Mark Scheme (Results)

January 2011

GCE

GCE Core Mathematics C1 (6663) Paper 1

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General Instructions for Marking

1. The total number of marks for the paper is 75.

2. The Edexcel Mathematics mark schemes use the following types of marks:

   - M marks: method marks are awarded for ‘knowing a method and attempting to apply it’, unless otherwise indicated.
   - A marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
   - B marks are unconditional accuracy marks (independent of M marks)
   - Marks should not be subdivided.

3. Abbreviations

   These are some of the traditional marking abbreviations that will appear in the mark schemes and can be used if you are using the annotation facility on ePEN.

   - bod – benefit of doubt
   - ft – follow through
   - the symbol $\sqrt{}$ will be used for correct ft
   - cao – correct answer only
   - cso - correct solution only. There must be no errors in this part of the question to obtain this mark
   - isw – ignore subsequent working
   - awrt – answers which round to
   - SC: special case
   - oe – or equivalent (and appropriate)
   - dep – dependent
   - indep – independent
   - dp decimal places
   - sf significant figures
   - $\ast$ The answer is printed on the paper
   - $\llcorner$ The second mark is dependent on gaining the first mark

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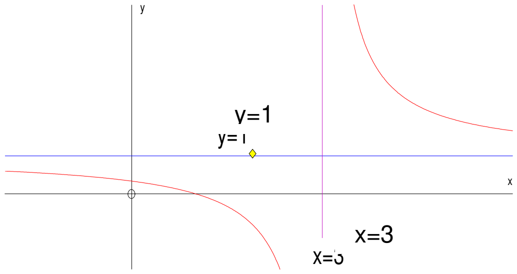
Core Mathematics C1 6663
Mark Scheme

Question Number	Scheme	Marks
1. (a)	$16^{\frac{1}{4}} = 2$ or $\frac{1}{16^{\frac{1}{4}}}$ or better	M1
	$\left(16^{-\frac{1}{4}} =\right) \frac{1}{2}$ or 0.5 (ignore $\pm$)	A1
		(2)
(b)	$\left(2x^{-\frac{1}{4}}\right)^4 = 2^4 x^{-\frac{4}{4}}$ or $\frac{2^4}{x^{\frac{4}{4}}}$ or equivalent	M1
	$x\left(2x^{-\frac{1}{4}}\right)^4 = 2^4$ or 16	A1 cao
		(2) 4
	Notes	
(a)	M1 for a correct statement dealing with the $\frac{1}{4}$ or the $-$ power This may be awarded if 2 is seen or for reciprocal of their $16^{\frac{1}{4}}$ s.c ¼ is M1 A0 , also 2^{-1} is M1 A0 $\pm\frac{1}{2}$ is not penalised so M1 A1	
(b)	M1 for **correct** use of the power 4 on both the 2 and the x terms A1 for cancelling the x and simplifying to one of these two forms. Correct answers with no working get full marks	

Question Number	Scheme	Marks
2.	$\left(\int =\right)\frac{12x^6}{6}, -\frac{3x^3}{3}, +\frac{4x^{\frac{4}{3}}}{\frac{4}{3}}, (+c)$ $= \underline{2x^6 - x^3 + 3x^{\frac{4}{3}} + c}$	M1 A1, A1, A1 A1 5
	Notes	
	M1 for some attempt to integrate: $x^n \to x^{n+1}$ i.e ax^6 or ax^3 or $ax^{\frac{4}{3}}$ or $ax^{1\frac{1}{3}}$, where a is a non zero constant 1st A1 for $\frac{12x^6}{6}$ or better 2nd A1 for $-\frac{3x^3}{3}$ or better 3rd A1 for $\frac{4x^{\frac{4}{3}}}{\frac{4}{3}}$ or better 4th A1 for each term correct and simplified and the $+c$ occurring in the final answer	

Question Number	Scheme	Marks
3.	$\frac{5-2\sqrt{3}}{\sqrt{3}-1} \times \frac{(\sqrt{3}+1)}{(\sqrt{3}+1)}$	M1
	$= \frac{\dots}{2}$ denominator of 2	A1
	Numerator = $5\sqrt{3}+5-2\sqrt{3}\sqrt{3}-2\sqrt{3}$	M1
	So $\frac{5-2\sqrt{3}}{\sqrt{3}-1} = -\frac{1}{2}+\frac{3}{2}\sqrt{3}$	A1
		4
	Alternative: $(p+q\sqrt{3})(\sqrt{3}-1) = 5-2\sqrt{3}$, and form simultaneous equations in p and q	M1
	$-p + 3q = 5$ and $p - q = -2$	A1
	Solve simultaneous equations to give $p = -\frac{1}{2}$ and $q = \frac{3}{2}$.	M1 A1
	<u>Notes</u>	
	1st M1 for multiplying numerator and denominator by same correct expression 1st A1 for a correct denominator as a single number (NB depends on M mark) 2nd M1 for an attempt to multiply the numerator by $(\sqrt{3}\pm 1)$ and get 4 terms with at least 2 correct. 2nd A1 for the answer as written or $p = -\frac{1}{2}$ and $q = \frac{3}{2}$. Allow -0.5 and 1.5. (Apply isw if correct answer seen, then slip writing p =, q =)	
	Answer only (very unlikely) is full marks if correct – no part marks	

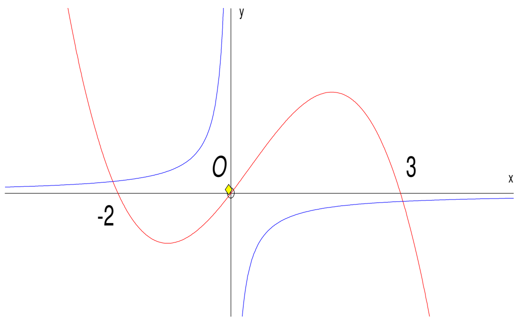
Question Number	Scheme	Marks
4 (a)	$(a_2 =)\ 6 - c$	B1 (1)
(b)	$a_3 = 3(\text{their } a_2) - c \qquad (= 18 - 4c)$ $a_1 + a_2 + a_3 = 2 + "(6-c)" + "(18-4c)"$ $\text{“}26 - 5c\text{”} = 0$ So $c = 5.2$	M1 M1 A1ft A1 o.a.e (4) 5
	Notes	
(b)	1st M1 for attempting a_3. Can follow through their answer to (a) but it must be an expression in c. 2nd M1 for an attempt to find the sum $a_1 + a_2 + a_3$ must see evidence of sum 1st A1ft for their sum put equal to 0. Follow through their values but answer must be in the form $p + qc = 0$ A1 – accept any correct equivalent answer	

Question Number	Scheme	Marks
5. (a)	 Correct shape with a single crossing of each axis $y = 1$ labelled or stated $x = 3$ labelled or stated	B1 B1 B1 (3)
(b)	Horizontal translation so crosses the x-axis at (1, 0) New equation is $(y =)\dfrac{x \pm 1}{(x \pm 1) - 2}$ When $x = 0$ $y =$ $= \dfrac{1}{3}$	B1 M1 M1 A1 (4) 7
	Notes	
(b)	B1 for point (1,0) identified - this may be marked on the sketch as 1 on x axis. Accept $x = 1$. 1st M1 for attempt at new equation and either numerator or denominator correct 2nd M1 for setting $x = 0$ in their new equation and solving as far as $y = \ldots$ A1 for $\frac{1}{3}$ or exact equivalent. Must see $y = \frac{1}{3}$ or (0, $\frac{1}{3}$) or point marked on y-axis. **Alternative** $f(-1) = \dfrac{-1}{-1-2} = \dfrac{1}{3}$ scores M1M1A0 unless $x = 0$ is seen or they write the point as (0, $\frac{1}{3}$) or give $y = 1/3$ Answers only: $x = 1$, $y = 1/3$ is full marks as is (1,0) (0, 1/3) Just 1 and 1/3 is B0 M1 M1 A0 Special case : Translates 1 unit to left (a) B0, B1, B0 (b) Mark (b) as before May score B0 M1 M1 A0 so 3/7 or may ignore sketch and start again scoring full marks for this part.	

Question Number	Scheme	Marks
6. (a)	$S_{10} = \frac{10}{2}[2a+9d]$ or $S_{10} = a+a+d+a+2d+a+3d+a+4d+a+5da+6d+a+7d+a+8d+a+9d$ $162 = 10a + 45d$ *	M1 A1cso (2)
(b)	$\left(u_n = a+(n-1)d \;\; \Rightarrow \;\; \right) 17 = a+5d$	B1 (1)
	$10\times(b)$ gives $10a+50d = 170$ (a) is $10a + 45d = 162$ Subtract $5d = 8$ so $d = \underline{1.6}$ o.e. Solving for a $a = 17 - 5d$ so $a = \underline{9}$	M1 A1 M1 A1 (4) 7
	<u>Notes</u>	
(a) (b)	M1 for use of S_n with $n = 10$ 1st M1 for an attempt to eliminate a or d from their two linear equations 2nd M1 for using their value of a or d to find the other value.	

Question Number	Scheme	Marks
7.	$\left(\text{f}(x)=\right)\dfrac{12x^3}{3}-\dfrac{8x^2}{2}+x(+c)$	M1 A1 A1
	$\left(\text{f}(-1)=0\Rightarrow\right)\ 0=4\times(-1)-4\times1-1+c$	M1
	$c=\underline{9}$	A1
	$\left[\text{f}(x)=4x^3-4x^2+x+9\right]$	5
	Notes	
	1st M1 for an attempt to integrate $x^n\to x^{n+1}$ 1st A1 for at least 2 terms in x correct - needn't be simplified, ignore $+c$ 2nd A1 for all the terms in x correct but they need not be simplified. No need for $+c$ 2nd M1 for using x = -1 and y =0 to form a linear equation in c. No $+c$ gets M0A0 3rd A1 for c = 9. Final form of f(x) is not required.	
8. (a)	$b^2-4ac=(k-3)^2-4(3-2k)$	M1
	$k^2-6k+9-4(3-2k)>0$ or $(k-3)^2-12+8k>0$ or better	M1
	$\underline{k^2+2k-3>0}$ *	A1cso (3)
(b)	$(k+3)(k-1)[=0]$	M1
	Critical values are k = 1 or -3	A1
	(choosing "outside" region)	M1
	$\underline{k>1 \text{ or } k<-3}$	A1 cao (4) 7
	Notes	
(a)	1st M1 for attempt to find b^2-4ac with one of b or c correct 2nd M1 for a correct inequality symbol and an attempt to expand. A1cso no incorrect working seen	
(b)	1st M1 for an attempt to factorize **or** solve leading to k = (2 values) 2nd M1 for a method that leads them to choose the "outside" region. Can follow through their critical values. 2nd A1 Allow "," instead of "or" $\geq$ loses the final A1 1 < k < -3 scores M1A0 unless a correct version is seen before or after this one.	

Question Number	Scheme	Marks
9.		
(a)	$(8-3-k=0)$ so $\underline{k=5}$	B1 (1)
(b)	$2y=3x+k$ $y=\frac{3}{2}x+\ldots$ and so $m=\frac{3}{2}$ o.e.	M1 A1 (2)
(c)	Perpendicular gradient = $-\frac{2}{3}$ Equation of line is: $y-4=-\frac{2}{3}(x-1)$ $\underline{3y+2x-14=0}$ o.e.	B1ft M1A1ft A1 (4)
(d)	$y=0,\quad \Rightarrow \quad B(7,0)$ or $\underline{x=7}$ $\qquad x=7$ or $-\frac{c}{a}$	M1A1ft (2)
(e)	$AB^2=(7-1)^2+(4-0)^2$ $AB=\sqrt{52}$ or $2\sqrt{13}$	M1 A1 (2) 11
	Notes	
(b)	M1 for an attempt to rearrange to $y=\ldots$ A1 for clear statement that gradient is 1.5, can be m =1.5 o.e.	
(c)	B1ft for using the perpendicular gradient rule correctly on their "1.5" M1 for an attempt at finding the equation of the line through A using their gradient. Allow a sign slip 1st A1ft for a correct equation of the line follow through their changed gradient 2nd A1 as printed or equivalent with integer coefficients – allow $\underline{3y+2x=14}$ or $\underline{3y=14-2x}$	
(d)	M1 for use of $y=0$ to find $x=\ldots$in their equation A1ft for $x=7$ or $-\frac{c}{a}$	
(e)	M1 for an attempt to find AB or AB^2 A1 for any correct surd form- need not be simplified	

Question Number	Scheme	Marks
10. (a)	 (i) correct shape (-ve cubic) Crossing at (-2, 0) Through the origin Crossing at (3,0) (ii) 2 branches in correct quadrants not crossing axes One intersection with cubic on each branch	B1 B1 B1 B1 B1 B1 (6)
(b)	"2" solutions Since only "2" intersections	B1ft dB1ft (2) 8
	Notes	
(b)	B1ft for a value that is compatible with their sketch dB1ft This mark is dependent on the value being compatible with their sketch. For a comment relating the number of solutions to the number of intersections. [Only allow 0, 2 or 4]	
11. (a)	$\left(\frac{dy}{dx}=\right)\frac{3}{2}x^2-\frac{27}{2}x^{\frac{1}{2}}-8x^{-2}$	M1A1A1A1 (4)
(b)	$x=4 \Rightarrow y=\frac{1}{2}\times 64-9\times 2^3+\frac{8}{4}+30$ $= 32 - 72 + 2 + 30 \qquad = \underline{-8}$ *	M1 A1cso (2)
(c)	$x=4 \Rightarrow y'=\frac{3}{2}\times 4^2-\frac{27}{2}\times 2-\frac{8}{16}$ $= 24-27-\frac{1}{2}= \qquad -\frac{7}{2}$ Gradient of the normal = $-1\div "\tfrac{7}{2}"$ Equation of normal: $y--8=\frac{2}{7}(x-4)$ $\underline{7y-2x+64=0}$	M1 A1 M1 M1A1ft A1 (6) 12

Question Number	Scheme	Marks
	Notes	
(a)	1st M1 for an attempt to differentiate $x^n \to x^{n-1}$ 1st A1 for one correct term in x 2nd A1 for 2 terms in x correct 3rd A1 for all correct x terms. No 30 term and no $+c$.	
(b)	M1 for substituting $x = 4$ into $y =$ and attempting $4^{\frac{3}{2}}$ A1 note this is a printed answer	
(c)	1st M1 Substitute x = 4 into y' (allow slips) A1 Obtains –3.5 or equivalent 2nd M1 for correct use of the perpendicular gradient rule using their gradient. (May be slip doing the division) Their gradient must have come from y' 3rd M1 for an attempt at equation of tangent or normal at P 2nd A1ft for correct use of their changed gradient to find **normal** at P. Depends on 1st, 2nd and 3rd Ms 3rd A1 for any equivalent form with integer coefficients	

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