GCSE MATHEMATICS **MARK SCHEME**

Practice Paper Higher 1 Maximum marks: 80

Non-Calculator

View detailed guidance on the conclusions you can draw from your students' performance in these papers on the MERiT welcome page. Understand how your students compare with others and target revision effectively by entering marks into MERiT.

1 0.667 B1 **[1]**

2 AAA B1 **[1]**

3 $\frac{9}{25}$ B1 **[1]**

4 (a) $\frac{2}{5}$ B1

(b) $\frac{5}{9} \times 72$ or 8×5 or $360 \div 9$ M1

oe e.g. multiples of 8 listed and 5th one chosen with maximum one error

40 A1

SC1 32

Additional Guidance

$\frac{40}{72}$ M1A0

40 out of 72 M1A1

[3]

5 **Alternative method 1**

$\frac{17}{2}$ or $\frac{8}{3}$ *oe fractions* M1

their $\frac{17}{2}$ × their $\frac{3}{8}$ *conversion of both mixed numbers to improper fractions and multiplication of the conversion of* $8\frac{1}{2}$ *by the reciprocal of the conversion of* $2\frac{2}{3}$ M1

$\frac{51}{16}$ `` *oe fractions or decimal* A1

$3\frac{3}{16}$ *oe mixed number* B1ft

ft correct conversion of their improper fraction to a mixed number

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Alternative method 2

$\frac{17}{2}$ or $\frac{8}{3}$	*oe fractions*	M1
$\frac{51}{6} \div \frac{16}{6}$	*conversion of both mixed numbers to improper fractions,*	M1
	correct conversion to improper fractions with a common denominator and division of the conversion of $8\frac{1}{2}$ *by the conversion of* $2\frac{2}{3}$	
$\frac{51}{16}$ ``	*oe fractions or decimal*	A1
$3\frac{3}{16}$	*oe mixed number*	B1ft
	ft correct conversion of their improper fraction to a mixed number	

Additional Guidance

Working with decimals 0, 3 or 4

Ignore incorrect attempt to simplify a mixed number

eg $3\frac{3}{16} = 3\frac{1}{8}$	M1M1A1B1
$3\frac{3}{16}$ seen, then $\frac{51}{16}$ on answer line	M1M1A1B0
$\frac{9}{2}$ and $\frac{8}{3}$, $\frac{27}{6} \div \frac{16}{6}$, $\frac{27}{16}$, $1\frac{11}{16}$	M1M1A0B1ft
$\frac{9}{2}$ and $\frac{8}{3}$, $\frac{27}{6} \div \frac{16}{6}$, $1\frac{11}{16}$	M1M1A0B1ft
$\frac{9}{2}$ and $\frac{4}{3}$, $\frac{27}{6} \div \frac{8}{6}$, $\frac{27}{8}$, $3\frac{3}{8}$	M0M1A0B1ft

[4]

6 (a) $3x + 6$ M**1**

$5x + 3$ = their $3x + 6$

$2x$ = their 3 M1

for collecting terms together

1.5 *oe* A1 ft

ft their second M1

(b) $2x + 32$ or $4x - 20$ M1

Accept ax + ab for M1

$6x + 12$ or $6(x + 2)$ A1

$a = 6$ and $b = 2$ A1 ft

ft from their 6x + 12 if M1 earned

SC2 a = 6 and b = 12

SC1 a = 6

[6]

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7	(a)	a^{25}		B1
	(b)	a^{15}		B1
	(c)	a^{100}		B1
				[3]
8	$\pi \times 8^2 (\div 2)$	*oe*		M1
	32π			A1
				[2]
9	(a)	$1(.0) \times 10^{-6}$		B1
	(b)	50 000 000 000 000		B1
	(c)	$4^3 = 2^6$	*$2^{10} = 4^5$*	M1
		their $2^6 \times 2 \times 2 \times 2 \times 2$		M1
			$4^5 \div 4 \div 4$	
			For this mark the correct number of 2s or 4s needed for their 2^6 or their 4^5	
		5	*SC1 answer only*	A1
		Alternative method 1		
		64 and 128		M1
			Allow one arithmetical slip when multiplying by 2.	
		64, 128, 256, 512 and 1024		M1dep
			Allow one arithmetical slip when multiplying by 2.	
		5	*If one arithmetical slip then A0*	A1
			SC1 answer only	
		Alternative method 2		
		64 and 1024		M1
		1024 ÷ 64 =16 *oe*		M1
		5	*SC1 answer only*	A1
				[5]
10	$4(x + 3)$			B1
				[1]
11	Pair of intersecting arcs, equal radii > half *XY*, above and below *XY*			M1
	Perpendicular bisector of *XY* drawn with correct construction			A1
	Arc, centre *Y*, radius [5.3, 5.7] cm			B1
	Correct region identified			B1ft
			ft region to left of their perpendicular bisector and inside their arc	
				[4]

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12 (a) 2 + 1 = 3 or clear connection between 1, 2 and 3 B1

oe eg $\frac{2}{3} \div \frac{1}{3} = 1$ *or clear connection between* $\frac{1}{3}$, $\frac{2}{3}$ *and 1*

(b) Each probability male $\frac{2}{3}$ B1

oe [0.66, 0.67]

Each probability female $\frac{1}{3}$ B1

oe 0.33 or better

SC1 probabilities wrong but all pairs add to 1

(c) $\frac{1}{3} \times \frac{1}{3}$ or $\frac{2}{3} \times \frac{2}{3}$ or $\frac{2}{3} \times \frac{1}{3}$ M1

or sight of $\frac{1}{9}$ *or* $\frac{2}{9}$ *or* $\frac{4}{9}$

Two males = $\frac{4}{9}$ **or** Two females = $\frac{1}{9}$ **or** MF or FM = $\frac{2}{9}$ M1

Probabilities must be linked with genders

Check on tree if not labelled to ensure correct outcomes being used

One of each = 2 × $\frac{2}{9}$ = $\frac{4}{9}$ or both same = $\frac{4}{9}$ + $\frac{1}{9}$ = $\frac{5}{9}$ A1

Must show how either $\frac{4}{9}$ *or* $\frac{5}{9}$ *is achieved*

Two of same (gender more likely) A1

First A1 must be awarded and decision for 4 marks but if both answers given, both must be correct

[7]

13 (a) 3 B1

(b) Correct attempt at full area M2

eg1 $\frac{1}{2}$ × 5 × 5 + 5 × their 3 + $\frac{1}{2}$ × 4 × 5

(= 12.5 + 15 + 10)

Eg 2 $\frac{1}{2}$ × (12 + their 3) × 5

(= $\frac{1}{2}$ × 15 × 5)

ft their 3 from (a) for M2 and M1

M1 Correct attempt at a relevant area

eg1 ½ × 5 × 5 (= 12.5)

eg2 5 × their 3 (= 15)

eg3 ½ × 4 × 5 (= 10)

eg 4 Counting squares

37.5 A1ft

oe

ft from M2 and their 3 from (a)

(c) 1 B1

(d) acceleration B1

[6]

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14 (a) Fully correct cumulative frequency diagram using UCBs and 2, 5, 25, 41, 50 B3

Ignore (50, 0)
Ignore before 1st point and after last point
B2 for one error
eg Consistent plotting at mid class intervals with line joining points
Consistent plotting at lower bounds with line joining points
One error on cumulative frequency values
eg 2, 6, 26, 42, 51
eg 2, 5, 25, 51, 60
Points not joined
B1 for 2, 5, 25, 41, 50
B1 for bar chart indicating correct heights with no lines

(b) **Alternative method 1**

Using correct cumulative frequency graph M1

[6, 9] or [31, 34]

Using incorrect cumulative frequency graph
Reading at 72 or reading at 85 ± ½ square tolerance

[6, 9] and [31, 34] M1

Reading at 72 and reading at 85 ± ½ square tolerance

[22, 28] A1ft

ft from their graph readings at 72 and 85

Alternative method 2

Using the table or dividing up frequency bars

$\frac{4}{5} \times 20$ or 16 or $\frac{1}{2} \times 16$ or 8 M1

$\frac{4}{5} \times 20$ or 16 and $\frac{1}{2} \times 16$ or 8 M1

24 A1

[6]

15 **Alternative method 1**

80 ÷ 16 (= 5) **or** 16 × 5 M1

*16 ÷ 80 (= 0.2) **or** 80 × 0.2*

196 × their 5^2 **or** $\frac{x}{196} = (\frac{80}{16})^2$ M1dep

196 ÷ their 0.2^2 ***or*** $\frac{196}{x} = (\frac{16}{80})^2$

4900 A1

Alternative method 2

80 ÷ 16 (= 5) **or** 16 × 5 M1

*16 ÷ 80 (= 0.2) **or** 80 × 0.2*

5000 ÷ their 5^2 **or** $\frac{5000}{x} = (\frac{80}{16})^2$ M1dep

5000 × their 0.2^2 ***or*** $\frac{x}{5000} = (\frac{16}{80})^2$

200 A1

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Alternative method 3

80 ÷ 16 (= 5) **or** 16 × 5 M1

*16 ÷ 80 (= 0.2) **or** 80 × 0.2*

their 5^2 **and** 5000 ÷ 196 M1dep

*their 0.2^2 **and** 196 ÷ 5000*

25 **and** [25.5, 25.5102041] A1

*0.04 **and** 0.039(2)*

[3]

16 **Alternative method 1 Working with 2.75.....**

$10x = 27.5...$ M1

or $100x = 275...$

oe multiplication by a power of 10

eg 1000x = 2755.5...

any letter

$10x - x = 27.5... - 2.75...$ M1dep

or $9x = 24.8$ with $10x = 27.5...$ seen

or $100x - 10x = 275.5... - 27.5...$

or $90x = 248$ with $100x = 275.5...$and $10x = 27.5...$ seen

or $100x - x = 275... - 2.75...$

or $99x = 272.8$ with $100x = 275.5...$ seen

oe subtraction to eliminate recurring digits

eg 1000x − 10x = 2755.5... − 27.5...

or 990x = 2728 with 1000x = 2755.5...

and 10x = 27.5... seen

numbers must all be correct

$x = 2.75...$ stated and M2 scored and $9x = 24.8$ and $x = \frac{24.8}{9} = \frac{124}{45}$ A1

or $x = 2.75...$ stated and M2 scored and $90x = 248$ and $x = \frac{248}{90} = \frac{124}{45}$

or $x = 2.75...$ stated and M2 scored and $99x = 272.8$ and $x = \frac{272.8}{99} = \frac{124}{45}$

oe

eg x = 2.75... stated and M2 scored and 990x = 2728

and $x = \frac{2728}{990} = \frac{124}{45}$

Alternative method 2 Working with 0.75...

$10x = 7.5...$ M1

or $100x = 75.5...$ *oe multiplication by a power of 10*

eg 1000x = 755.5... any letter

$10x - x = 7.5... - 0.75...$ M1dep

or $9x = 6.8$ with $10x = 7.5...$ seen

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or $100x - 10x = 75.5... - 7.5...$

or $90x = 68$ with $100x = 75.5...$and $10x = 7.5...$ seen

or $100x - x = 75.5... - 0.75...$

or $99x = 74.8$ with $100x = 75.5...$ seen

oe subtraction to eliminate recurring digits

eg $1000x - 10x = 755.5... - 7.5...$

or $990x = 748$ with $1000x = 755.5...$

and $10x = 7.5...$ seen

numbers must all be correct

$x = 0.75...$ stated and M2 scored and $9x = 6.8$ and $x = \frac{6.8}{9}$ and $2\frac{6.8}{9} = \frac{124}{45}$ A1

or $x = 0.75...$ stated and M2 scored and $90x = 68$ and $x = \frac{68}{90}$ and $2\frac{68}{90} = \frac{124}{45}$

or $x = 0.75...$ stated and M2 scored and $99x = 74.8$ and $x = \frac{74.8}{99}$ and $2\frac{74.8}{99} = \frac{124}{45}$

oe

eg $x = 0.75...$ stated and M2 scored

and $990x = 748$ and $x = \frac{748}{990}$ and $2\frac{748}{990} = \frac{124}{45}$

Alternative method 3 Working with 0.05.....

$10x = 0.5...$ M1

or $100x = 5.5...$ *oe multiplication by a power of 10*

eg $1000x = 55.55...$any letter

$10x - x = 0.5... - 0.05...$

or $9x = 0.5$ with $10x = 0.5...$ seen

or $100x - 10x = 5.5... - 0.5...$

or $90x = 5$ with $100x = 5.5...$and $10x = 0.5...$ seen

or $100x - x = 5.5... - 0.05...$

or $99x = 5.5$ with $100x = 5.5...$ seen

oe subtraction to eliminate recurring digits

eg $1000x - 10x = 55.5... - 0.5...$

or $990x = 55$ with $1000x = 55.5...$

and $10x = 0.5...$ seen

numbers must all be correct

$x = 0.05...$ stated and M2 scored and $9x = 0.5$ and $x = \frac{0.5}{9}$ and $2.7 + \frac{0.5}{9} = \frac{124}{45}$ A1

or $x = 0.05...$ stated and M2 scored and $90x = 5$ and $x = \frac{5}{90}$ and $2.7 + \frac{5}{90} = \frac{124}{45}$

or $x = 0.05...$ stated and M2 scored and $99x = 5.5$ and $x = \frac{5.5}{99}$ and $2.7 + \frac{5.5}{99} = \frac{124}{45}$

oe

eg $x = 0.05...$ stated and M2 scored

and $990x = 55$ and $x = \frac{55}{990}$ and $2.7 + \frac{55}{990} = \frac{124}{45}$

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Additional guidance

124 ÷ 45 = 2.75... M0M0A0

Alt 1 M1dep

oe subtraction to eliminate recurring decimals includes

$100x - 10x = 248$ with $100x = 275.5...$ and $10x = 27.5...$ seen

or $90x = 275.5... - 27.5...$ with $100x = 275.5...$ and $10x = 27.5...$ seen

(apply same principle in Alts 2 and 3)

Alt 2 equivalents for final part of A1

eg For $2\frac{68}{90} = \frac{124}{45}$

allow $2 + \frac{68}{90} = \frac{124}{45}$

Alt 3 equivalents for final part of A1

eg For $2.7 + \frac{5}{90} = \frac{124}{45}$

allow $2 + \frac{7}{10} + \frac{5}{90} = \frac{124}{45}$

[3]

17 $a + 2x = n(a - x)$ M1

$a + 2x = na - nx$ *oe* A1

$nx + 2x = na - a$ M1

or $x(n + 2) = na - a$

or $x(n + 2) = a(n - 1)$

oe

for collecting the x terms on one side and the other terms on the opposite side

Allow one sign error

$x = \frac{a(n-1)}{n+2}$ **or** $x = \frac{na-a}{n+2}$ A1

oe

[4]

18 C B1

[1]

19 $(3x + a)(x + b)$ M1

where $ab = 8$ or $a + 3b = 14$

or $3x(x + 4) + 2(x + 4)$

or $x(3x + 2) + 4(3x + 2)$

$(3x + 2)(x + 4)$ *oe* A1

[2]

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20 **Alternative Method 1**

$x^2 - cx - cx + c^2$ M1

or $x^2 - 2cx + c^2$

or $a = c^2$

or $12 = 2c$

or $12x = 2cx$

or $-12x = -2cx$

$c = 6$ A1

$a = 36$ A1ft

ft their c^2

Alternative Method 2

$(x - 6)^2 + a - 36$ M1

$c = 6$ A1

$a = 36$ A1ft

ft their c^2

[3]

21 (*C* has coordinates) (2, 4) B1

(Gradient =) −2 *Implied by $y = -2x$ …* B1

$\frac{-1}{\text{their gradient}}$ or (Gradient =) ½ M1

Implied by $y = \frac{1}{2}x$ …

their 4 = their ½ × their 2 + c M1
or $c = 3$

oe

$y = \frac{1}{2}x + 3$ *oe* $y \frac{1}{2}(x + 6)$ A1ft

ft their coordinates of C and their initial gradient if M1M1 scored

Additional Guidance

(Gradient =) ½ or $y = \frac{1}{2}x$ … implies the second B mark and the first M mark.

[5]

22 $\frac{9}{25x}$ B1

[1]

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23 (a) $\overrightarrow{BD} = x + y$ **B1**

oe

$\overrightarrow{BD} = \overrightarrow{BC} + \overrightarrow{CD}$

$\overrightarrow{MN} = ½x + ½y$ B1

oe

$\overrightarrow{MN} = ½\overrightarrow{BC} + ½\overrightarrow{CD}$

$\overrightarrow{MN} = \overrightarrow{MC} + \overrightarrow{CN}$

$\overrightarrow{BD}$ is a multiple of $\overrightarrow{MN}$ B1

oe

(b) 2 : 1 B1

[4]

24 **Alternative method 1**

$\frac{n(n+1)+(n+1)(n+2)}{2}$ M1

$\frac{(n+1)(n+n+2)}{2}$ M1dep

$\frac{(n+1)2(n+1)}{2}$ A1

$(n + 1)(n + 1)$ A1

Alternative method 2

$\frac{n^2+n}{2}$ or $\frac{n^2+2n+n+2}{2}$ M1

or $\frac{n^2+3n+2}{2}$ *may be seen in stages* e.g. $n^2 + n$ followed by $\frac{n^2+n}{2}$

$\frac{n^2+n}{2}$ and $\frac{n^2+2n+n+2}{2}$

or $\frac{n^2+n}{2}$ and $\frac{n^2+3n+2}{2}$ M1dep

may be seen in stages e.g. $n^2 + n$ *followed by* $\frac{n^2+n}{2}$

and $n^2 + 3n + 2$ *followed by* $\frac{n^2+3n+2}{2}$ *implies M2*

$\frac{2n^2+4n+2}{2}$ or $n^2 + 2n + 1$ with M2 seen A1

oe single fraction with terms collected e.g. $\frac{4n^2+8n+4}{4}$

$n^2 + 2n + 1$ and $(n + 1)^2$ with M2A1 seen A1

allow $(n + 1)(n + 1)$ *for* $(n + 1)^2$

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Alternative method 3

$\frac{n+1}{2}(n + n + 2)$ oe e.g. $(n + 1)\left(\frac{n}{2}+\frac{n+2}{2}\right)$ M1

$\frac{n+1}{2}(2n + 2)$ M1dep

or $\frac{n^2+n}{2} + \frac{n^2+n}{2} + \frac{2n+2}{2}$ with M1 seen

$\frac{2n^2+4n+2}{2}$ or $n^2 + 2n + 1$ with M2 seen A1

oe single fraction with terms collected e.g. $\frac{4n^2+8n+4}{4}$

$n^2 + 2n + 1$ and $(n + 1)^2$ with M2A1seen A1

allow $(n + 1)(n + 1)$ for $(n + 1)^2$

Alternative method 4

$\frac{n+1}{2}(n + n + 2)$ *oe eg* $(n + 1)\left(\frac{n}{2}+\frac{n+2}{2}\right)$ M1

$\frac{n+1}{2}(2n + 2)$ with M1 seen M1dep

oe eg $\frac{(n+1)(2n+2)}{2}$

$(n + 1)^2$ with M2 seen A2

A1 $2(n + 1)\frac{n+1}{2}$ or $\frac{2(n+1)^2}{2}$

allow $(n + 1)(n + 1)$ for $(n + 1)^2$

Additional Guidance

Only substituting in values of n M0M0A0A0

Consistently using a different letter to n can score up to M1M1A1A1

Using two different letters consistently within the two fractions (e.g. n replaced by x in the first equation and n replaced by y in the second equation) can score a maximum of M1M1A0A0 unless recovered to the same letter

Multiplying fractions instead of adding can score a maximum of M2A0

For M marks condone e.g. $n2$ for $2n$ etc

$n^2 + n$ /2 and $n^2 + 3n$ + 2/2 recovered to $\frac{2n^2+4n+2}{2}$

and/or n2 + 2n + 1 and/or (n + 1)2 M1M1A0A0

n2 + n /2 and n2 + 3n + 2/2 not recovered M0M0A0A0

$n^2 + n$ and $n^2 + 3n + 2$ recovered to $\frac{2n^2+4n+2}{2}$

and/or $n^2 + 2n + 1$ and/or $(n + 1)^2$ M1M1A0A0

$n^2 + n$ and $n^2 + 3n + 2$ not recovered M0M0A0A0

Equating to n^2 in working can score a maximum of M1M1A0A0

(equating to e.g. x^2 can score up to M1M1A1A1)

$1n$ is allowed for n throughout

Alts 2 and 3

$\frac{n+1}{2}(2n + 2)$ with M1 seen scores M2

If they attempt to expand $(n + 1)(2n + 2)$ use Alt 2; If they attempt to expand $\frac{1}{2}(2n + 2)$ use Alt 3

[4]

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