 or $27 \times 18 + 7 \times 18$ or $486 + 126$
 or 612

*any **two** of the above implies M2*

M1dep

$56 \times (24.5 + 27.5 + 18)$ or 56×70
 or 3920
 –
 35×27.5 or 962.5
 –
 $(27 + 7) \times 18$ or 34×18
 or $27 \times 18 + 7 \times 18$ or $486 + 126$
 or 612
 or
 $3920 - 962.5 - 612$
 or 2345.5

full method that would lead to 2345.5 if evaluated correctly
implies M3

M1dep

2345.50

A1**Additional Guidance**

2345.50(p)

M1M1M1A1

2345.5

M1M1M1A0

Working may be seen on the diagram

1155

Allow all decimal values to be seen as equivalent fractions e.g. $\frac{2}{5}$ for 577.5 for the M marks

A 'correct' calculation does not have to be evaluated correctly

Division or multiplication by 12 or division by 56 at the end will only lose the A mark e.g. $2345.50 \div 56 = 41.88$ per person

M1M1M1A0

For the first two marks use the scheme that awards the most credit and do not apply the rules of choice

Addition may be implied by a column of figures

[4]

Q12.

(a) **Alternative method 1**

$512 \div 743$
or 0.6 or 0.68... or 0.69
or $758 \div 1065$
or 0.7 or 0.71...
oe

M1

0.6 or 0.68... or 0.69
and
0.7 or 0.71...
and Week 2

A1

Alternative method 2

$512 \div 231$
or 2.2 or 2.21... or 2.22
or $758 \div 307$
or 2.4 or 2.46... or 2.47 or 2.5
oe

M1

2.2 or 2.21... or 2.22
and
2.4 or 2.46... or 2.47 or 2.5
and
Week 2

A1

Alternative method 3

$\frac{512}{743}$ or $\frac{758}{1065}$
 $\frac{512}{231}$ or $\frac{758}{307}$

M1

$\frac{545280}{791295}$ and $\frac{563194}{791295}$

and

Week 2

$\frac{157184}{70917}$ and $\frac{175098}{70917}$

and

Week 2

A1

Additional Guidance

Accept working in percentages

Proportions can be calculated using reciprocals in both Alternative method 1 and Alternative method 2

eg $231 \div 512$

60(%) or 68(%) or 69(%) or 70(%) or 71(%)

M1

(10% = 74.3 followed by) $\frac{512}{74.3} \times 10$
 $\frac{758}{106.5}$

or (10% = 106.5 followed by) $\frac{512}{106.5} \times 10$ is oe for Alternative method 1

M1

- (b) 396×3.74 or 1481.04
 or
 164×5.29 or 867.56
 or
 362×0.51 or 184.62
 or
 143×0.04 or 5.72
 oe Week 2 profit on 10-inch pizzas
 Week 2 profit on 12-inch pizzas
 Week 2 loss on 10-inch pizzas
 Week 2 loss on 12-inch pizzas

M1

their 1481.04 + their 867.56
 or 2348.6(0)
 or their 184.62 + their 5.72
 or 190.34
 or their 1481.04 – their 184.62
 or 1296.42
 or their 867.56 – their 5.72
 or 861.84
 oe Week 2 profit for both pizzas
 Week 2 loss for both pizzas
 Week 2 profit – loss on 10-inch pizzas
 Week 2 profit – loss on 12-inch pizzas

M1dep

their 2348.6(0) – their 190.34
 or their 1296.42 + their 861.84
 or 2158.26
 Total week 2 profit
 from total profit – total loss

M1dep

(£)87.71
 or
 (£)262.71 and Yes
 or
 (£)1983.26 and Yes
 or
 (£) 2158.26 and (£)2070.55 and Yes
 Total week 2 profit – (total week 1 profit + cost of adverts)
 Total week 2 profit – total week 1 profit
 Total week 2 profit – cost of adverts
 Condone eg £87.71p

Additional Guidance

Accept use of inequality sign or words to imply “Yes” in final answer
 Accept –184.62 and –5.72 for first M1
 Accept working in pence to calculate losses for M1
 2070.55 is total week 1 profit + cost of adverts
 Answer of (£)87.71 does not require “Yes” to be stated as the advert cost has been subtracted

M1M1M1A1

[6]

Q13.

(a) 80

B1

44 and 36

ft their 80 – 44

B1ft

27 and 9

*ft their 36 ÷ 4 × 3
and ft their 36 ÷ 4*

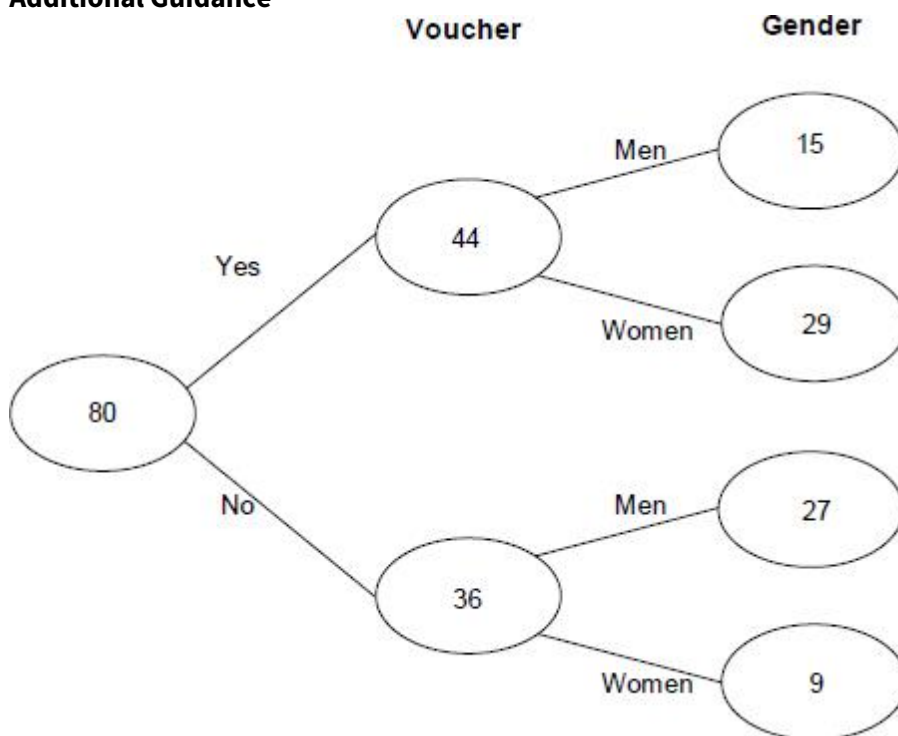
B1ft

15 and 29

*ft 42 – their 27
and ft 38 – their 9
Total on ft must be 44*

B1ft

Additional Guidance



B1B1B1B1

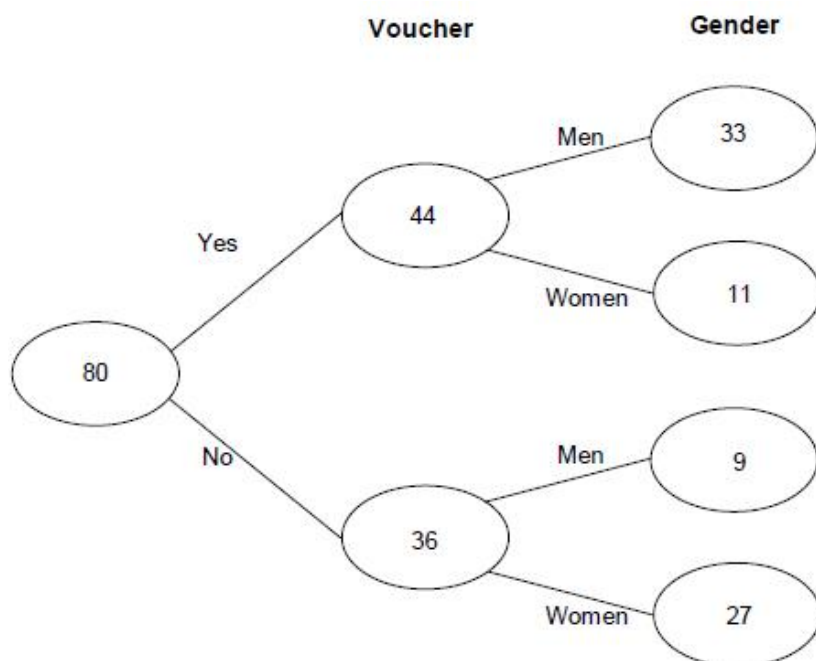
Mark diagram only, do not allow misread

Values may be rounded up or down to whole numbers provided the total is correct

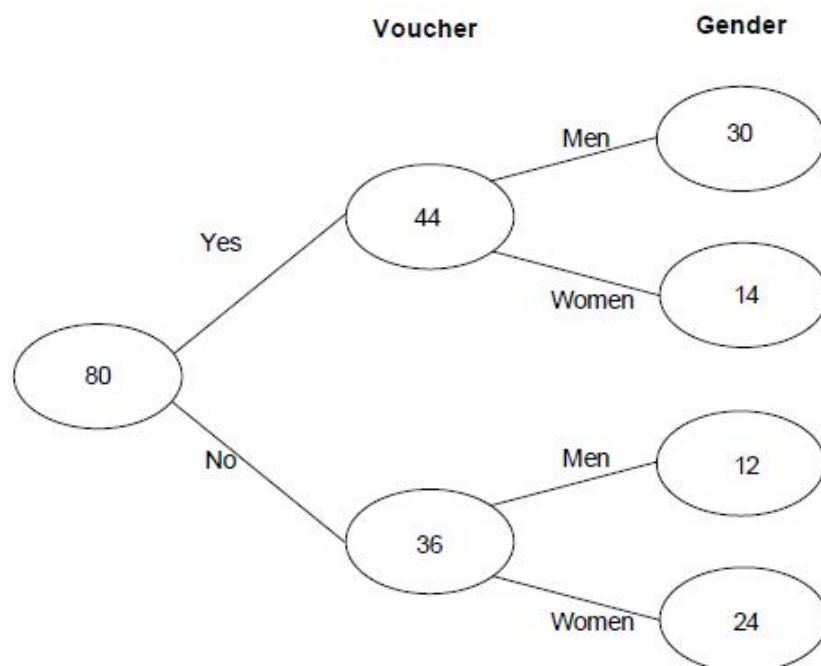
Penalise the use of relative frequencies on the first occurrence only

If relative frequencies are shown the denominator must be 80 and not simplified

eg $\frac{3}{4}$ and $\frac{1}{4}$ is B0



B1B1B0B1ft



B1B1B0B1ft

- (b) 85%
or 0.85

M1

$27.2 \div 0.85$
or $27.2 \div 85 (\times 100)$ or 0.32

M1dep

32(.00) *Correct money notation*
 Allow £32.00p

A1

Additional Guidance

32.0

M1M1A0

[7]