1. a) $10\times 2^3 - 21\times 2^2 - 2$ or $80-84-2$ M1

-6 c.a.o A1

b) LONG DIVIDES $10x^3-21x^2-x+6$ BY $x-2$) M1

OR $(x-2)(10x^2+Ax-3)$

$(x-2)(10x^2-x-3)$ MA1

$(x-2)(5x-3)(2x+1)$ A1

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2. $\frac{1}{2}r^2\theta = 15$ B1

$2r + r\theta = 23$ B1

SENSIBLE ATTEMPT OF SOLUTION OF ABOVE EQUATIONS M1

$2r^2 - 23r + 30$ OR $30\theta^2 - 409\theta + 120$ A1

FACTORIZATION, QUADRATIC FORMULA, OR COMPLETING THE SQUARE M1

$r = \begin{cases} 10 \\ \frac{3}{2} \end{cases}$ OR $\theta = \begin{cases} 0.3 \\ \frac{40}{3} \end{cases}$ A1 (EITHER PAIR)

CONCLUDES CLEARLY $r=10$ $\theta=0.3$ WITH JUSTIFICATION A1 c.a.o

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3. IMPLIES A GRADIENT OF 1 IS NEEDED M1

$y = x-11$ o.e MA1

$(x-3)^2 + (y+8)^2 = 100$) M1 STRUCTURE
M1 ALL CORRECT

SOLVES SIMULTANEOUSLY M1

$(x-3)^2 + (x-3)^2 = 100$ or $2x^2 - 12x - 82 = 0$ o.e MA1

QUADRATIC FORMULA OR COMPLETES THE SQUARE M1

$x = 3 \pm \sqrt{50}$ OR $x = 3 \pm 5\sqrt{2}$ c.a.o A1

4. a) $1+\sqrt{3} = 1 + 2\sin p$ OR $\sin p = \frac{\sqrt{3}}{2}$ M1

$p = 60$ c.a.o A1

$0 = 1 + 2\sin(50q + "60")$ OR $\sin(50q + "60") = -\frac{1}{2}$ M1 ft

SIGHT OF -30 & 210 (BOTH)
OR -90 & 150 (BOTH) } MA1

$q = 3$ c.a.o A1 dep

b) $0 = 1 + 2\sin("3x" + "60")$ (ALLOW $q=3$ EVEN IF GUESSED) M1 ft

o.e

SIGHT OF BOTH -30 & 210
OR BOTH -90 & 150 } MA1

CAN BE EARNED TWICE IN EACH PART IF THE PREVIOUS M1 APPEARED IN EACH PART & THIS FOLLOWS

D(90, 0) A1

B(10, 3) B1 B1

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5. $1 + 6y + 15y^2 + 20y^3$ o.e e.g. y MAY BE A FUNCTION OF x MA3

$1 + 6x - 6x^2 + 15x^2 - 30x^3 + 20x^3$ dep M1 (AT LEAST 3 OUT 5 SEEN)

$1 + 6x + 9x^2 - 10x^3$ MA3

OR $A = 6$ $B = 9$ $C = -10$

6. a) $20 \times 2^{-0.2 \times 10}$ M1

$m = 5$ A1

b) $\frac{m_0}{64} = m_0 \times 2^{-0.2T}$ o.e M1

$\log\left(\frac{1}{64}\right) = \log\left(2^{-0.2T}\right)$ o.e use of logs) or $2^{-6} = 2^{-0.2T}$) or $2^6 = 02^{\cdot 2T}$ M1

$T = 30$ c.a.o A1

c) sight of $m_0 \times 2^{-0.2t} < \frac{1}{100} m_0$ o.e B1

(Allow equal instead of <)

use of logs (correct) M1

$N = 34$ c.a.o A1

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7. $\frac{a(1-r^2)}{1-r} = 40$ or $a + ar = 40$ o.e B1

$\frac{a(1-r^4)}{1-r} = 130$ or $a + ar + ar^2 + ar^3 = 130$ o.e B1

Attempts solution (no bad errors) M1

$4r^4 - 13r^2 + 9 = 0$ or $40(1 + r^2) = 130$ o.e MA1

$r^2 = \frac{9}{4}$ A1

$r = \pm \frac{3}{2}$ (Ignore extras) A1

$a = 16$ or -80 MA1

211 A1

-275 A1

8. $\int 12x^2 - 12x + 6 \, dx$ B1

$y = 4x^3 - 6x^2 + 6x + C$ MA2 −1 eeoo −1 IF NO $y = \ldots$

$\int_0^2$ " $4x^3 - 6x^2 + 6x + C$ " $(= 22)$ M1 INTEGRAL M1 LIMITS

$[x^4 - 2x^3 + 3x^2 + Cx]_0^2 \ (= 22)$ M1 1st three terms M1 Cx

$[\ldots\ldots]_0^2 - [\ldots\ldots]_0 \ (= 22)$ M1

$2C + 12 = 22$ A1

$C = 5$ OR $y = 4x^3 - 6x^2 + 6x + 5$ A1

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9. a) SUBS $y = 54 - 3x$ INTO $\dfrac{(54x + 6y - xy - 324)}{3x} =$

$54x + 324 - 18x - 54x + 3x^2 - 324$ OR $3x^2 - 18x$ SEEN

SIMPLIFIES CORRECTLY & CONVINCINGLY TO $3x^3 - 36x + 108x$

b) $\dfrac{dP}{dx} = 108 - 72x + 9x^2$ MA1

SOLVES FOR ZERO M1

OBTAINS $x = 2$ & $x = 6$ (BOTH) A1

$\dfrac{d^2P}{dx^2} = -72 + 18x^2$, SUB $x = 2$ OBTAINS $36 < 0$ + COMMENT M1 MA1

SIGHT OF $108 \times 2 - 36 \times 2^2 + 3 \times 2^3$ OR $216 - 144 + 24$
$= 96$ $= 96$ A1

c) SIGHT OF $x = 18$ OR 7776 B1

MENTION OF "TRUE" MAXIMUM & "LOCAL MAXIMUM" A1