

8300

## GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

---

Algebra

Using and finding equations of linear real-life graphs

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

|                        |                                                                                                                                       |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>M</b>               | Method marks are awarded for a correct method which could lead to a correct answer.                                                   |
| <b>A</b>               | 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>B</b>               | Marks awarded independent of method.                                                                                                  |
| <b>ft</b>              | Follow through marks. Marks awarded for correct working following a mistake in an earlier step.                                       |
| <b>SC</b>              | Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.                       |
| <b>M dep</b>           | A method mark dependent on a previous method mark being awarded.                                                                      |
| <b>B dep</b>           | A mark that can only be awarded if a previous independent mark has been awarded.                                                      |
| <b>oe</b>              | Or equivalent. Accept answers that are equivalent.<br>e.g. accept 0.5 as well as $\frac{1}{2}$                                        |
| <b>[a, b]</b>          | Accept values between a and b inclusive.                                                                                              |
| <b>3.14...</b>         | Allow answers which begin 3.14 e.g. 3.14, 3.142, 3.1416                                                                               |
| <b>Use of brackets</b> | 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) 100

*Accept 1 hour 40 (minutes)***B1****Additional Guidance**

100 seen with answer 1:40 or 1.40

**B1**

1:40 or 1.40 without 100 seen

**B0**

- (b) 85

**B1**

- (c) A

**B1****[3]****Q2.**

- (a) Plan A

**B1**

Valid reason

*eg cheaper (for 800 minutes)***B1**

- (b) Attempt at any two readings from Plan B slope

*eg (600, 30), (700, 60), (800, 90), (900, 120), (1000, 150)**need not be coordinates eg 600(min), (£)30 or (£)30, 600(min)***M1**Compares cost and time or  $6000 \div 200$  or  $60 \div 200$ *oe**eg (£)30 in 100 (minutes) (£)120 in 400 (minutes)***M1 dep**

30p or £0.30

**A1****[5]**

**Q3.**

(a) 20

**B1**

(b)  $28 - 20$  or  $\frac{36 - 20}{2}$  or  $\frac{44 - 20}{3}$   
or  $\frac{52 - 20}{4}$  or  $\frac{60 - 20}{5}$

or correct calculation using any two points, eg  $\frac{60 - 44}{2}$

or

$2 \times 4$

**M1**

8

**A1**

**Additional Guidance**

$(60 \div 5 =) 12$

**M0A0**

(c) **Alternative method 1**

their  $20 + 7 \times$  their 8

oe

**M1**

76

*correct answer or ft their values in (a) and (b)*

**A1ft**

**Alternative method 2**

$60 + 2 \times$  their 8

oe

**M1**

76

*correct answer or ft their values in (b)*

**A1ft**

**Additional Guidance**

For Alt 2, they may read off any cost for  $n$  minutes (from 1 to 5) and add on  $(7 - n) \times$  their (b) for M1. A1 or A1ft may follow from their working

**[5]**

**Q4.**

(a)  $C = 8d + 16$

*Last one*

**B1**

(b) Plots graph ... at least two correct coordinates for  $C = 9d + 11$

*Works out costs for at least 2 days for Woods Tool Hire ...*

*20, 29, 38, 47, 56 ... (minimum of 2 of these)*

**M1**

Correct straight line to intersection at (5, 56)

*Identifies equal cost for 5 days*

**A1**

No ticked with valid statement

No may be implied

*eg cheaper up to 4 days, equal costs for 5 days, more expensive for 6 days onwards*

**A1**

**Alternative method 1**

$$8d + 16 = 9d + 11$$

**M1**

$$d = 5$$

**A1**

No ticked with valid statement

No may be implied

*eg cheaper up to 4 days, equal costs for 5 days, more expensive for 6 days onwards*

**A1**

**Alternative method 2**

$$9 \times \text{their } d + 11$$

$$\text{their } d \geq 5$$

**M1**

Correct calculation

**A1**

Corresponding correct value from

Branch Tool Hire **and** No ticked

No may be implied

*From graph or using correct formula*

**A1**

**[4]**

**Q5.**

(a)  $C = 4d + 20$

**B1**

(b) **Alternative method 1**

their  $(4d + 20) + 6d + 10 = 90$

**M1**

$10d = 60$

or their  $4d + 6d = 80$  – their 20 correctly evaluated

*correctly collects terms on both sides for their  $(4d + 20)$*

**M1**

6

**A1**

**Alternative method 2**

Correct value for hire of drill or sander for  $d$  days where  $d > 1$

**M1**

Correct total value for hire of drill and sander for  $d$  days where  $d > 1$

**M1**

6

**A1**

**Additional Guidance**

$20d + 4 + 6d + 10 = 90$

$26d + 14 = 90$

$26d = 76$

$4d + 24 + 6d + 10 = 90$

$10d + 34 = 90$

$10d = 56$

$24d - 4 + 6d + 10 = 90$

$30d + 6 = 90$

$30d = 84$

**M1M1A0**

| number of days  | 2  | 3  | 4  | 5  | 6  |
|-----------------|----|----|----|----|----|
| drill hire (£)  | 28 | 32 | 36 | 40 | 44 |
| sander hire (£) | 22 | 28 | 34 | 40 | 46 |
| total hire (£)  | 50 | 60 | 70 | 80 | 90 |

**[4]**

**Q6.**

$h = 3n + 20$

or

$h = 20 + 3n$

*oe in the form  $h =$*

*B2 correct equation not in the form  $h =$*

*or  $3n + 20$  or  $20 + 3n$*

*or  $h = 3n (+ k)$  ( $k$  is a number or letter)*

*or  $h = (k +) 3n$  ( $k$  is a number or letter)*

*or  $h = an + 20$  ( $a \neq 0$ )*

*or  $h = 20 + an$  ( $a \neq 0$ )*

*B1  $3n (+ k)$  ( $k$  is a number or letter)*

*or  $(k +) 3n$  ( $k$  is a number or letter)*

*or  $an + 20$  ( $a \neq 0$ )*

*or  $20 + an$  ( $a \neq 0$ )*

*SC1  $n = 3h + 20$*

**B3**

**Additional Guidance**

Allow  $h =$  in working but omitted on answer line

For an equation in the form  $h =$  in working, but rearranged (correctly or incorrectly) for the answer line, award 1 mark less than the  $h =$  form

Condone an unsimplified fraction for 3 if it has integer numerator and denominator

eg  $h = \frac{12}{4}n + 20$

**B3**

An unsimplified fraction for 3 can still score marks if it does not have integer numerator and denominator

eg  $h = \frac{32-20}{4}n + 20$

**B2**

Allow  $3 \times n$  or  $n \times 3$  for  $3n$

Ignore units

Condone capital  $H$  or  $N$ , but for incorrect variable(s) award 1 mark less than correct variable(s) would get

eg1  $h = 3x + 20$  or  $y = 3x + 20$

**B2**

eg2  $3x + 20$

**B1**

eg3  $3x$

**B0**

[3]

**Q7.**

(a) 0

**B1**

(b)  $\frac{1}{2} \times (50 + 30) \times 20$

*oe complete method to work out the area of the trapezium*

*eg*

$$\frac{1}{2} \times 10 \times 20 + 20 \times 30 + \frac{1}{2} \times 10 \times 20$$

*or*

$$50 \times 20 - \frac{1}{2} \times 10 \times 20 - \frac{1}{2} \times 10 \times 20$$

*or*

$$40 \times 20$$

**M1**

800

**A1**

[3]

**Q8.**

(a) 8

**B1**

(b) 3

*Accept -3*

**B1**

[2]

**Q9.**

- (a)  $1.2 \times 20 = 24$  and  $40 - 24 = 16$   
 oe eg  $1.2 \times 20 = 24$  and  $24 + 16 = 40$   
 or  $40 - 16 = 24$  and  $24 \div 20 = 1.2$   
 or  $24 + 16 = 40$  and  $24 \div 1.2 = 20$   
 may be seen as one calculation  
 eg  $40 - 1.2 \times 20 = 16$   
 or  $16 + 1.2 \times 20 = 40$   
 or  $40 - 16 = 1.2 \times 20$

**B1**

**Additional Guidance**

$40 - 24 = 16$  and  $40 - 16 = 24$  and  $24 + 16 = 40$  are equivalent  
 $1.2 \times 20 = 24$  and  $24 \div 1.2 = 20$  and  $24 \div 20 = 1.2$  are equivalent  
 $40 - 24 = 16$  or  $16 + 24 = 40$  or  $40 - 16 = 24$

**B0**

(20 minutes  $\Rightarrow$ ) 24 litres leak out  $40 - 24 = 16$

**B0**

$1.2 \times 20 = 24$  16 litres left

**B0**

Allow unambiguous working in ml and/or seconds

For eg  $40 - 24 = 16$  condone  $24 - 40 = 16$  or  $24 - 40 = -16$

Condone incorrect use of equals sign

eg  $1.2 \times 20 = 24 + 16 = 40$  or  $1.2 \times 20 = 24 - 40 = 16$

**B1**

Correct response with irrelevant work

**B1**

16 from two different ways with one way incorrect is choice

eg  $1.2 \times 20 = 24$  and  $40 - 24 = 16$  and  $20 \div 1.2 = 16$

**B0**

- (b) 3

**B1**

Correct method for gradient

eg  $\frac{40 - 16}{15 - \text{their } 3}$  or  $\frac{24}{12}$   
 oe eg  $\frac{30 - 25}{10 - 7.5}$  or  $\frac{10}{5}$  or  $40 - 38$

**M1**

2

correct or ft their 3

**A1ft**

**Additional Guidance**

Note that their 3 can be used to work out the rate but does not have to be

Values seen on graph must be used correctly

eg 24 and 12 seen on the graph is M0 unless subsequently used correctly

in attempt to work out the gradient

A1ft answers must be to 1 dp or better

eg 3.5

**B0**

$\frac{40 - 16}{15 - 3.5}$

**M1**

2.1 (accept 2.08...)

**A1ft**

After B0 the method may be implied (use  $\frac{40 - 16}{15 - \text{their } 3}$  to check)  
eg 6

**B0**

2.7 (accept 2.66...)

**M1A1ft**

If the report is blank, 3 and 2 must be unambiguously identified in working to be acceptable

Allow 2 to be written as  $\frac{2}{1}$

**[4]**

**Q10.**

(a) C

**B1**

E

**B1**

D

**B1**

B

**B1**

(b) 100 (+) 100

oe

**M1**

200

**A1**

**[6]**

**Q11.**

*This question has been adapted to better suit the style of the current specification*

No units on the vertical axis

oe

**B1**

Graph should be a straight line

oe

**B1**

**[2]**

**Q12.**

(a) B

**B1**

(b)  $(10 - 4) \div (12 - 8)$  or  $6 \div 4$

**M1**

1.5

oe

**A1**

**[3]**

**Q13.**

(a) 12

**B1**

(b)  $7 \times 9$  or 63

or  $12 + \frac{27}{4} \times 6$  or (£)52.5(0)

**M1**

63 or (£)52.5(0) and No

**A1**

(c)  $a = 9$

**B1**

Substitutes a correct pair of values for  $n$  and  $C$  into  $C = \text{their } 9 + b(n - 1)$   
or

method for gradient eg  $\frac{41 - 9}{5 - 1}$   
oe

**M1**

$b = 8$

**A1**

[6]

**Q14.**

$C = 0.6(0)n + 2.5(0)$

oe

Must have  $C =$  for B3

B2  $C = 0.6n + k$  ( $k \neq 0$ )

or  $C = an + 2.5$  ( $a \neq 0$ )

or  $0.6n + 2.5$

B1  $0.6n$  or  $an + 2.5$  ( $a \neq 0$ )

or  $C = 60n + 250$

**B3**

**Additional Guidance**

Allow correct fractions eg  $\frac{3}{5}$  or  $\frac{1}{1.6}$  for 0.6 and/or  $\frac{5}{2}$  for 2.5

Allow  $0.6 \times n$  or  $n \times 0.6$  for  $0.6n$

eg  $C = 0.6 \times n + 2.5$

**B3**

$n \times 0.6 + 2.5$

**B2**

$0.6 \times n$

**B1**

Penalise by one mark the use of  $n0.6$  for  $0.6n$

eg  $C = n0.6 + 2.5$

**B2**

$n0.6 + 2.5$

**B1**

$n0.6$

**B0**

Penalise by one mark the use of different letters

eg  $y = 0.6x + 2.5$

**B2**

$$0.6x + 2.5$$

**B1**

$$2p + 2.5$$

**B0**

Transposing 0.6 and 2.5 scores zero eg  $C = 2.5n + 0.6$

**B0**

Ignore £ signs e.g.  $£C = £0.6n + £2.5$  or  $C = £0.60n + £2.5$

**B3**

$$C = 1.2n + 2.5$$

**B2**

$$1.2n + 2.5$$

**B1**

$C = 0.6n + 2.5$  in working with  $0.6n + 2.5$  on answer line

**B3**

Equivalent formula but C not the subject scores B2

eg  $100C = 60n + 250$

**B2**

**[3]**

**Q15.**

(a) 8 cm

**B1**

(b) 
$$\frac{21-13}{11-6}$$

oe

**M1**

$$\frac{8}{5} \text{ or } 1.6$$

oe

**A1**

cm/s or  $\text{cm s}^{-1}$   
oe eg Centimetres per second

**B1**

**[4]**

**Q16.**

(a) C

**B1**

(b)  $y \propto \sqrt{x}$  or  $y = k\sqrt{x}$

oe

or  $cy = \sqrt{x}$

**B1**

$$36 = k\sqrt{100}$$

$$\text{or } k = 3.6$$

$$\text{or } y = 3.6\sqrt{x}$$

oe

$$36c = \sqrt{100}$$

$$\text{or } c = \frac{5}{18} \text{ or } 0.277\dots$$

$$\text{or } \frac{5}{18}y = \sqrt{x}$$

**M1**

$$3.6 \times \sqrt{250}$$

$$\text{or } 56.9(\dots)$$

oe

$$\sqrt{250} \div \frac{5}{18}$$

**M1**

$$57$$

**A1**

[5]

**Q17.**

(a) [2.9, 3]

**B1**

(b) [1.4, 1.6]

**B1**

(c)  $\frac{[4.55, 4.65] - 0}{3.5 - [1.5, 1.6]}$  or  $\frac{[4.55, 4.65]}{[1.9, 2]}$   
 $\frac{[4.55, 4.65] - 0}{[1.5, 1.6] - 3.5}$  or  $\frac{[4.55, 4.65]}{[-2, -1.9]}$   
 or  $[-2.45, -2.275]$   
 oe

**M1**

$$[2.275, 2.45]$$

**A1**

[4]

**Q18.**

(a) 17 cm

**B1**

(b)  $\frac{38-21}{13-4}$

oe

**M1**

$\frac{17}{9}$

or 1.88(...)

oe

**A1**

cm/s or  $\text{cm s}^{-1}$

oe eg *centimetres per second*

**B1**