MATHEMATICS C2

1. $h = 0{\cdot}1$

M1 (correct formula $h = 0{\cdot}1$)

Integral $\approx \frac{0{\cdot}1}{2}$ [1 + 1·012719 + 2(1·0000500 + 1·0007997 + 1·0040418)]

B1 (3 values)

B1 (2 values)

$\approx 0{\cdot}401$

A1 (F.T. one slip)

S. Case $h = 0{\cdot}08$

Integral $\approx \frac{0{\cdot}08}{2}$ [1 + 1·012719 + 2 (1·0000205 + 1·0003276 + 1·0016575 + 1·0052292)]

M1 (correct formula $h = 0{\cdot}08$)

$\approx 0{\cdot}401$

B1 (all values)
A1 (F.T. one slip)

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2. *(a)* $x = 158{\cdot}2^\circ, 338{\cdot}2^\circ$

B1, B1

(b) $3x = 60^\circ, 300^\circ, 420^\circ, 660^\circ$

B1 (any value)

$x = 20^\circ, 100^\circ, 140^\circ$

B1, B1, B1

(c) $2(1 - \sin^2\theta) + 3\sin\theta = 0$

M1 (correct use of $\cos^2\theta = 1 - \sin^2\theta$)

$2\sin^2\theta - 3\sin\theta - 1 = 0$

$(2\sin\theta + 1)(\sin\theta - 2) = 0$

M1 (attempt to solve quad in sinθ correct formula or $(a\cos\theta + b)(c\sin\theta + d)$ with ac = coefft. of $\sin^2\theta$ bd = constant term)

$\sin\theta = -\frac{1}{2}, 2$

A1

$\theta = 210^\circ, 330^\circ$

B1 (210°) B1 (330°)

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3. *(a)* Area $= \frac{1}{2}x \times 8 \sin 150^\circ$

B1

$\frac{1}{2}x \times 8 \times \sin 150^\circ = 10$

B1 (correct equation)

$x = \frac{10}{4\sin 150^\circ} = 5$

B1 (C.A.O.)

(b) $BC^2 = 5^2 + 8^2 + 2.5.8 \cos 30^\circ$ (o.e.) B1

$= 25 + 64 + 68{\cdot}29$ B1

$BC \approx 12{\cdot}58$ B1

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4. *(a)* $S_n = a + a + d + ... + a + (n-2)\,d + a\,(n-1)d$ B1 (at least 3 terms one at each end)

$S_n = a + (n-1)d + a + (n-2)d + ... + a + d + a$

$2S_n = 2a + (n-1)d + 2a + (n-1)d + ...$ M1

$+ 2a + (n-1)d + 2a + (n-1)d$

$= n[2a + (n-1)d]$

$\therefore\ S_n = \frac{n}{2}\,[2a + (n-1)d]$ A1 (convincing)

(b) (i) $\frac{20}{2}[2a + 19d] = 540$ B1

$\frac{30}{2}[2a + 29d] = 1260$ B1

$2a + 19d = 54$ (1)

$2a + 29d = 84$ (2)

Solve (1), (2), $d = 3$ M1 (reasonable attempt to solve equations)

$a = -\frac{3}{2}$ A1 (both) C.A.O.

(ii) 50^{th} term $= -\frac{3}{2} + (n-1)3$ $(n = 50)$ M1 (correct)

$= 145{\cdot}5$ A1 (F.T. derived values)

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5. *(a)* $ar = 9\,ar^3$ M1 ($ar = kar^3$, $k = 9, \frac{1}{9}$)

A1 (correct)

$1 = 9r^2$ A1 (F.T. value of k)

$r = \pm\,\frac{1}{3}$ A1 (F.T. value of k, $r = \pm\,3$)

(b) $\dfrac{a}{1-\frac{1}{3}} = 12$ M1 (use of correct formula)

$a = 8$ A1 (F.T. derived r)

Third term $= 8 \times \left(\dfrac{1}{3}\right)^2 = \dfrac{8}{9}$ (F.T. r) Al

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6. $3x^{\frac{4}{3}} + \dfrac{3}{2}x^{-2} + 5x(+C)$ B1, B1, B1

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7. *(a)* $7 + 2x - x^2 = x + 1$ M1 (equating *ys*)

$x^2 - x - 6 = 0$ M1 (correct attempt to solve quad)

$(x - 3)(x + 2) = 0$

$x = 3, -2$ A1

B (3, 4) A1

(b) Area $= \displaystyle\int_0^3 (7 + 2x - x^2)dx$ M1 (use of integration to find areas)

$\quad - \displaystyle\int_0^3 (x + 1)dx$ m1

$= \displaystyle\int_0^3 (6 + x - x^2)dx$ B1 (simplified)

$= \left[6x + \dfrac{x^2}{2} - \dfrac{x^3}{3}\right]_0^3$ B3 (3 correct integrations)

$= 18 + \dfrac{9}{2} - 9 - (0 + 0 - 0)$ M1 (use of limits)

$= \dfrac{27}{2}$ A1 (C.A.O.)

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8. *(a)* Let $\log_a x = p$ B1 (props of logs)

$\therefore x = a^p$

$x^n = (a^p)^n = a^{pn}$ B1 (laws of indices)

$\log_a x^n = pn = n \log_a x$ B1 (convincing)

(b) $\ln 5^{3x+1} = ln6$ M1 (taking logs)

$(3x + 1)\, ln\, 5 = ln6$ A1 (correct)

$3x\, ln\, 5 = ln\, 6 - ln\, 5$

$\therefore x = \dfrac{ln6 - ln5}{3ln5}$ (o.e.) m1 (reasonable attempt to isolate x)

$\approx 0{\cdot}0378$ A1 (C.A.O.)

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9. *(a)* Centre $(-1, 4)$ B1

Radius $= \sqrt{1^2 + 4^2 - 8} = 3$ B1 (use of formula or std form)

B1 (answer)

(b)

$DP^2 = 29$ (o.e.) B1 (F.T. coords of centre)

$PT^2 = DP^2 - (\text{radius})^2$ M1 (use of Pythagoras)

$= 29 - 9$

$= 20$

$PT = \sqrt{20}$ A1 (convincing)

(c) Equation of circle is M1 (use of $x^2 + y^2 + 2gx + 2fy + c = 0$ or $(x - 4)^2 + (y - 6)^2$ = any +ve no)

$(x - 4)^2 + (y - 6)^2 = 20$

or $x^2 + y^2 - 8x - 12y + 32 = 0$ A1 (either)

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10. *(a)* $x = 2 \times 4 + 4\theta = 8 + 4\theta$ B1

$A = \dfrac{1}{2} \times 4^2\theta = 8\theta$ B1

$8 + 4\theta = 3 \times 8\theta$ B1 (correct equation)

$20\theta = 8,\ \theta = 0{\cdot}4$ B1 (convincing)

(b) Area $= \dfrac{1}{2} \times 4^2 \times 0{\cdot}4 - \dfrac{1}{2} \times 4^2 \times \sin 0{\cdot}4$ B1 (sector)

B1 (Δ)

M1 (sector $- \Delta$)

$\approx 0{\cdot}085$ A1 (C.A.O.)

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