Mark Scheme (Results)

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General marking guidance

These notes offer general guidance, but the specific notes for examiners appertaining to individual questions take precedence.

1 All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.

  Where some judgement is required, mark schemes will provide the principles by which marks will be awarded; exemplification/indicative content will not be exhaustive. When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the response should be sent to review.

2 All the marks on the mark scheme are designed to be awarded; mark schemes should be applied positively. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme. If there is a wrong answer (or no answer) indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

  Questions where working is not required: In general, the correct answer should be given full marks.
  Questions that specifically require working: In general, candidates who do not show working on this type of question will get no marks – full details will be given in the mark scheme for each individual question.

3 **Crossed out work**
  This should be marked **unless** the candidate has replaced it with an alternative response.

4 **Choice of method**
  If there is a choice of methods shown, mark the method that leads to the answer given on the answer line.
  If no answer appears on the answer line, mark both methods **then award the lower number of marks.**

5 **Incorrect method**
  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review for your Team Leader to check.

6 **Follow through marks**
  Follow through marks which involve a single stage calculation can be awarded without working as you can check the answer, but if ambiguous do not award.
  Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

7   Ignoring subsequent work
It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question or its context. (eg. an incorrectly cancelled fraction when the unsimplified fraction would gain full marks).
It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect (eg incorrect algebraic simplification).

8   Probability
Probability answers must be given as a fraction, percentage or decimal. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).
Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.
If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

9   Linear equations
Unless indicated otherwise in the mark scheme, full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously identified in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded (embedded answers).

10   Range of answers
Unless otherwise stated, when an answer is given as a range (eg 3.5 – 4.2) then this is inclusive of the end points (eg 3.5, 4.2) and all numbers within the range.

11   Number in brackets after a calculation
Where there is a number in brackets after a calculation eg 2 × 6 (=12) then the mark can be awarded **either** for the correct method, implied by the calculation **or** for the correct answer to the calculation.

12   Use of inverted commas
Some numbers in the mark scheme will appear inside inverted commas eg "12" × 50 ; the number in inverted commas cannot be any number – it must come from a correct method or process but the candidate may make an arithmetic error in their working.

13   Word in square brackets
Where a word is used in square brackets eg [area] × 1.5 : the value used for [area] does **not** have to come from a correct method or process but is the value that the candidate believes is the area. If there are any constraints on the value that can be used, details will be given in the mark scheme.

14   Misread
If a candidate misreads a number from the question. eg uses 252 instead of 255; method or process marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review.

Guidance on the use of abbreviations within this mark scheme

M   method mark awarded for a correct method or partial method

P   process mark awarded for a correct process as part of a problem solving question

A   accuracy mark (awarded after a correct method or process; if no method or process is seen then full marks for the question are implied but see individual mark schemes for more details)

C   communication mark awarded for a fully correct statement(s) with no contradiction or ambiguity

B   unconditional accuracy mark (no method needed)

oe   or equivalent

cao   correct answer only

ft   follow through (when appropriate as per mark scheme)

sc   special case

dep   dependent (on a previous mark)

indep independent

awrt   answer which rounds to

isw   ignore subsequent working

Question	Answer	Mark	Mark scheme	Additional guidance
1	$3n - 2$	B2	for $3n - 2$ oe	Accept a different variable, eg. $3x - 2$
		(B1	for $3n + k$ where $k \neq -2$ or is absent unambiguously shown)	$n = 3n - 2$ gets B1 only $n + 3$ gets NO marks
2	Shown	M1	for conversion to improper fractions eg. $\dfrac{7}{3}$ **or** $\dfrac{15}{4}$	Need not be shown with operators
		M1	(dep) for method to multiply fractions, eg. $\dfrac{7 \times 15}{3 \times 4}$ $(=\dfrac{105}{12})$ **or** $\dfrac{28 \times 45}{12 \times 12}$ $(=\dfrac{1260}{144})$ oe	
		C1	for complete working showing each stage as far as $\dfrac{35}{4}$ or $8\dfrac{9}{12}$	
3	B C D A	B2	cao	
		(B1	for two or three correct)	
4	A & D	B1	cao	
5	20	P1	for process to find SP of 24 chocolate bars, eg. 0.50×24 $(= 12)$ oe **or** for process to find the overall profit eg $(24 \times 0.5) - 10$ $(= 2)$ **or** for process to find CP of one chocolate bar, eg. $1000 \div 24$ $(= 41.66\ldots)$ oe	Working can be carried out in either pounds or pence.
		P1	(dep) for start to a process to find percentage profit, eg. using $\dfrac{"12" - 10}{10}$ **or** $\dfrac{"12"}{10}$ **or** $\dfrac{50 - "41.66..."}{"41.66..."}$ oe with consistent units	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
6	85 with working and reasons	M1	for correct use of corresponding angles eg *AEB* = 63 **or** co-interior angles eg *BCD* = 180 – 148 (= 32) or *DEB* = 180 – 63 (= 117)	Angles must be clearly labelled on the diagram or otherwise identified. Full solution must be seen.
		M1	for a complete method to find angle *EAB* eg. 180 – "63" – (180 – 148) **or** 148 – "63" **or** "117" – (180 – 148)	Correct method can be implied from angles on the diagram if no ambiguity or contradiction.
		A1	for *EAB* = 85 (identified)	
		C2	(dep on M2) all working correct with all appropriate reasons stated. <u>Corresponding</u> angles are equal <u>Allied</u> angles / <u>Co-interior</u> angles add up to 180 <u>Angles</u> on a straight <u>line</u> add up to 180 <u>Angles</u> in a <u>triangle</u> add up to 180 The <u>exterior angle</u> of a triangle is <u>equal</u> to the sum of the <u>interior opposite angles</u>.	When reasons are given the key words underlined must be present. Reasons need to be linked to their method; any reasons not linked, do not credit. There should be no incorrect reasons given.
		(C1	for **one** reason relating to parallel lines clearly used and stated **or** for any **two** reasons clearly stated for their fully correct method)	
7	20 or 24 or 168	B1	for identification of the range of the girls (20) **or** the range (24) **or** the median (168) of the boys	
	Comparison	C2	for a correct comparison of medians **and** a correct comparison of ranges supported by correct figures eg the median height for girls (165) is less than the median height for boys (168) and the range for girls (20) is less than the range for boys (24) At least one comparison must be in context referring to height or quoting cm.	Simply quoting values for median, range is insufficient; they must be compared.
		(C1	for a correct comparison of medians **or** a correct comparison of ranges that could ft their incorrect figure(s))	Context not necessary for C1

Question	Answer	Mark	Mark scheme	Additional guidance
8	450	M1	for $18 \div 3 \ (=6)$	Ignore units
		M1	for substitution eg. $75 = \dfrac{F}{"6"}$ or $75 \times "6"$	
		A1	cao	
9	0.000 672, 67.2×10^{-4} 6.72×10^5 672×10^4	B2	cao	Accept correct numbers in any form
		(B1	for correct conversions to same format, condoning one error **or** for 3 numbers in the correct order (ignoring one) **or** for all 4 numbers listed in reverse order)	
10	6 : 15 : 20	P1	chooses a multiplier to equate the two fractions in terms of b eg $\dfrac{2}{5} \times \dfrac{3}{3} \ (=\dfrac{6}{15})$ **or** $\dfrac{3}{4} \times \dfrac{5}{5} \ (=\dfrac{15}{20})$ **or** lists equivalent fractions to $\dfrac{2}{5}$ up to at least $\dfrac{6}{15}$, eg. $\dfrac{2}{5}, \dfrac{4}{10}, \dfrac{6}{15}, ...$ **or** lists equivalent fractions to $\dfrac{3}{4}$ up to at least $\dfrac{15}{20}$, eg. $\dfrac{3}{4}, \dfrac{6}{8}, \dfrac{9}{12}, \dfrac{12}{16}, \dfrac{15}{20}, ...$ **or** $(a : b =)$ 2 : 5 **and** $(b : c =)$ 3 : 4 **or** for 6 : 15 or 15 : 20 seen	
		P1	puts into related terms ready for ratio eg $\dfrac{2}{5} \times \dfrac{3}{3} = \dfrac{6}{15}$ **and** $\dfrac{3}{4} \times \dfrac{5}{5} = \dfrac{15}{20}$ **or** for $(a : b =)$ 6 : 15 **and** $(b : c =)$ 15 : 20 **or** lists equivalent ratios up to a common element for b, eg $a : b =$ 2 : 5, 4 : 10, 6 : <u>15</u> **and** $b : c =$ 3 : 4, 6 : 8, 9 : 12, 12 : 16, <u>15</u> : 20	Need not be written in ratio form
		A1	for 6 : 15 : 20 oe	Accept equivalent ratios Accept $a = 6$, $b = 15$ and $c = 20$

Question	Answer	Mark	Mark scheme	Additional guidance
11 (a)	300	M1	for working out $\sqrt[4]{81}$ as 3 **or** $\sqrt[4]{10^8}$ as 10^2 or 100	Mark may be awarded if operations are attempted on 8100000000 eg 300000000
		A1	for 300 **or** 3×10^2 or 3×100	
(b)	$\dfrac{1}{8}$	M1	for showing a square root of 64 as 8 **or** recognition of the reciprocal eg $\dfrac{1}{n}$ **or** shows expressions that show an understanding of the ½ index and the minus index eg $\dfrac{1}{\sqrt{64}}$ or other equivalent forms	
		A1	oe	Accept $\pm\dfrac{1}{8}$ oe
(c)	3^{2-n}	M1	for $3^{2(n-1)}$ **or** 3^{2n-2} **or** $\left(3^2\right)^{n-1}$	
		A1	for 3^{2-n} oe eg $3^{n-2(n-1)}$	

Question	Answer	Mark	Mark scheme	Additional guidance
12 (a)	5,15,35,55,70,80	B1	cao	
(b)	Graph drawn	M1	for 5 or 6 of their points plotted correctly from a cf table	Ignore to the left of the first point and right of the last point
		A1	for a fully correct graph SC B1 if 5 or 6 of their points plotted not at end but consistent within each interval and joined by a curve or line segments providing no gradient is negative	If histograms drawn, points must be identified Accept a smooth curve or line segments
(c)	Correct decision and correct figures	M1	for 60 ÷ 100 × 80 (=48) oe	reading value from graph at wage = 360 (=40) **or** for $35 + \frac{1}{5} \times 20$ (=39)	ft from a cum freq graph
		M1	reading value from graph at cf = 48 (=380)	for "40" ÷ 80 × 100 (=50(%)) **or** for 60 ÷ 100 × 80 (=48)	
		C1	ft for correct decision and correct figures, eg No with 48 and "380" **or** with "40" and "50"(%) **or** with "40" and 48	
13	196	P1	for vol A = 1400 ÷ 70 (=20) **or** for mass B = 280 × 30 (=8400)	
		P1	for density C = $\frac{1400 + "8400"}{"20" + 30}$ (= $\frac{9800}{50}$) or answer with digits 196	
		A1	cao	An answer of 350 from 70 + 280 gets no marks
14	0.42	P1	for appropriate multiplication eg 0.3 × 0.7 (=0.21) **or** 0.3 × 0.1 (=0.03) **or** 0.3 × 0.6 (=0.18)	Probabilities could also be given in fraction or percentage form
		P1	(dep) for complete process eg 0.3 × 0.7 + 0.7 × 0.3 **or** 0.3 × 0.1 + 0.3 × 0.6 + 0.6 × 0.3 + 0.1 × 0.3	
		A1	oe	Acceptable equivalents are 42% or $\frac{42}{100}$ oe

Question	Answer	Mark	Mark scheme	Additional guidance
15	$y = -\dfrac{1}{3}x + 8$	M1	for a method for finding the gradient of L_2 eg use of $-\dfrac{1}{m}$ **or** $-\dfrac{1}{3}$	
		M1	(dep) for substitution of (9, 5) into $y = "-\dfrac{1}{3}"x + c$	
		A1	for $y = -\dfrac{1}{3}x + 8$ oe	$y - 5 = -\dfrac{1}{3}(x - 9)$ gets M2A1
16 (a)	540	P1	for $\dfrac{120}{20}(=6)$ **or** $\dfrac{20}{120}$ $(=0.16..)$ **or** $\dfrac{90}{20}$ $(=4.5)$ **or** $\dfrac{20}{90}$ $(=0.22..)$	Decimal values truncated or rounded to 2 dp or more
		P1	for $\dfrac{20}{120} = \dfrac{90}{n}$ **or** $\dfrac{20}{90} = \dfrac{120}{n}$ **or** $\dfrac{90 \times 120}{20}$ oe	
		A1	cao	
(b)	Explanation	C1	for explanation **Acceptable examples** If marks fall off Shirley will have over-estimated the number of bees There will be fewer bees Her amount will go down **Not acceptable examples** My answer will be wrong It will increase the answer	

Question	Answer	Mark	Mark scheme	Additional guidance
17	$f = \dfrac{4d + 3}{d + 3}$	M1	for clearing the fraction eg $d(f - 4) = 3(1 - f)$ **or** $df - 4d = 3 - 3f$	Condone error in expansion of RHS for this mark
		M1	(dep M1) for isolating f terms in a correct equation eg $df + 3f = 3 + 4d$	
		M1	(dep on two terms in f) for factorising eg $f(d + 3) = 3 + 4d$	
		A1	oe	
18	20	P1	for a statement of proportionality eg $x = k\sqrt{y}$ **or** 1.44 oe	Must be written in the form of an equation with a constant term, accept $x \propto k\sqrt{y}$
		P1	for using $\sqrt{1.44}$ as multiplier eg $(x_2 =) k\sqrt{1.44y}$ **or** 1.2 oe	
		A1	cao	
19 (a)	33	B1	cao	
(b)	27	M1	for f(9) = 12 ÷ √9 (=4) **and** a clear intention to find g("4") **or** for $3 \times (2 \times \dfrac{12}{\sqrt{9}} + 1)$ **or** for stating gf eg $3(2 \times \dfrac{12}{\sqrt{x}} + 1)$ oe	
		A1	cao	
(c)	$\dfrac{1}{2}$	M1	for g^{-1} as $\dfrac{x - 3}{6}$ oe **or** for starting to solve $3(2x + 1) = 6$	Accept $\dfrac{y - 3}{6}$
		A1	for $\dfrac{1}{2}$ oe	

Question	Answer	Mark	Mark scheme	Additional guidance
20	$1+\dfrac{\sqrt{5}}{5}$	P1	for writing $\sqrt{180}$ as $6\sqrt{5}$	This process mark can be awarded whenever this is seen, which might be later in the process.
		P1	for process to rationalising the denominator eg $\dfrac{\sqrt{180}-2\sqrt{5}}{5\sqrt{5}-5}\times\dfrac{5\sqrt{5}+5}{5\sqrt{5}+5}$ **or** $\dfrac{4\sqrt{5}}{5\sqrt{5}-5}\times\dfrac{5\sqrt{5}+5}{5\sqrt{5}+5}$ oe	
		P1	(dep on previous P1) for expanding terms eg $\dfrac{5\sqrt{5}\sqrt{180}+5\sqrt{180}-50-10\sqrt{5}}{125-25}$ **or** $\dfrac{100+20\sqrt{5}}{100}$ oe	
		A1	for $1+\dfrac{\sqrt{5}}{5}$	Accept written as $a=1$, $b=5$
21	Proof	M1	for $\overrightarrow{DQ}=\frac{1}{2}\,(\mathbf{b}-\mathbf{a})$ oe or $\overrightarrow{EQ}=\frac{1}{2}\,(\mathbf{a}-\mathbf{b})$ oe	Vectors could be written on the diagram
		M1	for $\overrightarrow{PQ}=\frac{1}{2}\,\mathbf{a}+\overrightarrow{DQ}$ **or** $\frac{1}{2}\,\mathbf{a}+\frac{1}{2}\,(\mathbf{b}-\mathbf{a})$ oe **or** $\overrightarrow{PQ}=-\frac{1}{2}\,\mathbf{a}+\mathbf{b}+\overrightarrow{EQ}$ **or** $-\frac{1}{2}\,\mathbf{a}+\mathbf{b}+\frac{1}{2}\,(\mathbf{a}-\mathbf{b})$ oe	
		B1	for $\overrightarrow{PQ}=\frac{1}{2}\,\mathbf{b}$	
		C1	for complete proof with statement, eg $FE=2PQ$ **or** FE is a multiple of PQ **or** $\mathbf{b}=2(\frac{1}{2}\,\mathbf{b})$	

Question	Answer	Mark	Mark scheme	Additional guidance
22	0.5	P1	derive an algebraic expression for the area of A eg $\dfrac{1}{8}\pi\left[(5x-1)^2-(3x-1)^2\right]$	
		P1	expand and simplify for either area A or area B eg $\dfrac{1}{8}\pi(16x^2-4x)$ **or** $\pi(x^2-2x+1)$	
		P1	(dep P2) equate and rearrange into a quadratic eqn of the form $ax^2+bx+c=0$ eg $2x^2+3x-2=0$	
		P1	(dep P3) factorise eg $(2x-1)(x+2)=0$ **or** use of formula eg $\dfrac{-3\pm\sqrt{3^2-4\times2\times-2}}{2\times2}$	
		A1	oe	Accept only the single value of 0.5 oe but award 0 marks for a correct answer with no supportive working

Question	Answer	Mark	Mark scheme	Additional guidance
23	$\dfrac{27}{56}$	P1	for $\dfrac{3}{8}$ **and** $\dfrac{7}{9}$ **OR** uses a total of 72 cards and shows a process to find the number of cards with a black shape **or** the number of cards with a triangle, eg 72 ÷ 8 × 3 (=27) **or** 72 ÷ 9 × 7 (=56)	72 or any multiple of 72 Could be seen in a ratio, eg 27 : 45 or 16 : 56
		P1	for process shown to divide fractions $\dfrac{3}{8} \div \dfrac{7}{9}$ **or** $\dfrac{3}{8} \times \dfrac{9}{7}$ **OR** for $\dfrac{3}{8} \times \dfrac{9}{9}$ $(=\dfrac{27}{72})$ **and** $\dfrac{7}{9} \times \dfrac{8}{8}$ $(=\dfrac{56}{72})$ **OR** uses a total of 72 cards and shows a process to find the number of cards with a black shape **and** the number of cards with a triangle, eg 72 ÷ 8 × 3 (=27) **and** 72 ÷ 9 × 7 (=56)	Accept the division shown as $\dfrac{\frac{3}{8}}{\frac{7}{9}}$ Could be seen in ratios, eg 27 : 45 and 16 : 56
		A1	for $\dfrac{27}{56}$ or any other equivalent fraction	Answer of 27 : 56 gets P2A0