C2 Paper F – Marking Guide

1. GP: $a = 10, r = 2$ — B2

$S_{12} = \frac{10(2^{12}-1)}{2-1}$ — M1

$= 40\,950$ — A1 **(4)**

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2. *(i)* $\angle BAC = 180 - (107 + 31) = 42$ — B1

$\frac{BC}{\sin 42} = \frac{12.6}{\sin 31}$ — M1

$BC = \frac{12.6 \sin 42}{\sin 31} = 16.4$ cm (3sf) — A1

(ii) $= \frac{1}{2} \times 12.6 \times 16.37 \times \sin 107 = 98.6$ cm^2 (3sf) — M1 A1 **(5)**

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3. $f(x) = \int (4x^{\frac{1}{3}} - 5)\ dx$

$f(x) = 3x^{\frac{4}{3}} - 5x + c$ — M1 A2

$(8, 7)\ \therefore\ 7 = 3(\sqrt[3]{8})^4 - 40 + c$ — M1

$7 = 48 - 40 + c$

$c = -1$ — A1

$f(x) = 3x^{\frac{4}{3}} - 5x - 1$ — A1 **(6)**

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4. $1 - \cos^2\theta = 4\cos\theta$ — M1

$\cos^2\theta + 4\cos\theta - 1 = 0$ — A1

$\cos\theta = \frac{-4 \pm \sqrt{16+4}}{2}$ — M1

$\cos\theta = -2 - \sqrt{5}$ (no solutions) or $-2 + \sqrt{5}$ — A1

$\theta = 76.3, 360 - 76.3$ — B1 M1

$\theta = 76.3°, 283.7°$ (1dp) — A1 **(7)**

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5. *(i)* $= 3 - \log_8 8^{\frac{2}{3}}$ — B1 M1 A1

$= 3 - \frac{2}{3} = \frac{7}{3}$ — A1

(ii) $(2^2)^x - 3(2 \times 2^x) = 0$ — M1

$(2^x)^2 - 6(2^x) = 0$

$2^x(2^x - 6) = 0$ — M1

$2^x = 0$ (no solutions) or 6 — A1

$x = \frac{\lg 6}{\lg 2} = 2.58$ (3sf) — M1 A1 **(9)**

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6. *(a)* $= 1 + 4x + 6x^2 + 4x^3 + x^4$ — M1 A1

(b) *(i)* $= 1 + 4(\sqrt{2}) + 6(\sqrt{2})^2 + 4(\sqrt{2})^3 + (\sqrt{2})^4$ — M1

$= 1 + 4\sqrt{2} + 6(2) + 4(2\sqrt{2}) + 4$ — M1

$= 17 + 12\sqrt{2}$ — A1

(ii) $(1 - \sqrt{2})^4 = 17 - 12\sqrt{2}$ — B1

$(1 - \sqrt{2})^8 = [(1 - \sqrt{2})^4]^2 = (17 - 12\sqrt{2})^2$ — M1

$= 289 - 408\sqrt{2} + 288$ — M1

$= 577 - 408\sqrt{2}$ — A1 **(9)**

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7. *(i)* $a + d = 26$
$a + 4d = 41$ M1
subtracting, $3d = 15$ M1
$d = 5$ A1

(ii) $a = 21$ B1
$u_{12} = 21 + (11 \times 5) = 76$ M1 A1

(iii) $\frac{n}{2}[42 + 5(n-1)] = \frac{n}{2}[-24 + 7(n-1)]$ M1 A1
$n(5n + 37) = n(7n - 31)$
$2n(n - 34) = 0$ M1
$n > 0 \ \therefore n = 34$ A1 **(10)**

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8. *(i)* $p(-2) = 20 \ \therefore -16 + 4 - 2a + b = 20$ M1
$b = 2a + 32$ A1

(ii) $p(\frac{1}{2}) = 0 \ \therefore \ \frac{1}{4} + \frac{1}{4} + \frac{1}{2}a + b = 0$ M1
sub. $\frac{1}{2} + \frac{1}{2}a + (2a + 32) = 0$ M1
$a = -13, b = 6$ A2

(iii)

$$\begin{array}{r} x^2 + x - 6 \\ 2x - 1 \overline{)\ 2x^3 + x^2 - 13x + 6} \\ \underline{2x^3 - x^2} \\ 2x^2 - 13x \\ \underline{2x^2 - x} \\ -12x + 6 \\ \underline{-12x + 6} \end{array}$$

M1 A1

$p(x) = (2x - 1)(x^2 + x - 6)$
$p(x) = (2x - 1)(x + 3)(x - 2)$ M1 A1 **(10)**

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9. *(i)* $\frac{dy}{dx} = 1 - 2x$ M1
grad $= 1 - 2 = -1$ A1
grad of normal $= \frac{-1}{-1} = 1$ M1
$y - 5 = 1(x - 1)$ M1
$y = x + 4$ A1

(ii) $5 + x - x^2 = x + 4$
$x^2 - 1 = 0$ M1
$x = 1$ (at P) or $-1 \ \therefore Q(-1, 3)$ A1

(iii) area $= \int_{-1}^{1} [(5 + x - x^2) - (x + 4)] \ dx$ M1
$= \int_{-1}^{1} (1 - x^2) \ dx$
$= [x - \frac{1}{3}x^3]_{-1}^{1}$ M1 A1
$= (1 - \frac{1}{3}) - (-1 + \frac{1}{3}) = \frac{4}{3}$ M1 A1 **(12)**

Total **(72)**