General Certificate of Secondary Education
2019

Mathematics

M3

Calculator Paper

Higher Tier

[GMC31]

TUESDAY 21 MAY, MORNING

MARK
SCHEME

GCSE MATHEMATICS

Introduction

The mark scheme normally provides the most popular solution to each question. Other solutions given by candidates are evaluated and credit given as appropriate; these alternative methods are not usually illustrated in the published mark scheme.

The marks awarded for each question are shown in the right hand column and they are prefixed by the letters **M**, **W** and **MW** as appropriate. The key to the mark scheme is given below:

M   indicates marks for correct method.

W   indicates marks for working.

MW   indicates marks for combined method and working.

The solution to a question gains marks for correct method and marks for an accurate working based on this method. Where the method is not correct no marks can be given.

A later part of a question may require a candidate to use an answer obtained from an earlier part of the same question. A candidate who gets the wrong answer to the earlier part and goes on to the later part is naturally unaware that the wrong data is being used and is actually undertaking the solution of a parallel problem from the point at which the error occurred. If such a candidate continues to apply correct method, then the candidate's individual working must be followed through from the error. If no further errors are made, then the candidate is penalised only for the initial error. Solutions containing two or more working or transcription errors are treated in the same way. This process is usually referred to as "follow-through marking" and allows a candidate to gain credit for that part of a solution which follows a working or transcription error.

Positive marking:

It is our intention to reward candidates for any demonstration of relevant knowledge, skills or understanding. For this reason we adopt a policy of **following through** their answers, that is, having penalised a candidate for an error, we mark the succeeding parts of the question using the candidate's value or answers and award marks accordingly.

Some common examples of this occur in the following cases:

(a) a numerical error in one entry in a table of values might lead to several answers being incorrect, but these might not be essentially separate errors;

(b) readings taken from candidates' inaccurate graphs may not agree with the answers expected but might be consistent with the graphs drawn.

When the candidate misreads a question in such a way as to make the question easier only a proportion of the marks will be available (based on the professional judgement of the examining team).

General Marking Advice

(i) If the correct answer is seen in the body of the script and the answer given in the answer line is clearly a transcription error, full marks should be awarded.

(ii) If the answer is missing, but the correct answer is seen in the body of the script, full marks should be awarded.

(iii) If the correct answer is seen in working but a completely different answer is seen in the answer space, then some marks will be awarded depending on the severity of the error.

(iv) Work crossed out but not replaced should be marked.

(v) In general, if two or more methods are offered, mark only the method that leads to the answer on the answer line, if two (or more) answers are offered (with no solution offered on the answer line), mark the poorest answer.

(vi) For methods not provided for in the mark scheme, give as far as possible equivalent marks for equivalent work.

(vii) Where a follow through mark is indicated on the mark scheme for a particular part question, the marker must ensure that you refer back to the answer of the previous part of the question.

(viii) Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen, e.g. the answer in the mark scheme is 4.65 and the candidate then correctly rounds to 4.7 or 5 on the answer line. Allow full marks for 4.65 seen in the working.

(ix) Anything in the mark scheme which is in brackets (...) is not required for the mark to be earned, but if present it must be correct.

(x) For any question, the range of answers given in the mark scheme is inclusive.

			AVAILABLE MARKS

1 £57 – £5 = £52 MA1

2 adult A1

3 senior citizen A1 3

2 **(a)** (3 × 5) + (4 × 11) + (5 × 8) + (6 × 6) MA1

135 A1

(b) Sight of 'number of people' × 12 MA1

Angles 60 , 132 , 96 , 72 A1

Sectors drawn correctly and labelled correctly A2

(Sectors drawn correctly, not labelled A1) 6

3 £67 – £25 = £42 MA1

£42 ÷ £1.20 MA1

35 A1 3

4 2% of £1500 = £30 MA1

3 × £30 MA1

£90 A1 3

5 **(a)** 360 – (110 + 130 + 52) MA1

68 MA1

112 A1

(b) (180 – 32) ÷ 2 MA1

74 A1 5

6 3.2 × £6 = £19.20 MA1

£20.46 – £19.20 = £1.26 MA1

£1.26 ÷ 1.8 MA1

70p A1 4

7 70% , 64% , 68%   M1A1

No (must also have a reason) $\Big\}$

Her best mark was in Geography   A1

Alternative No because Geography 70% is higher than English 68%   M1 A1 A1   3

8 **(a)** 8% of £840 = £67.20   MA1

£840 + £67.20 = £907.20   MA1

£75.60   A1

(b) 5% of £840 = £42 and £840 – £42 = £798   MA1

£907.20 – £798 = £109.20   A1   5

9 One card must be 5 to allow mode to be 5   A1
Total of cards 5 × 6 = 30   MA1
Last card = 30 – (3 + 5 + 8 + 5) = 9   MA1
Range = 9 – 3 = 6   MA1   4

10 **(a)** $4(2b + 3)$ A1

(b) $t(t – 1)$ A1   2

11 $\dfrac{1}{4} + \dfrac{1}{6}$ MA1

$= \dfrac{5}{12}$ A1

$\dfrac{2}{3} = \dfrac{8}{12}$ A1

Yes 8 > 5 so enough in C to fill A and B   A1   4

12 35 in overlap   MA1
(95 – 35 =) 60 in French only   MA1
(75 – 35 =) 40 in German only   MA1
200 – (35 + 60 + 40) = 65   A1   4

13 QSP = 110   MA1
TUP = 50 so QPU = 50 (alternate)   MA1
PQS = 180 – (50 + 110) = 20, x = 180 – 20 = 160   MA1   3

14 **(a)** $5 < t \leq 10$ A1

(b) 2.5 × 7 + 7.5 × 8 +12.5 × 5 + 17.5 × 5 + 22.5 × 4 + 27.5 × 1 (= 345)   M1 A1

$\dfrac{345}{30}$ MA1

=11.5   A1   5

15 $8x - 12 - 2x + 10$ MA1
    $= 6x - 2$ MA1   2

16 $200 = 2 \times 2 \times 2 \times 5 \times 5$ M1 A1
    $2^3 \times 5^2$ A1   3

17 $2x + 10 + 2x + x + 20 = 180$ M1
    $5x = 150$ MA1
    $x = 30$ MA1
    Smallest angle = 50   A1   4

18 Diagram correctly set up   M1
    $4^2 + x^2 = 12^2$ MA1
    $x^2 = 128$ MA1
    $x = 11.3$ MA1
    Perimeter = $4 + 12 + 11.3 = 27.3$ MA1   5

19 (a) 20% increase, e.g. 120% of 150 = 180   M1 A1
       20% decrease, e.g. 80% of 180 = 144 – decrease   MA1

  (b) % decrease = 4%   M1 A1

  (c) (20% decrease) = 0.8×1.2 (20% increase) = same   M1 A1
       (or similar explanation/calculation to justify answer)
       Alternative 20% decrease = 0.8 20% increase = 1.2 $0.8 \times 1.2 = 0.96$ 7

20 SA of sphere = $4 \times \pi \times 6^2 = 452$ MA1
    SA hemisphere = 226   MA1
    base = $\pi \times 6^2 = 113$ MA1
    total = 339
    Martha is correct   MA1   4

21 Distance travelled in 1 minute = 720 m   MA1
    $\sin \left(20 = \frac{x}{720} \right)$ MA1
    $x = 720 \sin 20$ MA1
    $x = 246.25$ m   A1   4

22 $(x - 4)(x + 3) = 0$ M1 A1
    $x = 4$ $x = -3$ A1   3

23 $2(a - 1) + (a + 1) = 12$ MA1
    $2a - 2 + a + 1 = 12$ MA1
    $3a = 13$ MA1
    $a = 4\frac{1}{3}$ MA1   4

			AVAILABLE MARKS

24 $y = 3x + c$ (c = any numerical value, c ≠ 5)   M1 A1   2

25 **(a)** Cumulative frequency graph and scale   M1 A2

     (b) 160 – (reading from 55 on their graph)   A2   5
           (correct reading approx. 160 – 72 = 88)
           Allow A1 for reading at 55

26 107.5% = 29 455   MA1
     (100%) = 29 455 ÷ 107.5 × 100   MA1
     = £27 400   A1

Alternative Solution

     (100%) = 29 455 ÷ 1.075   M1 A1
     = £27 400   A1   3

                                       Total   **100**