PURE 23 LINEARISING

SECTION 1

1) a) 3 b) $y = 3 + e^{-1}$ c) $7 = 3 + e^{2x-1}$

$\Rightarrow 2x - 1 = \ln(4)$

$x = \frac{1}{2} + \ln 2$

2) a) e^{15} b) $-6 + 2e^{2.5}$ c) $\ln(0.7)$ d) $\frac{1}{4}(\ln(12) - 1)$

e) $2e^{2x} - 11e^{x} + 12 = 0$

$(2e^{x} - 3)(e^{x} - 4) = 0$

$x = \ln(3/2)$ or $x = \ln(4)$

f) $\ln\left(\frac{3x^2 - 10x + 8}{x^2 - 5x + 6}\right) = \ln(2x)$

$\Rightarrow 3x^2 - 10x + 8 = 2x(x^2 - 5x + 6)$

$\Rightarrow 2x^3 - 13x^2 + 22x - 8 = 0$

$(x - 2)(2x^2 - 9x + 4) = 0$

$(x - 2)(2x - 1)(x - 4) = 0$

$x = 2$ $x = 1/2$ $x = 4$

SECTION 2

1) a) $\log P = \log(Ac^t) = \log A + \log(c^t)$

$\Rightarrow \log P = \log A + t \log c$ ✓

$y = c + xm$ straight line ✓

b) $m = 0.0128 = \log c \Rightarrow c = 10^{0.0128} = 1.03$ ✓

$\log A = 1.97$ ✓ $\Rightarrow A = 10^{1.97}$ ✓ $= 93.3$ ✓ (million)

c) $P = 93.3 \times (1.03)^t$ so 3% growth ✓

d) growth will not stay at 3% for all values of t.

2) a) gradient $= 4/8 = \frac{1}{2}$ ✓

b) $\log V = n \log r + \log a$ ← intercept y AXIS $= 1.5$

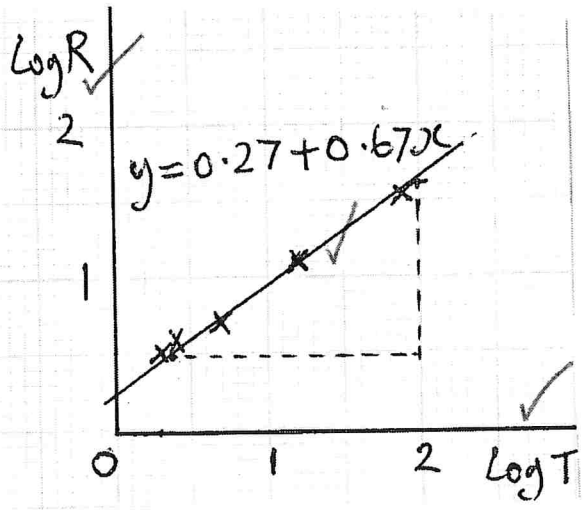
c) $a = 10^{1.5} = 31.6$ ✓ $n = \frac{1}{2}$ (gradient $= n$)

d) $V = 31.6 \times (100)^{\frac{1}{2}} = \underline{316}$ ✓

3) a) $\log(R) = \log(k) + \log(T^n) = \log(k) + n\log(T)$

b)

$\log R$	0.46	0.58	0.72	1.09	1.55
$\log T$	0.28	0.43	0.73	1.20	1.90



c) $m = 0.67 = n$

$\log(k) = 0.27$

$k = 1.86$

d) $R = 1.86\,T^{0.67}$

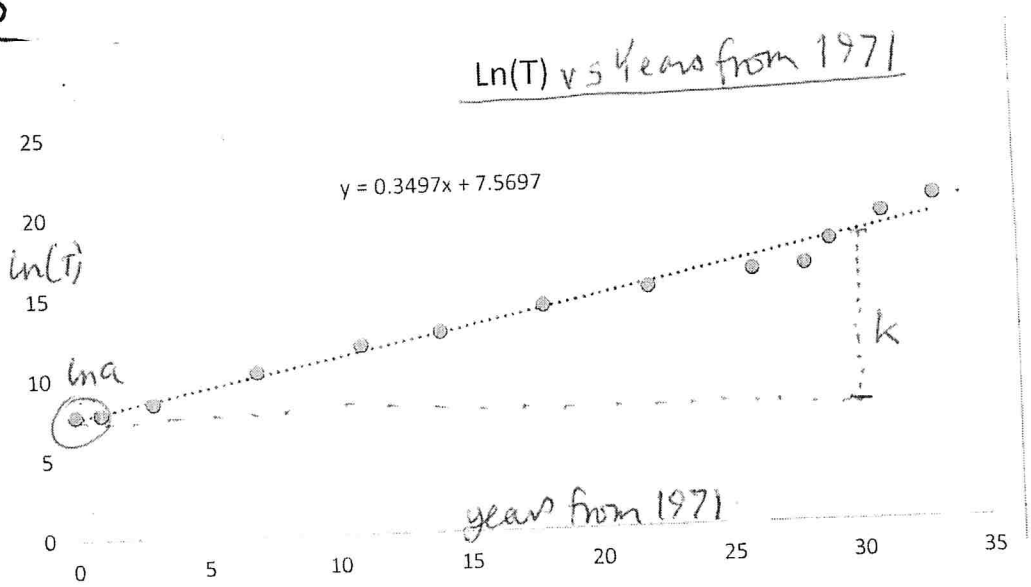
$R = 1.4$

$\Rightarrow 1.4 = 1.86\,T^{0.67}$

$\Rightarrow T = \log(0.752\ldots)/\log(0.67) = \underline{0.71 \text{ days}}$

SECTION 3

Date	x	Transistors (T)	Ln(T)
1971	0	2,300	7.74
1972	1	2,500	7.82
1974	3	4,500	8.41
1978	7	29,000	10.3
1982	11	134,000	11.8
1985	14	275,000	12.5
1989	18	1,200,000	14
1993	22	3,100,000	15
1997	26	7,500,000	15.8
1999	28	9,500,000	16.1
2000	29	42,000,000	17.6
2002	31	220,000,000	19.2
2004	33	592,000,000	20.2



$T = ae^{kt} \Rightarrow \ln T = \ln a + kt \quad \Rightarrow \ln a = 7.5697$

$y = c + mx \qquad a = 1939$

$k = m = \underline{0.3497} \qquad \text{so } T = 1939\,e^{0.3497t}$

when $t = 39 \Rightarrow T = 1939\,e^{0.3497 \times 39} = 1{,}600{,}000{,}000$ APPROX