

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Number

Calculating with roots and powers (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.

8

accept $2 \times 2 \times 2 = 8$

B1

[1]

Q2.

1000

B1

[1]

Q3.

7

condone ± 7

B1

Additional Guidance

-7 only

B0

[1]

Q4.

64 or +64

B1

[1]

Q5.

16

B1

[1]

Q6.

(a) 10

B1

(b) 169

B1

[2]

Q7.

12

accept ± 12

B1

[1]

Q8.

- (a) $5 \times 5 \times 5$ or $125 \div 5 \div 5 = 5$ oe
or $5^2 = 25$ and 25×5
Condone $\sqrt[3]{125} = 5$
or $5^2 \times 5$
or 5^3

B1

- (b) $a = 4$ and $b = 121$
and
 $a = 25$ and $b = 100$
(both in either order)

B1

$a = 4$ and $b = 121$

or

$a = 25$ and $b = 100$

(either order)

B1 correct list of square numbers to 100 allow one error or omission

B2

[3]

Q9.

- (a) 27
(b) 31
(c) 25 or 45

Allow both

B1

B1

B1

[3]

Q10.

9

B1

[1]

Q11.

27

B1

81

ft their 27×3

Answers must be evaluated

B1ft

[2]

Q12.

27

B1

[1]

Q13.

- (a) 16
- (b) 125
- (c) 14

B1

B1

B1

[3]

Q14.

- (a) 8
- (b) 10 000
- (c) 12

B1

B1

B1

[3]

Q15.

125

B1

[1]

Q16.

- (a) $5 \times 5 \times 2 \times 2 \times 2$ oe
eg $10 \times 10 \times 2$
Or 25
Or 8

200

M1

A1

- (b) 12

Accept -12
Accept **twelve** or **minus twelve**

B1

- (c) 4

Accept **four**

B1

[4]

Q17.

- (a) A and D

B1

- (b) No and a number cannot be both odd and even

or

No and a number cannot be both square and prime

or

No and a number cannot be two-digit, even and prime

oe

*Accept eg**No and a number cannot be both A and B***B1**

- (c) 16 or 36 or 64 and A, D, E

or

25 or 49 or 81 and B, D, E

or

11 or 13 or 17 or 19 or 23 or 29 or

31 or 37 or 41 or 43 or 47 or 53 or

59 or 61 or 67 or 71 or 73 or 79 or

83 or 89 or 97 and B, C, E

B1 Any of the correct possible numbers (listed for B2) but with incorrect properties

or

any even square number and A, D

or

any odd square number and B, D

or

any prime number > 2 and B, C

or

*2 and A, C***B2****[4]****Q18.**

- (a) 1000

B1

- (b) 0.08

oe

B1**Additional Guidance**

Accept use of comma eg 0,08

Accept $\frac{2}{25}$ or $\frac{4}{50}$ or $\frac{8}{100}$ or $\frac{80}{1000}$ or $\frac{800}{10000}$ or 0.080 or 0.0800**[2]****Q19.**

25

B1**[1]**

Q20.

(a) 125

B1

(b) 11

Accept - 11 or ± 11

B1

(c) 6^2 or 36 or 7^2 or 49

or $\sqrt{36}$ (= 6) or $\sqrt{49}$ (= 7)

M1

6 and 7 or 7 and 6

5 and 6 or 7 and 8 without working is M0A0

A1

[4]

Q21.

1.5×1.5

or

$\left(\frac{3}{2}\right)^2$

oe

oe improper fraction squared

M1

2.25 or $\frac{9}{4}$ or $2\frac{1}{4}$

oe decimal, improper fraction or mixed number

SC1 answer digits 225

A1

Additional Guidance

Ignore attempt to simplify or convert if correct fraction seen

Do not allow further work but condone adjusting place value

eg $1.5 \times 1.5 = 2.25$, $2.25 \div 100 = 0.0225$ (adjusting place value)

M1A0

eg $1.5 \times 1.5 = 2.25$, 2.25×1.5 (cubing not squaring)

M0A0

$1.5 \times 1.5 = 3$

M1A0

2.25^2

M1A0

225^2

M0A0

[2]

Q22.

(a) 20

B1

(b) 9

B1

(c) 14 and 29 *either order*

B1

(d) 15

B1

[4]

Q23.

(a) 27 or 16

M1

43

A1

(b) $(5^3 =) 125$ or $(10^2 =) 100$

M1

125 and 100

A1

5^2

25 without working implies M1A1

A1

[5]

Q24.

(a) 10^5

B1

(b) 20

B2 for 8 and 25 seen

B1 for 8 or 25 seen

B3

[4]

Q25.

$(2^2 + 5 =) 9$

or $4 \times 2^2 + 4 \times 5$

or $-4 \times 2^2 + -4 \times 5$

or $(-)36$

oe

M1

100 – their 36 or 64

oe

M1dep

8

accept ± 8

A1

Additional Guidance

100 – $4 \times 4 + 4 \times 5$ or 100 – 16 + 20 not recovered

M0M0A0

[3]

Q26.

$$2 + 0 + 1 - 7 = -4$$

$$\text{or } 2 - 0 + 1 - 7 = -4$$

B1

$$2 \times 0 \times 1 \times 7 = 0$$

$$\text{or } 2 \times 0 \div 1 \times 7 = 0$$

$$\text{or } 2 \times 0 \times 1 \div 7 = 0$$

$$\text{or } 2 \times 0 \div 1 \div 7 = 0$$

Allow any brackets in pairs for first four

$$\text{or } 2 \times 0 \times (1 + 7) = 0$$

$$\text{or } 2 \times 0 \div (1 + 7) = 0$$

*Allow - instead of + for last two***B1**

$$(2 + 0) \times (1 + 7) = 2^4$$

$$\text{or } (2 - 0) \times (1 + 7) = 2^4$$

$$\text{or } 2 \times (0 + 1 + 7)$$

B1**Additional Guidance**

In all cases, allow extra pairs of brackets which do not alter the result of the calculation

e.g. in 3rd calculation $((2 + 0) \times (1 + 7)) = 2^4$

B1

Brackets can be used in the place of a multiplication sign

e.g. in 2nd calculation $2 \times 0(1 + 7) = 0$

B1

Each gap must have a bracket or an operator in

Allow additional + or - signs in any gap, if correct

e.g. in 1st calculation $2 + 0 + 1 + - 7 = -4$

B1**[3]****Q27.**

(a) 35 and 65

B1

(b) 34 and 76

B1

(c) 76

B1

(d) 21

B1**[4]**

Q28.

- (a) 144 and 36

Any order

B1 for two square numbers with a total greater than 100

or

for 12 and 6 seen

or 12^2 and 6^2

B2

- (b) No and two square numbers correctly added to give an odd number

eg No and $4 + 9 = 13$

No and $2^2 + 3^2 = 13$

Additional Guidance

Even square + odd square = odd number (correctly evaluated) with No

B1

$4 + 9 = 13$ (Not stated No)

B0

[3]

Q29.

1 000 000

B1

[1]

Q30.

$2\frac{1}{4}$

oe mixed number

B1

Additional Guidance

$\frac{9}{4} = 2\frac{1}{4}$ or $2.25 = 2\frac{1}{4}$ on answer line

B1

$2\frac{1}{4} = \frac{9}{4}$ or $2\frac{1}{4} = 2.25$ on answer line

B0

Otherwise, $2\frac{1}{4}$ and $\frac{9}{4}$ or $2\frac{1}{4}$ and 2.25 on answer line in either order (or in working with answer line blank and answer unclear)

B0

$1\frac{5}{4}$

B0

$2\left(\frac{1}{4}\right)$ or $2 + \frac{1}{4}$

B0

[1]

Q31.

$$(12^2 =) 144$$

or

$$(\sqrt{36} =) 6 \text{ or } \left(\frac{1}{3} \times \sqrt{36} =\right) 2$$

implied by correct answer

$$\text{accept } (\sqrt{36} =) \pm 6 \text{ or } \left(\frac{1}{3} \times \sqrt{36} =\right) \pm 2$$

M1

$$(12^2 =) 144$$

and

$$\left(\frac{1}{3} \times \sqrt{36} =\right) 2$$

implied by correct answer

$$144 \times \frac{1}{2} \\ \underline{432}$$

or $\frac{432}{6}$ oe fraction implies M1M1

$$\text{accept } \left(\frac{1}{3} \times \sqrt{36} =\right) \pm 2$$

M1dep

$$72$$

accept ± 72

SC2 288

A1

Additional Guidance

-72 only

M1M1A0

Condone missing brackets if recovered

eg $12^2 \div \frac{1}{3} \times 6$ with answer 72

M1M1A1

$$\frac{144}{\frac{1}{3} \times 6} \text{ with no further correct work}$$

M1M0A0

Using a decimal for $\frac{1}{3}$ must be recovered

[3]

Q32.

$$x = 81 \text{ and } y = 19$$

*B1 100 – (a square number) correctly evaluated
 or 100 – (a prime number) correctly evaluated
 or A list of square numbers up to and including 81 with one error or omission and a list of prime numbers up to and including 19 with one error or omission
 or A correctly evaluated trial of a square number plus a prime number.
 e.g. $49 + 53 = 102$*

B2**Additional Guidance**

Condone $x = 19$ and $y = 81$

B2

$$x = 9^2 \text{ and } y = 19$$

B2

$x = 9$ and $y = 19$ with $9^2 = 81$ or $9^2 + 19$ or $81 + 19$ in working

B2

$x = 9$ and $y = 19$ without working

B1

49 and 51 implies 100 – (a square number) correctly evaluated

B1

91 and 9 implies 100 – (a square number) correctly evaluated

B1**[2]****Q33.**

16 seen or 32 seen or 27 seen

M1

$(2 \times) 16 (+) 27$
 or $32 (+) 27$

M1

59 SC2 43

A1**[3]****Q34.**

Any three of
 $a = 2, b = 5$
 $a = 7, b = 2$
 $a = 7, b = 11$
 $a = 11, b = 3$

*B1 for each correct pair
 SC1 if no other marks scored for:
 $a = 3, b = 3$ (same numbers)
 $a = 3, b = 19$ oe (prime > 12) Listing all primes less than 12
 ie 2, 3, 5, 7, 11
 Listing the square numbers (1, 4,) 9, 16, 25*

B3**[3]**