5.2.1.

$p = 144 - q^2$ $\quad 1000 \div -\frac{1}{9} = 111$.

$\frac{dp}{dt} = -2q \cdot \frac{dq}{dt}$

$2 = -2 \cdot 9 \cdot \frac{dq}{dt}$

$\frac{2}{18} = \frac{dq}{dt}$

$\frac{dq}{dt} = -\frac{1}{9}$

∴ the 111 unit per weeks.

5.2.2.

$\frac{dq}{dt}$ $\quad 100q^2 + qp^2 = 3600$. $\quad p = 14$ $\quad \frac{dp}{dt} = -0.15$.

$100q^2 + q(14)^2 = 3600$

$q = 4.29$.

$qp^2 = 3600 - 100q^2$

$18p \cdot \frac{dp}{dt} = -200q \cdot \frac{dq}{dt}$

$18 \cdot 14 \cdot -0.15 = -200 \cdot 4.29 \cdot \frac{dq}{dt}$

$-37.8 = -858 \frac{dq}{dt}$

$\frac{dq}{dt} \approx 0.044$.

$1000 \times 0.044 = 44$ unit/per week.

5.2.3.

$625p^2 - q^2 = 100$. $\quad \frac{dq}{dt} = -1$ $\quad q = 28$ $\quad \frac{dp}{dt}$?

$625p^2 - 28^2 = 100$

$p \approx 1.077$

$625p^2 - q^2 - 100 = 0$

$625p^2 - 100 = q^2$

$1250 \cdot p \cdot \frac{dp}{dt} = 2q \cdot \frac{dq}{dt}$

$1250 \cdot 1.077 \cdot \frac{dp}{dt} = 56 \cdot -1$

$\frac{dp}{dt} = -0.0397$

∴ It will decrease to 0.0397.

5.2.4.

$p = -0.01q^2 - 0.1q + 6$ $\quad q = 10$.

$E_{dp} = -\frac{p'(q)}{p(q)}$

$= \frac{-pq'}{q}$

$\frac{d}{dp}p = \frac{d}{dp}(-0.01q^2 - 0.1q + 6)$

$1 = -0.02q \cdot q' - 0.1q'$

$1 = -0.02q - 0.1)q'$

$q' = \frac{1}{-0.02q - 0.1}$

$= \frac{-(-0.01q^2 - 0.1q + 6)\left(\frac{1}{-0.02q - 0.1}\right)}{q}$

$= \frac{-4\left(-\frac{10}{3}\right)}{10}$

$= \frac{4}{3}$

∴ It is elastic

T.2.7.

$1L = 0.001m^3$

$\frac{dV}{dt} = \frac{3}{1000}$

$V = \pi(r)^2 h$ $\quad \frac{dh}{dt} = ?$

$\frac{dV}{dt} = \pi \frac{dh}{dt}$

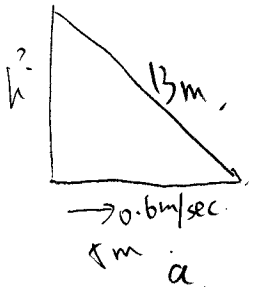
$-\frac{3}{1000} = \pi \frac{dh}{dt}$

$= \frac{dh}{dt}$

$= 0.00096$

∴ the decrease of the rate is 0.00096.

T.2.8



$13^2 - 5^2 = 12^2$

$h = 12$

$h^2 + a^2 = 13^2$

$2h\frac{dh}{dt} + 2a\frac{da}{dt} = 0$

$2 \cdot 12\frac{dh}{dt} + 2 \cdot 5 \cdot 0.6 = 0$

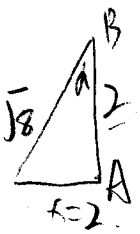
$24\frac{dh}{dt} = -6$

$\frac{dh}{dt} = -\frac{1}{4}$

$= -0.25$

∴ the ladder moving down at the rate is -0.25.

T.2.10.



$\frac{d\alpha}{dt} = 2\pi(2\pi)$

$= 20\pi$ rad/min.

$\tan\alpha = \frac{x}{2}$

$\frac{d\alpha}{dt}\sec^2\alpha = \frac{1}{2}\frac{dx}{dt}$

$20\pi \cdot 2 \quad \frac{1}{2}\frac{dx}{dt}$

$80\pi = \frac{dx}{dt}$

$\sec^2\alpha$

$\sec x = \frac{1}{\cos} = \sqrt{2}$

$\sec^2 x = 2$