

(2) $\frac{dP}{dt} = -2P \rightarrow \int \frac{dP}{P} = \int -2dt$

$P(0) = 1$

$\ln|P| = -2t + c$

$(0, 1) \rightarrow \ln|1| = 0 + c$
 $0 = 0 + c$
 $0 = c$

$P = e^{-2t}$

$\ln|P| = -2t$
 $P = e^{-2t}$

(4) $\frac{dL}{dp} = \frac{L}{2} \rightarrow \int \frac{dL}{L} = \int 2dp$

$L(0) = 100$

$\ln|L| = 2t + c$

$(0, 100) \rightarrow \ln|100| = 0 + c$
 $\ln|100| = c$

$\ln|L| = 2t + \ln|100|$
 $L = e^{2t + \ln|100|}$

$L = e^{\ln|100|} \cdot e^{2t}$
 $L = 100 \cdot e^{2t}$

$L = 100e^{2t}$

(12) $\frac{dz}{dy} = zy \rightarrow \int \frac{dz}{z} = \int y dy$

$(y, z) = (0, 1)$

$\ln|z| = \frac{1}{2}y^2 + c$

$(0, 1) \rightarrow \ln|1| = 0 + c$
 $c = 0$

$z = e^{\frac{y^2}{2}}$

$\ln|z| = \frac{1}{2}y^2$
 $z = e^{\frac{1}{2}y^2}$

(14) $\frac{dy}{dt} = \frac{1}{2}(y-200) \rightarrow \int \frac{dy}{y-200} = \int \frac{1}{2} dt$

$(t, y) = (0, 50)$

$\ln|y-200| = \frac{1}{2}t + c$

$(0, 50) \rightarrow \ln|-150| = 0 + c$
 $c = \ln(150)$

$\ln|y-200| = \frac{1}{2}t + \ln(150)$

$y-200 = e^{\frac{1}{2}t + \ln(150)}$

$y = 150e^{\frac{t}{2}} + 200$

$y = 150e^{\frac{t}{2}} + 200$

16) $\frac{dy}{dx} = 2y - 4 = 2(y-2) \rightarrow \int \frac{dy}{y-2} = \int 2 dx$
 (2,5)

$\ln|y-2| = 2t + c \Big|_{(2,5)} \rightarrow \ln|3| = 4 + c$
 $\ln|y-2| = 2t + (\ln|3| - 4)$
 $y-2 = e^{2t + \ln|3| - 4}$
 $y-2 = \left(\frac{3}{e^4}\right) e^{2t}$
 $y = \frac{3}{e^4} e^{2t} + 2$ or $y = 3e^{2t-4} + 2$

$y = 3e^{2t-4} + 2$

18) $\frac{dm}{dt} = \frac{1}{10}m + 200 = \frac{1}{10}(m+2000) \rightarrow \int \frac{dm}{m+2000} = \int \frac{dt}{10}$
 (t,m) = (0,1000)

$\ln|m+2000| = \frac{1}{10}t + c \Big|_{(0,1000)} \rightarrow \ln(1200) = 0 + c$
 $\ln|m+2000| = \frac{1}{10}t + \ln|1200|$
 $m+2000 = e^{\frac{1}{10}t + \ln|1200|}$
 $m+2000 = 1200 e^{\frac{t}{10}}$
 $m = 1200 e^{\frac{t}{10}} - 2000$

$m = 1200 e^{\frac{t}{10}} - 2000$

20) $\frac{dB}{dt} + 2B = 50$
 $\frac{dB}{dt} = -2(B-25) \rightarrow \int \frac{dB}{B-25} = \int -2 dt$

$B(1) = 100 \rightarrow (1,100)$
 $\ln|B-25| = -2t + c \Big|_{(1,100)} \rightarrow \ln|75| = -2 + c$
 $c = -2 - \ln|75|$
 $\ln|B-25| = -2t - 2 - \ln|75|$
 $B-25 = e^{-2t-2-\ln|75|}$
 $B-25 = \left(\frac{1}{75}\right) e^{-2t-2}$
 $B = \frac{1}{75} e^{-2t-2} + 25$

21) $\frac{dy}{dt} = \frac{y}{3+t} \rightarrow \frac{dy}{y} = \frac{dt}{3+t}$
 $y(0) = 1 \rightarrow (0,1)$

$\ln|y| = \ln|t+3| + c \Big|_{(0,1)} \rightarrow 0 = \ln|3| + c$
 $c = -\ln|3|$

$\ln|y| = \ln|t+3| - \ln|3|$
 $y = e^{\ln|t+3| - \ln|3|}$
 $y = e^{\ln|t+3|} \cdot e^{-\ln|3|}$
 $y = \frac{1}{3}(t+3)$