OCR
Oxford Cambridge and RSA

GCE

Mathematics

Unit **4722**: Core Mathematics 2

Advanced Subsidiary GCE

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations and abbreviations

Annotation in RM Assessor	Meaning
✓and ✗	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
NGE	Not good enough
Highlighting	
Other abbreviations in mark scheme	**Meaning**
E1	Mark for explaining
U1	Mark for correct units
G1	Mark for a correct feature on a graph
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working
cwo	Correct working only

Subject-specific Marking Instructions for GCE Mathematics Pure strand

a Annotations should be used whenever appropriate during your marking.

The A, M and B annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

For subsequent marking you must make it clear how you have arrived at the mark you have awarded

b An element of professional judgement is required in the marking of any written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct *solutions* leading to correct answers are awarded full marks but work must not be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly.

Correct but unfamiliar or unexpected methods are often signalled by a correct result following an *apparently* incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, award marks according to the spirit of the basic scheme; if you are in any doubt whatsoever (especially if several marks or candidates are involved) you should contact your Team Leader.

c The following types of marks are available.

M
A suitable method has been selected and *applied* in a manner which shows that the method is essentially understood. Method marks are not usually lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, eg by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

A
Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated Method mark is earned (or implied). Therefore M0 A1 cannot ever be awarded.

B
Mark for a correct result or statement independent of Method marks.

E
A given result is to be established or a result has to be explained. This usually requires more working or explanation than the establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, eg wrong working following a correct form of answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this would not apply to a case where a candidate passes through the correct answer as part of a wrong argument.

d When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep *' is used to indicate that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may happen that when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no more marks can sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, the earlier marks are implied and full credit must be given.

e The abbreviation ft implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only — differences in notation are of course permitted. A (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded for work at an intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, exactly what is acceptable will be detailed in the mark scheme rationale. If this is not the case please consult your Team Leader.

Sometimes the answer to one part of a question is used in a later part of the same question. In this case, A marks will often be 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question even if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.

f Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise. Candidates are expected to give numerical answers to an appropriate degree of accuracy, with 3 significant figures often being the norm. Small variations in the degree of accuracy to which an answer is given (e.g. 2 or 4 significant figures where 3 is expected) should not normally be penalised, while answers which are grossly over- or under-specified should normally result in the loss of a mark. The situation regarding any particular cases where the accuracy of the answer may be a marking issue should be detailed in the mark scheme rationale. If in doubt, contact your Team Leader.

g Rules for replaced work

If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

If there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others.

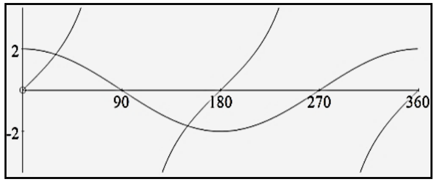
NB Follow these maths-specific instructions rather than those in the assessor handbook.

h For a *genuine* misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for some units. This is achieved by withholding one A or B mark in the question.

Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

Question			Answer	Marks	Guidance	
1	(i)		$80k = -40$	M1	Equate attempt at $80k$ to -40 and solve for k	Attempt at $80k$ must be from a product of 5 ($^5C_1$ is M0 until it is evaluated), 2^4 and k or kx soi Allow M1 if equating to 40 not -40 Allow BOD if inconsistent use of coeffs eg $80kx = -40$
			$k = -0.5$	A1	Obtain -0.5	Allow any exact equiv Allow BOD if $k = -0.5$ comes from eg $80kx = -40$ A0 for $k = -0.5x$, unless later seen as -0.5
			$c = 80(-0.5)^2$	M1	Attempt third term of expansion	Must be attempt at product of 10 ($^5C_2$ is M0 until it is evaluated), 2^3 and k^2 or $(kx)^2$ Allow BOD for kx^2, even if the k is never squared Could be in terms of k or their numerical value for k Allow if seen as part of a bigger expansion
			$c = 20$	A1FT **[4]**	Obtain 20	FT on their numerical value of k A0 for $c = 20x^2$, unless later seen as 20 Using $2^5\left(1+\frac{1}{2}kx\right)^5$ can get full credit M0 if 2^5 and/or $\frac{1}{2}kx$ incorrect
	(ii)		$(2 \times 32) + (-3 \times -40)$	M1	Attempt to find sum of both relevant products	Both products are needed and sum attempted M0 if also other terms in x May be seen as part of a bigger expansion Allow M1 if using $32 + 40x$, but this is the only error allowed
			$= 184$	A1 **[2]**	Obtain 184	Allow $184x$ Attention must be drawn to this term, so A0 if only ever seen in bigger expansion

Question			Answer	Marks	Guidance	
2			$a + 6d = 3$	B1*	State $a + 6d = 3$	Could be unsimplified eg $a + (7 - 1)d = 3$ Allow unknowns other than a and d as long as intention clear
			$10(2a + 19d) = 165$	B1*	State $10(2a + 19d) = 165$	Could be unsimplified Must be in terms of the same two unknowns as first equation, so $10(a + l) = 165$ is not yet enough for B1 – need to see $10(a + a + 19d) = 165$ or equiv
			$2(3 - 6d) + 19d = 16.5$	M1d*	Attempt to solve equations simultaneously	Must have correct equations for u_7 and S_{20} As far as attempting a value for a or d Could be substitution (using a correct rearrangement of one equation) or balancing (correct operation to eliminate one unknown)
			$a = -6$, $d = 1.5$	A1	Obtain at least one of $a = -6$, $d = 1.5$	Any exact equiv for 1.5
				A1	Obtain both $a = -6$ and $d = 1.5$	Any exact equiv for 1.5
				[5]		

Question			Answer	Marks	Guidance	
3	(i)			B1	Correct graph of $y = 2\cos x$	Must be one complete cycle, starting at 0° and ending at 360° with correct intercepts on the *x*-axis Gradient should be intended to be approximately 0 at (0, 2), (180, – 2) and (360, 2) 2 and – 2 should be marked on the *y*-axis, and graph should be level with these at the relevant points
				B1 **[2]**	Correct graph of $y = 3\tan x$	Must have correct intercepts on the *x*-axis B0 if the graph does not extend beyond the max and min points of the $y = 2\cos x$ graph Asymptotes should be intended at 90° and 270°, but do not need to be drawn. Condone graph still being some distance from the asymptotes, which may happen if there is an attempt to draw to scale but graph must exist for at least [0°, 45°], [135°, 225°] and [315°, 360°] B0 if two parts of the graph overlap at 90° and/or 270° Ignore any attempt at scales on the *y*-axis
	(ii)		$2\cos x = \dfrac{3\sin x}{\cos x}$	M1	Use correct identity for $\tan x$	Must be used and not just stated Could be equivalent eg $\tan x\cos x = \sin x$
			$2\cos^2 x = 3\sin x$ $2(1 - \sin^2 x) = 3\sin x$	M1	Multiply by $\cos x$ and use correct identity for $\cos^2 x$	Must be used and not just stated
			$2 - 2\sin^2 x = 3\sin x$ $2\sin^2 x + 3\sin x - 2 = 0$ **AG**	A1 **[3]**	Obtain $2\sin^2 x + 3\sin x - 2 = 0$	Need to see $2(1 - \sin^2 x)$ expanded before given answer Replacing $2\cos^2 x$ with $2 - 2\sin^2 x$ and then stating given answer is sufficient Final answer must be equation so A0 if no '= 0' Notation must be fully correct throughout so A0 for eg sin not $\sin x$

Question			Answer	Marks	Guidance	
	(iii)		$(2\sin x - 1)(\sin x + 2) = 0$	M1	Attempt to solve quadratic in $\sin x$	This M mark is just for solving a 3 term quadratic (see appendix for acceptable methods) Condone any substitution used, including $x = \sin x$
			$\sin x = {}^1/_2$			
			$x = 30^\circ, 150^\circ$	M1	Attempt to solve $\sin x = k$	Attempt $\sin^{-1}$ of their root Not dependent, so M0 M1 possible If going straight from $\sin x = k$ to $x = \ldots$ then award M1 only if their angle is consistent with their k
				A1	Obtain $x = 30^\circ$	Must be in degrees, so A0 for radian equiv Must come from correct solution of given quadratic ie correct factorisation or correct substitution into formula so A0 if root is from eg $(2\sin x - 1)(\sin x - 2) = 0$
				A1	Obtain $x = 150^\circ$	Must be in degrees, so A0 for radian equiv Must come from correct solution of given quadratic ie correct factorisation or correct substitution into formula so A0 if root is from eg $(2\sin x - 1)(\sin x - 2) = 0$ A0 if other incorrect solutions in range $[0^\circ, 360^\circ]$, but ignore any outside of this range
				[4]		**SR** If no working shown then allow **B2** for each correct angle in degrees (max of **B3** if extra incorrect angles in range)

Question			Answer	Marks	Guidance	
4	(a)		$\int(3\sqrt{x}+5)\mathrm{d}x = 2x^{\frac{3}{2}}+5x$	M1*	Attempt integration	Obtain expression of the form $ax^{\frac{3}{2}}+bx$, any non-zero *a* and *b*
				A1	Obtain fully correct integral	Allow unsimplified coefficients May also include + *c*
			$\left[2x^{\frac{3}{2}}+5x\right]_1^4 = 36-7$	M1d*	Attempt correct use of limits	Must have integral of correct form Correct order and subtraction
			= 29	A1	Obtain 29	Answer only gets full marks
				[4]		
	(b)		$\int(6x^2+4x^{-2})\mathrm{d}x$	B1	Rewrite integrand as $6x^2+4x^{-2}$	Any two term equiv, such as $6x^2+\frac{4}{x^2}$
				M1	Attempt integration	Obtain expression of the form ax^3+bx^{-1}, any non-zero *a* and *b*
			$= 2x^3 - 4x^{-1} + c$	A1	Obtain fully correct integral, including $+c$	Coefficients must be simplified Allow equivs such as $2x^3-\frac{4}{x}+c$ A0 if d*x* or integral sign still present in final answer Allow MR on coefficients, but not on indices
				[3]		**OR** M1 – attempt integration by parts (correct parts) A1 – obtain $-\frac{6x^4+4}{x}+\int 24x^2\mathrm{d}x$, or better A1 – obtain $2x^3 - 4x^{-1} + c$ (must be simplified)

Question			Answer	Marks	Guidance	
5	(i)		$u_2 = 16$; $u_3 = 12.8$	B1	Obtain 16 and 12.8	Could be seen in a list, such as 20, 16, 12.8 Ignore any additional terms Allow any equiv for 12.8
			Geometric	B1	State geometric	Allow GP Ignore any additional detail as long as not incorrect B0 if additional contradictory or incorrect statements
				[2]		
	(ii)		$\frac{20(1-0.8^N)}{1-0.8} > 99.3$	B1	Correct inequality linking S_N to 99.3	Condone an equation, but B0 if incorrect inequality
			$1 - 0.8^N > 0.993$ $0.8^N < 0.007$	M1*	Attempt to rearrange to usable form	Rearrange to two terms (20×0.8^N counts as one term) Allow one slip, such as a sign error M0 if clear misunderstanding of indices eg 20×0.8^N becoming 1.6^N
				A1	Obtain $0.8^N < 0.007$	Condone an equation, or an incorrect inequality sign $20 \times 0.8^N < 0.14$ is not enough for A1 unless logs are used correctly on the product ie $\log 20 + \log 0.8^N$
			$N > \log_{0.8} 0.007$	M1d*	Attempt to find N, using logs correctly	Must make an attempt at N Could use logs to any base, as long as consistent on both sides, and allow no explicit base as well If using $\log_{0.8}$ then base must be explicit
			$N = 23$	A1	Obtain $N = 23$ (must be equality)	Allow worded conclusion such as N is 23 A0 for inequality, such as $N \geq 23$ or equiv in words Correct inequality sign must be seen throughout for A1 If using an equation then justification for choice of final value must be seen for A1 (eg check at least one of S_{22} and S_{23})
				[5]		Answer only gains no credit Trial and improvement could gain partial credit for an equation, but need to see use of logs for full credit

Question			Answer	Marks	Guidance	
	(iii)		$a = 16$, $r = 0.64$	B1	Identify correct a and/or correct r	Could imply by using correct a and/or correct r
			$S_\infty = \dfrac{16}{1-0.64}$	M1	Attempt sum to infinity with $a = 16$ and $r = 0.64$	Correct formula, with these values of a and r only
			$= \dfrac{400}{9}$	A1	Obtain $\frac{400}{9}$	Allow any exact equiv
				[3]		
6	(i)		$\dfrac{\sin A}{10} = \dfrac{\sin \frac{1}{6}\pi}{7}$ $\sin A = \frac{5}{7}$ so $A = 0.7956\ldots$ rad	M1*	Attempt use of sine rule, to find a value for A	Must be correct sine rule M0 if evaluated in degree mode (gives 0.748) Condone working with 30°, to obtain $A = 45.58°$
			$BAC = \pi - 0.7956$	M1d*	Attempt to find obtuse angle from their acute angle	Subtract their angle in radians from π, or their angle in degrees from 180° (could be implied by 134.4°)
			$= 2.346$ rad	A1	Obtain 2.346 rad, or better	If > 4sf, allow answer in range [2.3459, 2.3460] Allow 0.7468π Final answer must be in radians not degrees
				[3]		
	(ii)		angle $ACB = \pi - 2.346 - \frac{1}{6}\pi = 0.272$	M1*	Attempt to find angle ACB	$\frac{5}{6}\pi$ – their angle BAC (which could be acute) If their BAC is incorrect then method has to be shown – it cannot be implied by eg just stating $ACB = 1.822$
			area $= 0.5 \times 7 \times 10 \times \sin 0.272$	M1d*	Attempt area of triangle	Must be using correct formula Allow any valid method, which could include using length AB (= 3.76 cm)
			$= 9.40$ cm^2	A1	Obtain area of 9.40, or better	If > 3sf, allow answer rounding to 9.403 Allow 9.4 www Units not required
				[3]		

Question			Answer	Marks	Guidance	
	(iii)		$0.5 \times 7^2 \times \theta = 9.40$ $\theta = 0.384$	M1*	Attempt to find angle *CAD*	Equate $0.5 \times 7^2 \times \theta$ to their area and solve for θ
			arc length = 7×0.384	M1d*	Attempt arc length using 7θ	Allow M1 to be implied by answer of $7 \times$ their θ
			= 2.69 cm	A1	Obtain 2.69	If > 3sf, allow answer rounding to 2.69 www Must be from using the correct area of 9.40 or better Units not required
				[3]		**OR** **M1** – find proportion of circle using areas (= 0.0611) **M1** – apply this proportion to the circumference **A1** – obtain 2.69, or better **Alt MS -** for using the cosine rule (either in part **(i)** and/or in part **(ii)**) **part (i)** **M1** – attempt *AB* using the cosine rule correctly, and then use either solution to attempt angle *BAC* by using the cosine rule again **M1** – use shorter length of *AB* only in attempt at angle *BAC* **A1** – obtain 2.346 **part (ii)** **M1*** – attempt *AB* (which may have already been done in part **(i)**, so M1 can be awarded as soon as used in part **(ii)**, as long as valid method in **(i)**) **M1**d* – attempt area of triangle **A1** – obtain area of 9.40, or better

Question			Answer	Marks	Guidance	
7	(i)		$0.5 \times 1 \times (4 + 2 \times \frac{4}{3} + \frac{4}{9})$	M1	Attempt correct trapezium rule, using given y values	$h = 1$ could be implied y values must be correctly placed Brackets must be seen or implied No credit for working with a and b, unless correct numerical values subsequently used
			$= \frac{32}{9}$	A1	Obtain $\frac{32}{9}$	Allow decimal equiv of 3.56 or better
				[2]		Answer only is 0/2
	(ii)		$a = 4$	B1	State correct value for a	Allow B1 for $4 \times b^x$, any b
			$b = \frac{1}{3}$	B1	State correct value for b	Allow B1 for $a \times \left(\frac{1}{3}\right)^x$, any a Allow any exact equiv for b
				[2]		
	(iii)					**NB** B1FT M1 M1 can be gained for using correct numerical a and b, their incorrect numerical a and/or b, or algebraic a and b
			$\log_2(4\times\left(\frac{1}{3}\right)^x) = \log_2 4^{3x-1}$	B1FT	Obtain a correct equation from equating curves and introducing logs	A correct equation must be seen, so B0 if an error occurs at the same time as logs are taken eg $\log_2 4 \times \log_2\left(\frac{1}{3}\right)^x = \log_2 4^{3x-1}$ Allow logs to any base, or no base, as long as consistent Could use a single log on just one side of the equation, as long as the base is consistent with the position
			$\log_2 4 + \log_2\left(\frac{1}{3}\right)^x = \log_2 4^{3x-1}$	M1	Use $\log ab^x = \log a + \log b^x$ correctly	Used on $\log ab^x$, and not an expression where an error has already been made Could be an equivalent correct use if a division has occurred before the log law is used

Question			Answer	Marks	Guidance	
			$\log_2 4 + x\log_2\left(\frac{1}{3}\right) = (3x-1)\log_2 4$	M1	Use log p^q = $q$log$p$ correctly at least once	Used on $\log b^x$ or $\log a^{3x-1}$, but there could possibly be errors elsewhere in the equation Allow BOD for $3x - 1 \log_2 4$, as long as brackets implied by later working Allow BOD if $x\log\left(\frac{1}{3}\right)$ is seen when logs are introduced, even if $\log\left(\frac{1}{3}\right)^x$ has not previously been seen
			$2 - x\log_2 3 = 2(3x - 1)$ OR $2 + x\log_2\left(\frac{1}{3}\right) = 2(3x-1)$	A1	Obtain a correct equation	Equation must be equivalent to $2 - x\log_2 3 = 2(3x - 1)$ or a rearrangement of this Allow $+x\log_2\left(\frac{1}{3}\right)$ instead of $-x\log_2 3$ $\log_2 4$ must have base explicit before being simplified to 2
			$6x + x\log_2 3 = 4$ $x\left(6 + \log_2 3\right) = 4$ $x = \dfrac{4}{6 + \log_2 3}$ **AG**	A1 **[5]**	Make x the subject, factorise by x and obtain given answer convincingly	Must see factorisation before given answer appears The base of the logs must be explicit and correct throughout proof for A1 – most likely to be $\log_2$ but other methods are possible Allow BOD for missing brackets **Alternative approaches** Candidates may choose to work with rules of indices for some / most of their solution before using logs so marks may be gained in a different order eg $4\times\left(\frac{1}{3}\right)^x = 4^{3x-1}$ equated, but not yet B1 as no logs $16 \times \left(\frac{1}{3}\right)^x = 4^{3x}$ $16 \times 3^{-x} = 4^{3x}$ $16 = 3^x \times 4^{3x}$ could even be $16 = (3 \times 64)^x$ $\log_2 16 = \log_2(3^x \times 4^{3x})$ logs introduced so B1,and other M and A marks can follow – must still be correct expressions used for M marks to be awarded

Question			Answer	Marks	Guidance	
						Some candidates may combine the powers of 4 as their first step, which means that the law for splitting logs will never be used. This should be marked: M1 – attempt to combine powers of 4 eg $\left(\frac{1}{3}\right)^x = 4^{3x-2}$ B1 – correct equation involving logs M1 – use log $p^q = q\log p$ correctly at least once A1 – correct equation A1 – obtain given answer convincingly
8			$y = x^2 - \frac{1}{2}ax^{-2} + 3x + c$	M1*	Attempt integration	At least two terms to increase in power by 1
				A1	Obtain correct integral	Condone no + c Condone no 'y =' Allow unsimplified coefficients
			$8 = 1 - \frac{1}{2}a + 3 + c$	M1	Attempt to find equation in a and c using (1, 8)	Must follow attempt at integration ie two terms increasing in power by 1 M1 could be implied by eg $8 = 1 - \frac{1}{2}a + 3$ followed by an attempt to balance the equation M0 if no + c seen or implied M0 for $x = 8$, $y = 1$ Allow a slip when substituting, as long as it is clear that use of $x = 1$, $y = 8$ is intended
			$c = 4 + \frac{1}{2}a$	A1	Obtain correct equation in c and a	Could be explicit or as part of the correct $y = f(x)$ equation

Question			Answer	Marks	Guidance	
			$\frac{1}{3}x^3+\frac{1}{2}ax^{-1}+\frac{3}{2}x^2+4x+\frac{1}{2}ax$ OR $\frac{1}{3}x^3+\frac{1}{2}ax^{-1}+\frac{3}{2}x^2+cx$ OR $\frac{1}{3}x^3+(c-4)x^{-1}+\frac{3}{2}x^2+cx$	M1d* A1	Attempt integration Obtain correct integral	Must follow first attempt at integration, and include either c or an attempt at c in terms of a (and possibly even have a in terms of c) At least three terms to increase in power by 1 Any correct integral in terms of a and/or c
			$(9+\frac{1}{6}a+\frac{27}{2}+12+\frac{3}{2}a)$ $-(\frac{1}{3}+\frac{1}{2}a+\frac{3}{2}+4+\frac{1}{2}a)$	M1**	Attempt correct use of limits and equate to 30	Correct order and subtraction Must be using limits of 1 and 3 Dependent on M1M1 for the two integration attempts
			$\frac{86}{3}+\frac{2}{3}a=30$ $\frac{2}{3}a=\frac{4}{3}$	M1d**	Attempt to solve for either a or c	Solving for c gives $c = 5$ Another valid method is to find an equation involving a and c from use of limits ($6c - a = 28$) and solve simultaneously with their $c = 4 + \frac{1}{2}a$
			$a = 2$	A1 **[9]**	Obtain $a = 2$	
9	**(i)**		$\frac{x}{x-1}=\frac{2}{2-1}=2$ $\frac{6}{2x^2-5}=\frac{6}{8-5}=2$ $2 = 2$, so $x = 2$ must be a root	B1 **[1]**	Substitute $x = 2$ and conclude appropriately	Must see evidence of substitution into both terms, and both evaluated as 2 Conclusion required Could use a rearranged version of the equation instead, but substitution and evaluation must still be seen

Question		Answer	Marks	Guidance	
	(ii)	$2x^3 - 5x = 6x - 6$	M1	Attempt to rearrange equation to usable form	Attempt to remove fractions and combine like terms
		$2x^3 - 11x + 6 = 0$	A1	Obtain correct cubic in form f(x) = 0	Correct three term cubic, with all terms on the same side Condone no '= 0'
		$(x - 2)(2x^2 + 4x - 3) = 0$	B1	State or imply that $(x - 2)$ is a factor	Could be stated explicitly, or implied by using it in an attempt at the quotient or a factorisation attempt
			M1*	Attempt full division or equiv method	Must be dividing by $(x - 2)$ Must be complete method - ie all 3 terms attempted Long division - must subtract lower line (allow one slip) Inspection - expansion must give at least three correct terms of the cubic Coefficient matching - must be valid attempt at all coeffs of quadratic, considering all relevant terms each time Synthetic division - must be using 2 (not – 2) and adding within each column (allow one slip); expect to see $\begin{array}{c\|cccc} 2 & 2 & 0 & -11 & 6 \\ & & 4 & 8 & \\ \hline & 2 & 4 & -3 & \end{array}$
			A1	Obtain correct quadratic quotient	Could appear as quotient in long division, or as part of a product if using inspection. For coeff matching it must be explicit and not just $A = 2$, $B = 4$, $C = -3$ (but A1 could then be implied in attempt to solve quadratic)

Question			Answer	Marks	Guidance	
			$x = \dfrac{-4 \pm \sqrt{40}}{4} = -1 \pm \frac{1}{2}\sqrt{10}$	M1d*	Attempt to solve quadratic	Using the quadratic formula, or completing the square only (unless their quadratic quotient can be factorised) Dependent on M1 being awarded for the division attempt Allow M1 for finding the roots of their quadratic quotient, even if it was not a factor (ie an error in the division attempt resulted in a non-zero remainder)
				A1	Obtain correct exact roots (not nec simplified surd)	Any exact form - does not have to be simplified surd form ISW any attempt to simplify that goes wrong Ignore x = 2 if also given, but A0 for an additional, incorrect, root
				[7]		

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