

OXFORD

INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL GCSE MATHEMATICS EXTENSION 9260/1E

Paper 1E

Mark scheme

November 2019

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from oxfordaqa.org.uk

Copyright information

OxfordAQA retains the copyright on all its publications. However, registered schools/colleges for OxfordAQA are permitted to copy material from this booklet for their own internal use, with the following important exception: OxfordAQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Copyright © 2019 Oxford International AQA Examinations and its licensors. All rights reserved.

Key to mark types and abbreviations

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 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. eg accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
[a, b)	Accept values $a \leq \text{value} < b$
3.14...	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Q	Answer	Mark	Comments
1	$7n - 23$	B1	
	Additional Guidance		
2	1 : 18	B1	
	Additional Guidance		
3	1	B1	
	Additional Guidance		
4	similar	B1	
	Additional Guidance		

Q	Answer	Mark	Comments
5	Alternative method 1		
	$194 - 160$ or 34	M1	
	$\frac{\text{their } 34}{160} (\times 100)$ or 0.2125	M1dep	oe
	$\frac{85}{4}$ or $21\frac{1}{4}$ or 21.25 or 21.3	A1	
	Alternative method 2		
	$\frac{194}{160} (\times 100)$ or 1.2125 or 121.25	M1	oe
	(their 1.2125 – 1) ($\times 100$) or 0.2125 or their 121.25 – 100	M1dep	oe
	$\frac{85}{4}$ or $21\frac{1}{4}$ or 21.25 or 21.3	A1	
	Additional Guidance		
	Answer only 21		M0M0A0

Q	Answer	Mark	Comments
6(a)	Straight line from (10.00, 0) through (10.30, 2.5) or (11.00, 5) or 48 (minutes) seen or 10.48	M1	mark intention for straight line may be implied by a line that stops at 10.48 $\pm \frac{1}{2}$ square tolerance
	Correct line stopping at 10.48	A1	mark intention for straight line $\pm \frac{1}{2}$ square tolerance
	Horizontal line from their (10.48, 4) intersecting Sabine's line	B1ft	$\pm \frac{1}{2}$ square tolerance
	Additional Guidance		
6(b)	Correct value for the time between the end of their line and Sabine's line	B1ft	must fit the horizontal time difference
	Additional Guidance		
	22 from no line or from a line that would give a different answer		B0

Q	Answer	Mark	Comments
7	$(18 \times 25) + (20 \times 35) + (33 \times 45) + (9 \times 55)$ or $450 + 700 + 1485 + 495$ or 3130	M1	may be seen in table allow one error
	(their 450 + their 700 + their 1485 + their 495) $\div$ 80 or their 3130 $\div$ 80	M1dep	condone bracket error if working seen eg $450 + 700 + 1485 + 495 \div 80$
	39.1(25) or 39.13 or $\frac{313}{8}$ or $39\frac{1}{8}$	A1	
	Additional Guidance		
	One error may be a consistent error in the midpoints eg using 24.5, 34.5, 44.5 and 54.5		
	Correct value seen but answer given as one of the classes		M2A0
	Correct products seen in the table but a different method not using their products is choice eg 3130 in table but mean calculated as $80 \div 4 = 20$		M0M0A0

Q	Answer	Mark	Comments
8	$(x^6 \times x^8 =) x^{6+8}$ or x^{14} or $(x^6 \times x^8 \times x^4 =) x^{6+8+4}$ or x^{18} or $c - 4 = 6 + 8$ or $6 + 8 + 4$	M1	
	18	A1	
	Additional Guidance		
	Allow using a value for x leading to answer 18		M1A1
9	$\frac{2(5x-6)}{2 \times 3}$ or $\frac{3(7x+4)}{3 \times 2}$ or $\frac{10x-12}{6}$ or $\frac{21x+12}{6}$ or $\frac{5x}{3} + \frac{7x}{2}$	M1	oe any multiple of 6 for denominator
	$\frac{10x-12}{6} + \frac{21x+12}{6}$ or $\frac{10x}{6} + \frac{21x}{6}$	M1dep	oe eg $\frac{62x}{12}$ or $\frac{15.5x}{3}$
	$\frac{31x}{6}$ or $5\frac{1}{6}x$	A1	oe
	Additional Guidance		
	Numerator only		M0M0A0
	Further incorrect simplification after the correct answer is A0 eg $\frac{31x}{6} = 5\frac{x}{6}$ or $\frac{31x}{6} = \frac{15.5x}{3}$ or $\frac{31x}{6} = 5\frac{1}{6}$ or $\frac{31x}{6} = 25x$		M1M1A0

Q	Answer	Mark	Comments
10	180×3 or 540 or (exterior angle =) $360 \div 5$ or 72	M1	oe may be implied by interior angle
	$180 \times 3 \div 5$ or $540 \div 5$ or $180 - 360 \div 5$ or $180 - 72$ or 108	M1dep	oe method for interior angle of pentagon may be seen on diagram
	(BCP =) their $108 - 60$ or 48	M1dep	may be seen on diagram
	$(180 - \text{their } 48) \div 2$ or $132 \div 2$	M1dep	their 48 must not be 60
	66	A1	
	Additional Guidance		
	Interior angle 108 seen even if not subsequently used	M1M1	
	Angle BCP seen as 48 even if not subsequently used	M1M1M1	
	$360 \div 5 = 72$ $180 - 72 = 108$ $108 - 60 = 48$ $180 - 48 - 72$ Ans = 60	M1M1M1M0	
	$360 \div 5 = 72$ $72 - 60 = 12$ (72 is being used as the interior angle of the pentagon)	M0	
	Angle BPC = $360 \div 5$ with no other valid work	M0	

Q	Answer	Mark	Comments
11	Alternative method 1		
	$504 \div (13 - 9)$ or $504 \div 4$ or 126	M1	oe working to find the negative pair eg $504 \div (9 - 13)$ or -126
	$9 \times$ their 126 or 1134 or $13 \times$ their 126 or 1638	M1dep	oe -1134 or -1638
	1134 and 1638 or -1134 and -1638	A1	either order
	Alternative method 2		
	$\frac{x}{x + 504} = \frac{9}{13}$ or $\frac{x - 504}{x} = \frac{9}{13}$	M1	oe working to find the negative pair eg $\frac{x + 504}{x} = \frac{9}{13}$ or $\frac{x}{x - 504} = \frac{9}{13}$
	$9 \times 504 \div 4$ or $4536 \div 4$ or 1134 or $13 \times 504 \div 4$ or $6552 \div 4$ or 1638	M1dep	oe -1134 or -1638
	1134 and 1638 or -1134 and -1638	A1	either order

Alternative method 3 is on the next page

Q	Answer	Mark	Comments
---	--------	------	----------

11 cont	Alternative method 3		
	$\frac{13}{9}x - x = 504$ or $x - \frac{9}{13}x = 504$	M1	oe working to find the negative pair eg $x - \frac{13}{9}x = 504$ or $\frac{9}{13}x - x = 504$
	$\frac{9}{4} \times 504$ or 1134 or $\frac{13}{4} \times 504$ or 1638	M1dep	oe -1134 or -1638
	1134 and 1638 or -1134 and -1638	A1	either order
	Additional Guidance		

12	Pair of intersecting arcs, equal radii > half XY, above and below XY	M1	
	Perpendicular bisector of XY drawn with correct construction	A1	all construction arcs required may be a dashed line
	Arc, centre Z, radius [5.8, 6.2] cm	B1	
	Correct point marked and labelled	B1	no construction arcs required
	Additional Guidance		
	Correct point marked and labelled with no evidence of constructions		M0A0B0B1

Q	Answer	Mark	Comments
13(a)	$5 = 2 \times 4 + c$ and $c = -3$ or $5 = 8 + c$ and $c = -3$ or $\frac{5-c}{4-0} = 2$ and $c = -3$ or $y = 2 \times 4 - 3$ and $y = 5$	B1	oe equation in c and $c = -3$ or full substitution shown in equation of line leading to the given y -coordinate
	Additional Guidance		
	$\frac{5-(-3)}{4-0} = \frac{8}{4} = 2$		B0
13(b)	$5 = 2 \times 4^2 + 4b - 3$ or $5 = 29 + 4b$ or $2 \times 4^2 + 4b = 2 \times 4$ or $32 + 4b = 8$	M1	oe
	$5 - 29 = 4b$ or $4b = 8 - 32$ or $-24 = 4b$ or $-24 \div 4$	M1dep	must reach at least $4b = \dots$
	-6	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
14	Alternative method 1		
	$15^2 \times \pi \times \frac{180 - 140}{360}$ or $15^2 \times \pi \times \frac{40}{360}$ or 25π or [78.5, 78.6]	M1	oe
	$15^2 \times \pi \times \frac{180 - 140}{360} \times 2$ or $15^2 \times \pi \times \frac{80}{360}$	M1dep	oe
	[157, 157.1] or 50π	A1	SC2 [39.25, 39.275] or 12.5π
	Alternative method 2		
	$15^2 \times \pi \times \frac{140}{360} (\times 2)$ or 87.5π or 175π or [274.75, 274.925] or [549.5, 549.9]	M1	oe
	$15^2 \times \pi - 15^2 \times \pi \times \frac{140}{360} \times 2$ or $15^2 \times \pi - 15^2 \times \pi \times \frac{280}{360}$ or $225\pi - \text{their } [549.5, 549.9]$ or $225\pi - \text{their } 175\pi$	M1dep	oe
	[157, 157.1] or 50π	A1	SC2 [39.25, 39.275] or 12.5π
	Additional Guidance		
	Special case is answer using 15 cm as the diameter		

Q	Answer	Mark	Comments
15(a)	$P(R) = \sqrt{0.36}$ or 0.6 or $P(B) = \sqrt{0.16}$ or 0.4	M1	oe fraction or percentage correctly placed at least once
	$P(R) = 0.6$ and $P(B) = 0.4$	A1	oe fraction or percentage correctly placed in all positions
	their $0.6 \times$ their 0.4 correctly evaluated or their $0.4 \times$ their 0.6 correctly evaluated	M1	ft their $P(R)$ and $P(B)$ if $P(R) + P(B) = 1$ for each pair of branches
	their $0.6 \times$ their 0.4 correctly evaluated and their $0.4 \times$ their 0.6 correctly evaluated	A1ft	correctly placed in both positions ft their $P(R)$ and $P(B)$ if $P(R) + P(B) = 1$ for each pair of branches
	Additional Guidance		
	<pre> graph LR A[0.6] --- B[Red] A[0.4] --- C[Blue] B[0.6] --- D[Red Red] B[0.4] --- E[Red Blue] C[0.6] --- F[Blue Red] C[0.4] --- G[Blue Blue] D --- H[0.36] E --- I[0.24] F --- J[0.24] G --- K[0.16] </pre>		4 marks
15(b)	$0.36 + 0.16$ or 0.52 or their $0.24 +$ their 0.24 or 0.48	M1	oe ft their tree diagram if $P(RB) + P(BR) = 0.48$
	0.52 and 0.48 and Yes	A1ft	oe eg Yes, $0.52 > 0.5$ or Yes, 0.48 is less than 50% ft their tree diagram if $P(RB) + P(BR) = 0.48$
	Additional Guidance		

Q	Answer	Mark	Comments
16	Alternative method 1		
	$m = kr^3$ or $1000 = k \times 2.5^3$ or $\frac{1000}{2.5^3}$	M1	oe
	(k =) 64 or $m = 64r^3$	A1	
	their 64×6.5^3	M1dep	oe
	17 576	A1ft	ft their k and M1A0M1 accept 17 580 or 17 600 or 18 000 with working
	Alternative method 2		
	$\left(\frac{6.5}{2.5}\right)^3$	M1	oe
	$\frac{m}{1000} = \left(\frac{6.5}{2.5}\right)^3$ or 17.576	A1	oe
	$\left(\frac{6.5}{2.5}\right)^3 \times 1000$ or their 17.576×1000	M1dep	oe
	17 576	A1ft	ft their 17.576 and M1A0M1 accept 17 580 or 17 600 or 18 000 with working
	Additional Guidance		
	Using $m = kr^3$	M0A0M0A0	

Q	Answer	Mark	Comments
---	--------	------	----------

17(a)	1.995	B1	
	Additional Guidance		

17(b)	Alternative method 1		
	245 or 255	M1	
	their $255 \times 80 (\div 1000)$ or 20 400	M1	their 255 must be in range (250, 260]
	20.4	A1	allow 20.40(0)
	Alternative method 2		
	0.245 or 0.255	M1	
	their 0.255×80	M1	their 0.255 must be in range (0.250, 0.260]
	20.4	A1	allow 20.40(0)
	Additional Guidance		
	245 and 254 and answer 20.32 or 20 320		M1M1A0
	254 and answer 20.32 or 20 320		M0M1A0

18(a)	$5x^2 - 4x = 0$ or $y = 0$	M1	
	$x(5x - 4) = 0$ or $x = 0$ and $x = 0.8$	M1dep	oe
	(0, 0) and (0.8, 0)	A1	oe
	Additional Guidance		
	(0, 0) or (0.8, 0) with no working for second mark		M1M0A0

Q	Answer	Mark	Comments
18(b)	$10x - 4$	M1	
	their $(10x - 4) = 1$	M1	oe their $(10x - 4)$ must have one correct term and be of the form $ax + b$ with $a \neq 0$
	$n = \frac{1}{2}$	A1	oe
	$p = -\frac{3}{4}$	A1ft	oe dep on second M ft their $\frac{1}{2}$
	Additional Guidance		
	$10x - 4 = 1$ $n = 2, p = 12$		M1M1 A0A1ft
	$10x = 1$ $n = \frac{1}{10}, p = -\frac{7}{20}$		M0M1 A0A1ft
	$15x - 4 = 1$ $n = \frac{1}{3}, p = -\frac{7}{9}$		M0M1 A0A1ft

Q	Answer	Mark	Comments
19	$24^2 = 17^2 + 10^2 - 2 \times 17 \times 10 \times \cos y$	M1	oe
	$\cos y = \frac{17^2 + 10^2 - 24^2}{2 \times 17 \times 10}$ or $\cos y = -\frac{187}{340}$ or $\cos y = -\frac{11}{20}$	M1dep	oe implies M2
	$\cos^{-1}\left(\text{their } -\frac{187}{340}\right)$ or $\cos^{-1}\left(\text{their } -\frac{11}{20}\right)$ or $\cos^{-1}(\text{their } -0.55)$ or 123(.3...)	M1dep	oe
	123.4	A1	
	Additional Guidance		
20	$x > -\frac{1}{4}$	B1	
	Additional Guidance		
21	1 : 16	B1	
	Additional Guidance		

Q	Answer	Mark	Comments
---	--------	------	----------

22(a)	3.5×10^6	B1	
	Additional Guidance		

22(b)	0.5, 1, 1.5, 2	B2	B1 3 or 4 correct with up to 2 incorrect or 2 correct with 0 or 1 incorrect or 1 correct with 0 incorrect or a correct number in standard form using one of the values for b with no incorrect numbers	
	Additional Guidance			
	8×10^4 (uses $b = 2$)		B1	
	2×10^4 (different values of b used)		B0	

23(a)	At least two points plotted correctly	M1	(0, 1), (1, 2), (2, 4), (3, 8), (4, 16) $\pm \frac{1}{2}$ small square
	All points plotted correctly and joined with a smooth curved line	A1	$\pm \frac{1}{2}$ small square
	Additional Guidance		

23(b)	Correct reading from their graph	B1ft	$\pm \frac{1}{2}$ small square ft their increasing graph
	Additional Guidance		
	No graph		B0
	Correct value from incorrect graph		B0
	Correct value but too accurate for graph eg 3.322		B0

Q	Answer	Mark	Comments
24(a)	$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$	B1	
	Additional Guidance		
24(b)	(A) (anticlockwise) rotation of 90° (about the origin)	B1	oe
	(B) reflection in the line $y = -x$	B1	oe
	(BA) reflection in the y-axis	B1	oe eg reflection in $x = 0$
	Additional Guidance		
25(a)	$\tan 34 = \frac{5.4}{BC}$ or $5.4 \div \tan 34$ or $\tan (90 - 34) = \frac{BC}{5.4}$ or $5.4 \times \tan (90 - 34)$	M1	oe eg $\frac{BC}{\sin(90 - 34)} = \frac{5.4}{\sin 34}$
	[8, 8.01]	A1	
	Additional Guidance		
25(b)	$\sin ADB = \frac{5.4}{17}$ or $\sin^{-1} \frac{5.4}{17}$	M1	oe eg $\tan ADB = \frac{5.4}{\sqrt{17^2 - 5.4^2}}$ or $\cos ADB = \frac{17^2 + (17^2 - 5.4^2) - 5.4^2}{2 \times 17 \times \sqrt{(17^2 - 5.4^2)}}$
	[18.5, 18.521]	A1	
	Additional Guidance		
	Answer in range seen followed by 18 or 19		M1A1

Q	Answer	Mark	Comments
26	Alternative method 1		
	$\frac{4+6\sqrt{5}}{4+2\sqrt{5}} \times \frac{4-2\sqrt{5}}{4-2\sqrt{5}}$	M1	oe rationalisation of their denominator may be implied by second and third mark
	$16 - 8\sqrt{5} + 24\sqrt{5} - 60$ or $-44 + 16\sqrt{5}$	M1dep	numerator
	$16 - 8\sqrt{5} + 8\sqrt{5} - 20$ or $16 - 20$ or -4	M1dep	dep on first M1 denominator
	$16 - 8\sqrt{5} + 24\sqrt{5} - 60$ and $16(-8\sqrt{5} + 8\sqrt{5}) - 20$ and $11 - 4\sqrt{5}$ or $a = 11, b = -4$	A1	must show all four terms of the numerator and at least $16 - 20$ for the denominator
	Alternative method 2		
	$\frac{2+3\sqrt{5}}{2+\sqrt{5}} \times \frac{2-\sqrt{5}}{2-\sqrt{5}}$	M1	oe rationalisation of their denominator may be implied by second and third mark
	$4 - 2\sqrt{5} + 6\sqrt{5} - 15$ or $-11 + 4\sqrt{5}$	M1dep	numerator
	$4 - 2\sqrt{5} + 2\sqrt{5} - 5$ or $4 - 5$ or -1	M1dep	dep on first M1 denominator
	$4 - 2\sqrt{5} + 6\sqrt{5} - 15$ and $4(-2\sqrt{5} + 2\sqrt{5}) - 5$ and $11 - 4\sqrt{5}$ or $a = 11, b = -4$	A1	must show all four terms of the numerator and at least $4 - 5$ for the denominator
	Additional Guidance		
	Allow eg 12×5 for 60 or 4^2 for 16 for all marks		
	$(2\sqrt{5})^2$ must have been seen as 4×5 or 20 to award the A mark		
	Further work eg $11 - 4\sqrt{5} = 7\sqrt{5}$		A0

Q	Answer	Mark	Comments
27(a)	Alternative method 1		
	$6 \times 5 + 14 \times 5 + 10 \times 5 + 30 \times 5$ $+ 16 \times 10 + 4 \times 10$ or $30 + 70 + 50 + 150 + 160 + 40$ or 500	M1	oe with consistent multiples allow one error or omission
	$\frac{160}{\text{their } 500} \times 100$	M1dep	oe
	32	A1	
	Alternative method 2		
	$1.2 \times 5 + 2.8 \times 5 + 2 \times 5 + 6 \times 5$ $+ 1.6 \times 10 + 1.6 \times 10 + 0.4 \times 10$ $+ 0.4 \times 10$ or $6 + 14 + 10 + 30 + 16 + 16 + 4 + 4$ or 100	M1	oe with consistent multiples allow one error or omission
	$\frac{16+16}{\text{their } 100} \times 100$	M1dep	oe
	32	A1	
	Additional Guidance		
	32 in working without percentage sign and no evidence of total of 100	M0M0A0	
	32 on answer line with no evidence of incorrect working	M1M1A1	
	$1.2 + 2.8 + 2 + 6 + 6.4 + 1.6$ (may have one error or omission) $\frac{6.4}{\text{their } 20} \times 100$ Answer 32	M1 M1A1	
	$120 + 280 + 200 + 600 + 640 + 160$ (may have one error or omission) $\frac{640}{\text{their } 2000} \times 100$ Answer 32	M1 M1A1	

Q	Answer	Mark	Comments
27(b)	Alternative method 1		
	$\frac{120}{\text{their } 30} \times \text{their } 500$ or $\text{their } 500 \times 4$	M1	oe their 500 must be using areas not heights
	2000	A1ft	ft their 500 and their 30 must be using areas not heights
	Alternative method 2		
	$\frac{120}{\text{their } 6} \times \text{their } 100$ or $\text{their } 100 \times 20$	M1	oe their 100 must be using areas not heights
	2000	A1ft	ft their 100 and their 6 must be using areas not heights
	Additional Guidance		
	Do not follow through their area if it is the total of heights eg $\frac{120}{30} \times 400$ Answer 1600 eg $\frac{120}{6} \times 80$ Answer 1600	M0A0ft M0A0ft	

Q	Answer	Mark	Comments
28	$\overrightarrow{BE} = \mathbf{a} - 2\mathbf{b}$ or $\overrightarrow{EB} = -\mathbf{a} + 2\mathbf{b}$	M1	oe
	$\overrightarrow{CD} = -6\mathbf{b} + \frac{3}{2}\mathbf{a} + 3\mathbf{b}$ or $\overrightarrow{CD} = -4\mathbf{b} + \text{their } \overrightarrow{BE} + \frac{1}{2}\mathbf{a} + 3\mathbf{b}$ or $\overrightarrow{DC} = 4\mathbf{b} + \text{their } \overrightarrow{EB} - \frac{1}{2}\mathbf{a} - 3\mathbf{b}$	M1	oe may use $\overrightarrow{BD} = \frac{3}{2}\mathbf{a} + \mathbf{b}$ or $\overrightarrow{CE} = \mathbf{a} - 6\mathbf{b}$
	$\frac{3}{2}\mathbf{a} - 3\mathbf{b} = \frac{3}{2}(\mathbf{a} - 2\mathbf{b})$	A1	oe with M2 seen
	Additional Guidance		
	Full method up to $\overrightarrow{CD} = \frac{3}{2}\mathbf{a} - 3\mathbf{b}$ and $\overrightarrow{CD} = \frac{3}{2}\overrightarrow{BE}$	M1M1A1	
	Full method up to $\overrightarrow{CD} = \frac{3}{2}\mathbf{a} - 3\mathbf{b}$ and $\overrightarrow{BE} = \frac{2}{3}\overrightarrow{CD}$	M1M1A1	

Q	Answer	Mark	Comments
29	Alternative method 1		
	$\sqrt{n} + \dots$	M1	implied by $\sqrt{n} + 2$
	$(\sqrt{n} + 2)^2$	M1dep	
	$n + 4\sqrt{n} + 4$	A1	
	Alternative method 2		
	$n = (2k)^2$ and $(2k + 2)^2$	M1	oe k any letter except n or a
	$4k^2 + 8k + 4$ and $2k = \sqrt{n}$ or $k = \frac{\sqrt{n}}{2}$	M1dep	
	$n + 4\sqrt{n} + 4$	A1	
	Additional Guidance		
	Substitutes consecutive even square numbers	M0	
	In Alt 2 allow a method that shows it is valid for alternate square numbers ie a sequence of odd squares or a sequence of even squares eg $n = k^2$ and $(k + 2)^2$ k not n or a $k^2 + 4k + 4$ and $k = \sqrt{n}$ $n + 4\sqrt{n} + 4$	M1 M1dep A1	

Q	Answer	Mark	Comments
30(a)	$\left(x - \frac{1}{2}\right)^2$	M1	oe
	$\left(x - \frac{1}{2}\right)^2 - \frac{5}{4}$ or $a = \frac{1}{2}, b = \frac{5}{4}$	A1	oe
	Additional Guidance		
30(b)	$f(x) \dots -\frac{5}{4}$	B1ft	oe ft their b dep on correct form in part (a) allow $y \geq$
	Additional Guidance		
	$f(x) > -\frac{5}{4}$		B0

Q	Answer	Mark	Comments
30(c)	Alternative method 1		
	$y - 1 = \frac{1}{x}$	M1	
	$x(y - 1) = 1$ or $x = \frac{1}{y-1}$	M1dep	
	$\frac{1}{x-1}$	A1	oe ignore $g^{-1}(x) =$ allow $y =$
	Alternative method 2		
	$xy = x + 1$	M1	
	$x(y - 1) = 1$	M1dep	
	$\frac{1}{x-1}$	A1	oe ignore $g^{-1}(x) =$ allow $y =$
	Alternative method 3		
	$x = 1 + \frac{1}{y}$ and $x - 1 = \frac{1}{y}$	M1	$x \rightarrow y$ and $y \rightarrow x$ and starts to rearrange
	$y(x - 1) = 1$	M1dep	
	$\frac{1}{x-1}$	A1	oe ignore $g^{-1}(x) =$ allow $y =$
	Alternative method 4		
	$x = 1 + \frac{1}{y}$ and $xy = y + 1$	M1	$x \rightarrow y$ and $y \rightarrow x$ and starts to rearrange
	$y(x - 1) = 1$	M1dep	
	$\frac{1}{x-1}$	A1	oe ignore $g^{-1}(x) =$ allow $y =$
	Additional Guidance		