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1. a) $C(1,1)$ B1 B1

$r = \sqrt{10}$ B1

b) ATTEMPTS GRAD CP eg $\frac{2-1}{4-1} = \frac{1}{3}$ M1

IMPLIES GRADIENT NEEDED IS "-3" M1 ft

$y - 2 = "-3"(x-4)$ M1

SIMPLIFIES TO CORRECT ANSWER A1

$y = 14 - 3x$

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2. $4x - x^2$ B1

$(a^2 - a^2) - (2a - 4)$ M1

$4 - 2a = -5$ A1

$a = \frac{9}{2}$ A1 c.a.o

---

3. $\left(\frac{dy}{dx} =\right) 4x^3 - 6x^2$ B1

$\left(\frac{d^2y}{dx^2} =\right) = 12x^2 - 12x$ B1

"$4x^3 - 6x^2$" $= 0$ B1

$2x^2(2x - 3)$ M1

SIGHT OF 0 & $\frac{3}{2}$ BOTH, $(0,1)$ & $\left(\frac{3}{2}, \frac{-11}{16}\right)$ IMPLIED (MUST BE CO-ORDINATES OR PAIRING STRONGLY) A1 A1

CHECKS $x = \frac{3}{2}$ WITH $\frac{d^2y}{dx^2}$, OBTAINS -9 & STATES MIN M1

CHECKS $x = 0$ WITH $\frac{d^2y}{dx^2}$, OBTAINS 0 & FINDS $\frac{d^3y}{dx^3} = 24x - 12$ M1

OBTAINS $\left.\frac{d^3y}{dx^3}\right|_{x=0} = -12 \neq 0$ & STATES POINT OF INFLEXION A1

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4. $48 = 60\theta$ M1

$\theta = 0.8$ o.e A1

$\frac{1}{2} \times 60^2 \times "0.8"$ M1

1440 A1

$\frac{1}{2} \times 24 \times 24 \times \sin(0.8)"$ M1

206.60... A1

FINAL ANSWER A.W.R.T 1233 A1

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5. a) 0.8 B1

$5000 \times 0.8^4 = 2048$ M1 "CENTRAL STRUCTURE"

MA1 ALL CORRECT + ANSWER

b) $\frac{5000(1-0.8^{24})}{1-0.8}$ M1

24881 OR 24882 A1

c) 1000×1.05^{23} M1

3071 OR 3072 A1

d) $1000 \times 1.05^{k-1} > 5000 \times 0.8^{k-1}$ B1

$1.05^{k-1} > 5 \times 0.8^{k-1}$

$\frac{1.05^{k-1}}{0.8^{k-1}}$ OR $\left(\frac{1.05}{0.8}\right)^{k-1} > 5$ & THEN ANSWER } ALL M1

e) USE OF LOGS $\log\left(\frac{21}{16}\right)^{k-1} > \log 5$ M1

$(k-1)\log\left(\frac{21}{16}\right)$ MUST USE BRACKET IN $(k-1)$ M1

$k-1 > \frac{\log 5}{\log\left(\frac{21}{16}\right)}$ OR 5.9... M1

$k = 7$ C.A.O A1

IN PART (e)
ALLOW USE OF (=)
BUT NOT IN PART (d)

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6. Use of $\tan x = \frac{\sin x}{\cos x}$ B1

$a\sin x + b\sin x\cos x = 0$ o.e M1

$\sin x(a + b\cos x)$ M1

$\sin x = 0$ B1

$\cos x = \frac{1}{2}$ M1

$0, 180, 60, 300$ A2 −1 eeoo (ignore extras)

---

7. a)

$100 = A \times b^0$ or $A = 100$ B1

$740 = "100" \times b^{21}$ Allow b^{20} M1

$b^{21} = 7.4$ (or $b^{20} = 7.4$) M1

$b = 1.0999..$ before 1.10 A1

b)

$"100" \times 1.10^t > 10000$ M1 ft

$1.10^t > \frac{10000}{"100"}$ M1 ft

Use of logs correctly B1

48.33... A1 ft from their "10."

2018 or 2019 A1

Allow use of = instead of <
Do not allow trial & improvement
Allow use of n instead t, or n−1, t−1

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8. $k^3 - 9k^2 + 24k - 20 = -4$ o.e) M1

$k^3 - 9k^2 + 24 - 16 = 0$

ATTEMPTS TO FIND A FACTOR

e.g SUBS $k = \pm 1, \pm 2, \pm 4, \pm 8, \pm 16$) M1

STATES $(k-1)$ OR $(k-4)$ IS A FACTOR A1

$(k-1)(k^2 - 8k + 16)$ OR $(k-4)(k^2 - 5k + 4)$ M1

$(k-1)(k-4)^2$ M1

$k = < 1, 4$ A1 BOTH

---

9 A : $\pi - x_0$ B1

D : $\pi + x_0$ B1

E : $3\pi - x_0$ B1

---

10 $1 + 7bx + 21bx^2 + \ldots$ M1, M1

MULTIPLIES OUT TO

$2 + 14bx + 42bx^2 + ax + 7abx^2$ M1 (allow one error)

$a + 14b = -41$ M1

$42b^2 + 7ab = 357$ M1

SENSIBLE ATTEMPT TO SOLVE BY SUBSTITUTION M1

$8b^2 + 41b + 51$ A1

$(b+3)(8b+17)$ M1

$b = -3$ ONLY A1

$a = 1$ A1