GCE MARKING SCHEME

SUMMER 2018

MATHEMATICS – C1 (LEGACY)
0973-01

INTRODUCTION

This marking scheme was used by WJEC for the 2018 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 2018

Solutions and Mark Scheme

1. (*a*) (i) Gradient of $AB(DC) = \dfrac{\text{increase in } y}{\text{increase in } x}$ M1

Gradient of $AB = -2$, gradient of $DC = -2$,

(or equivalent, at least one correct) A1

Gradient of AB = gradient of $DC \Rightarrow AB$ and DC are parallel

(c.a.o.) A1

(ii) A correct method for finding the equation of AB using candidate's gradient for AB M1

Equation of AB: $y - 7 = -2\,[x - (-2)]$ (or equivalent)

(f.t. candidate's gradient for AB) A1

(*b*) (i) Gradient $L = {}^1/_2$ B1

${}^1/_2 \times -2 = -1 \Rightarrow L$ is perpendicular to AB (o.e.)

(f.t. candidate's derived gradients for AB and L) B1

(ii) An attempt to solve equations of AB and L simultaneously M1

$x = -1$, $y = 5$ (convincing) A1

(iii) A correct method for finding the coordinates of the mid-point of AB M1

Mid-point of AB has coordinates (0, 3) A1

A correct method for finding the length of EF M1

$EF = \sqrt{5}$ (f.t. the candidate's derived coordinates of F) A1

(*c*) $ABCD$ is a trapezium B1

2. $\sqrt{500} = 10\sqrt{5}$ B1

$(\sqrt{12} \times \sqrt{15}) = 6\sqrt{5}$ B1

$\dfrac{7\sqrt{60}}{\sqrt{3}} = 14\sqrt{5}$ B1

$\sqrt{500} + (\sqrt{12} \times \sqrt{15}) - \dfrac{7\sqrt{60}}{\sqrt{3}} = 2\sqrt{5}$ (c.a.o.) B1

3. (*a*) y-coordinate of $P = -1$ B1

$\frac{dy}{dx} = 2x - 6$

(an attempt to differentiate, at least one non-zero term correct) M1

An attempt to substitute $x = 2$ in candidate's expression for $\frac{dy}{dx}$ m1

Value of $\frac{dy}{dx}$ at $P = -2$ (c.a.o.) A1

Gradient of normal = $\dfrac{-1}{\text{candidate's value for } \frac{dy}{dx}}$ m1

Equation of normal to C at P: $y - (-1) = \frac{1}{2}(x - 2)$

Equation of normal to C at P: $y = \frac{1}{2}x - 2$ (convincing) A1

(*b*) $x^2 - 6x + 7 = \frac{1}{2}x - 2$ M1

An attempt to collect terms, form and solve the quadratic equation in x either by correct use of the quadratic formula or by writing the equation in the form $(ax + b)(cx + d) = 0$, with $a \times c$ = candidate's coefficient of x^2 and $b \times d$ = candidate's constant m1

$2x^2 - 13x + 18 = 0 \Rightarrow (2x - 9)(x - 2) = 0$ (or equivalent)

$\Rightarrow x = \frac{9}{2}, (x = 2)$ (c.a.o.) A1

At Q, $x = \frac{9}{2}$, $y = \frac{1}{4}$ (c.a.o.) A1

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

$b = 5$ B1

$c = -169$ B1

(*b*) $4(x + 5)^2 = 169$ (f.t. candidate's values for a, b, c) M1

$(x + 5) = (\pm)\frac{13}{2}$ (f.t. candidate's values for a, b, c) m1

$x = \frac{3}{2}, -\frac{23}{2}$ (both values) (c.a.o.) A1

5. (*a*) $\left(1 - \frac{x}{2}\right)^7 = 1 - \frac{7}{2}x + \frac{21}{4}x^2 - \frac{35}{8}x^3 + \ldots$ B1 B1 B1 B1

(– 1 for further incorrect simplification)

(*b*) ${}^nC_2 \times 4^k = 3360$ (k = 1, **2**) M1

Either $16n^2 - 16n - 6720 = 0$ or $n^2 - n - 420 = 0$ or $n(n - 1) = 420$ A1

$n = 21$ (c.a.o.) A1

6. Finding critical values $x = -2$, $x = {}^2/_9$ B1

A statement (mathematical or otherwise) to the effect that

$x < -2$ or $x > {}^2/_9$ (or equivalent)

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

Deduct 1 mark for each of the following errors

the use of non-strict inequalities

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

7. (*a*) $y + \delta y = 9(x + \delta x)^2 - 7(x + \delta x) - 8$ B1

Subtracting y from above to find δy M1

$\delta y = 18x\delta x + 9(\delta x)^2 - 7\delta x$ A1

Dividing by δx and letting $\delta x \to 0$ M1

$\frac{dy}{dx} = \lim_{\delta x \to 0} \frac{\delta y}{\delta x} = 18x - 7$ (c.a.o.) A1

(*b*) $\frac{dy}{dx} = k \times (-1) \times x^{-2} + 14 \times \frac{1}{2} \times x^{-1/2}$ B1, B1

Attempting to substitute $x = 9$ in candidate's expression for $\frac{dy}{dx}$ and putting expression equal to 2 M1

(The M1 is only awarded if at least one B1 has been awarded)

$k = 27$ (c.a.o.) A1

8. (*a*) Denoting $8x^3 + 7x^2 - 13x + 10$ by $f(x)$,

(i) **Either:** showing that $f(-2) = 0$

Or: trying to find $f(r)$ for at least two values of r M1

$f(-2) = 0 \Rightarrow x = -2$ is a root of $8x^3 + 7x^2 - 13x + 10 = 0$ A1

(ii) $f(x) = (x + 2)(8x^2 + mx + n)$ with one of m, n correct M1

$f(x) = (x + 2)(8x^2 - 9x + 5)$ A1

An expression for $b^2 - 4ac$ for the quadratic $8x^2 - 9x + 5 = 0$ with at least two of a, b or c correct

(f.t. candidate's derived quadratic expression) M1

$b^2 - 4ac = -79$ or $b^2 - 4ac < 0$

(f.t. candidate's derived quadratic expression) A1

$b^2 - 4ac < 0 \Rightarrow 8x^2 - 9x + 5 = 0$ has no real roots $\Rightarrow x = -2$ is the only real root of $8x^3 + 7x^2 - 13x + 10 = 0$

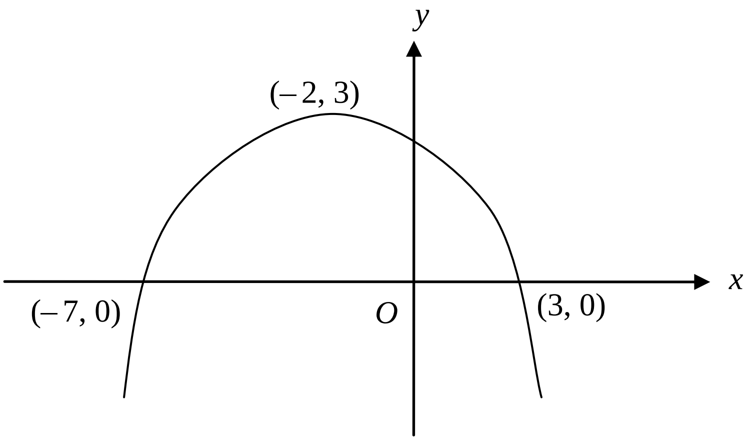
(f.t. candidate's derived **negative** value for $b^2 - 4ac$) A1

(*b*) Denoting $x^3 - 80$ by $g(x)$,

Use of $g(a) = 45$ M1

$a^3 - 80 = 45 \Rightarrow a = 5$ A1

9. (*a*)



Concave down curve with x-coordinate of maximum = – 2	B1
y-coordinate of maximum = 3	B1
Both points of intersection with x-axis	B1

(*b*) $a = -2$ B1

$a = 3$ B1

10. (*a*) Height of box $= \dfrac{6000}{3x^2}$

(or an equivalent expression for the height) B1

$L = 4 \times (x + 3x + \dfrac{6000}{3x^2})$

(f.t. candidate's derived expression for height of box in terms of x) M1

$L = 16x + \dfrac{8000}{x^2}$ (convincing) A1

(*b*) $\dfrac{dL}{dx} = 16 - \dfrac{16000}{x^3}$ (o.e.) B1

Putting derived $\dfrac{dL}{dx} = 0$ M1

$x = 10$ (f.t. candidate's $\dfrac{dL}{dx}$ provided x is positive) A1

Stationary value of L at $x = 10$ is 240

(f.t. candidate's derived positive value for x) A1

A correct method for finding nature of the stationary point yielding a minimum value (provided x is positive) B1