GCE MARKING SCHEME

SUMMER 2017

MATHEMATICS - C1
0973/01

INTRODUCTION

This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

Mathematics C1 May 2017

Solutions and Mark Scheme

1.	(*a*)	(i)	Gradient of $AB = \dfrac{\text{increase in } y}{\text{increase in } x}$	M1
			Gradient of $AB = {}^1/_3$ (or equivalent)	A1
		(ii)	Use of gradient $L_1 \times$ gradient $AB = -1$ (or equivalent)	M1
			A correct method for finding the equation of L_1 using candidate's gradient for L_1	M1
			Equation of L_1: $y - 5 = -3(x - 4)$ (or equivalent) (f.t. candidate's gradient for AB provided that both the 3rd and 4th marks (M1, M1) have been awarded)	A1
	(*b*)	(i)	An attempt to solve equations of L_1 and L_2 simultaneously	M1
			$x = 7$, $y = -4$ (convincing)	A1
		(ii)	A correct method for finding the length of $AC(BC)$	M1
			$AC = \sqrt{130}$	A1
			$BC = \sqrt{90}$	A1
			$\text{Cos } BCA = \dfrac{BC}{CA} = \dfrac{\sqrt{90}}{\sqrt{130}}$ (f.t. candidate's derived values for AC and BC)	M1
			$\text{Cos } BCA = \dfrac{3}{\sqrt{13}}$ (c.a.o.)	A1
	(*c*)	(i)	A correct method for finding D	M1
			$D(1, 14)$	A1
		(ii)	Isosceles	E1

2.	(*a*)	$\dfrac{5\sqrt{5} - 9}{3 + 2\sqrt{5}} = \dfrac{(5\sqrt{5} - 9)(3 - 2\sqrt{5})}{(3 + 2\sqrt{5})(3 - 2\sqrt{5})}$	M1
		Numerator: $15 \times \sqrt{5} - 10 \times 5 - 9 \times 3 + 18 \times \sqrt{5}$	A1
		Denominator: $9 - 20$	A1
		$\dfrac{5\sqrt{5} - 9}{3 + 2\sqrt{5}} = 7 - 3\sqrt{5}$ (c.a.o.)	A1
		Special case	
		If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $3 + 2\sqrt{5}$	
	(*b*)	$(2\sqrt{13})^2 = 52$	B1
		$3\sqrt{7} \times \sqrt{28} = 42$	B1
		$\dfrac{5\sqrt{99}}{\sqrt{11}} = 15$	B1
		$(2\sqrt{13})^2 - 3\sqrt{7} \times \sqrt{28} - \dfrac{5\sqrt{99}}{11} = -5$ (c.a.o.)	B1

3. (*a*) $\frac{dy}{dx} = \frac{3}{2}x - 4$ (an attempt to differentiate, at least one non-zero term correct) M1

An attempt to substitute $x = 6$ in candidate's expression for $\frac{dy}{dx}$ m1

Value of $\frac{dy}{dx}$ at $P = 5$ (c.a.o.) A1

Equation of tangent at P: $y - (-7) = 5(x - 6)$ (or equivalent)

(f.t. candidate's value for $\frac{dy}{dx}$ provided M1 and m1 both awarded) A1

(*b*) Use of gradient of tangent = $\frac{-1}{\text{gradient of normal}}$ (o.e.) M1

An attempt to put candidate's expression for $\frac{dy}{dx} = \frac{1}{2}$

(f.t candidate's derived value for gradient of tangent) m1

x-coordinate of $Q = 3$ (c.a.o.) A1

4. (*a*) $a = -2$ B1

$b = 5$ B1

$c = 85$ B1

(*b*) Stationary value = 85 (f.t. candidate's value for c) B1

This is a maximum B1

5. (*a*) $\left(x + \frac{2}{x}\right)^4 = x^4 + 4x^3\left(\frac{2}{x}\right) + 6x^2\left(\frac{2}{x}\right)^2 + 4x\left(\frac{2}{x}\right)^3 + \left(\frac{2}{x}\right)^4$

(4 or 5 terms correct) B2

(**If B2 not awarded**, award B1 for 3 correct terms)

$\left(x + \frac{2}{x}\right)^4 = x^4 + 8x^2 + 24 + \frac{32}{x^2} + \frac{16}{x^4}$ (5 terms correct) B2

(**If B2 not awarded**, award B1 for 3 or 4 correct terms)

(– 1 for further incorrect simplification)

(*b*) Coefficient of $x = {}^6C_1 \times a^5 \times 2(x)$ B1

Coefficient of $x^2 = {}^6C_2 \times a^4 \times 2^2(x^2)$ B1

$15 \times a^4 \times m = 6 \times a^5 \times 2$ (m = **4** or 2) M1

$a = 5$ (c.a.o.) A1

6. Finding critical values $x = -{}^{3}/_{2}$, $x = -4$ B1

A statement (mathematical or otherwise) to the effect that $x \le -4$ or $-{}^{3}/_{2} \le x$

(or equivalent, f.t. candidate's derived critical values) B2

Deduct 1 mark for each of the following errors

the use of strict inequalities

the use of the word 'and' instead of the word 'or'

7. (*a*) Use of $f(2) = 0$ M1

$8k + 8 - 82 + 10 = 0 \Rightarrow k = 8$ (convincing) A1

Special case

Candidates who assume $k = 8$ and then either show that $f(2) = 0$ or that $x - 2$ is a factor by long division are awarded B1

(*b*) $f(x) = (x - 2)(8x^2 + ax + b)$ with one of a, b correct M1

$f(x) = (x - 2)(8x^2 + 18x - 5)$ A1

$f(x) = (x - 2)(4x - 1)(2x + 5)$ (f.t. only $8x^2 - 18x - 5$ in above line) A1

Special case

Candidates who find one of the remaining factors,

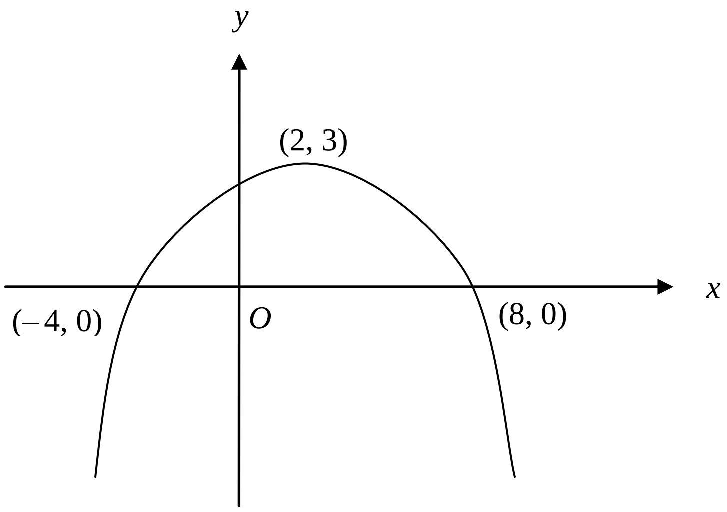
$(4x - 1)$ or $(2x + 5)$, using e.g. factor theorem, are awarded B1

(*c*) Attempting to find $f(-1/2)$ M1

Remainder = 30 A1

If a candidate tries to solve (*c*) by using the answer to part (*b*), f.t. for M1 and A1 when candidate's expression is of the form $(x - 2) \times$ two linear factors

8. (*a*)



Concave down curve with maximum at (2, *a*)	B1
Maximum at (2, 3)	B1
Both points of intersection with *x*-axis	B1

(*b*) The stationary point will always be a minimum — E1

The *y*-coordinate of the stationary point will always be – 6 — E1

9. (*a*)

$y + \delta y = -5(x + \delta x)^2 - 7(x + \delta x) + 13$		B1
Subtracting y from above to find δy		M1
$\delta y = -10x\delta x - 5(\delta x)^2 - 7\delta x$		A1
Dividing by δx and letting $\delta x \to 0$		M1
$\frac{dy}{dx} = \lim_{\delta x \to 0} \frac{\delta y}{\delta x} = -10x - 7$	(c.a.o.)	A1

(*b*) $\frac{dy}{dx} = 6 \times \frac{3}{4} \times x^{-1/4} + 5 \times -3 \times x^{-4}$ (completely correct answer) B2

(**If B2 not awarded**, award B1 for at least one correct non-zero term)

10. (*a*) (i) $\frac{dy}{dx} = 3x^2 - 18x + 15$ B1

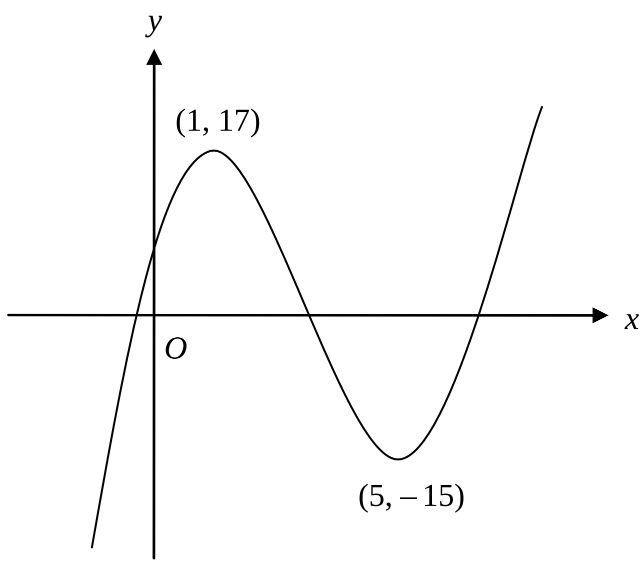
Putting candidate's derived $\frac{dy}{dx} = 0$ M1

$x = 1, 5$ (both correct) (f.t. candidate's $\frac{dy}{dx}$) A1

Stationary points are (1, 17) and (5, – 15)
(both correct) (c.a.o) A1

(ii) A correct method for finding nature of stationary points yielding
either (1, 17) is a maximum point
or (5, – 15) is a minimum point
(f.t. candidate's derived values) M1
Correct conclusion for other point
(f.t. candidate's derived values) A1

(*b*)



Graph in shape of a positive cubic with two turning points M1
Correct marking of both stationary points
(f.t. candidate's derived maximum and minimum points) A1

(*c*) Use of both $k = -15$, $k = 17$ to find the range of values for k
(f.t. candidate's y-values at stationary points) M1
$k < -15$ or $17 < k$ (f.t. candidate's y-values at stationary points) A1