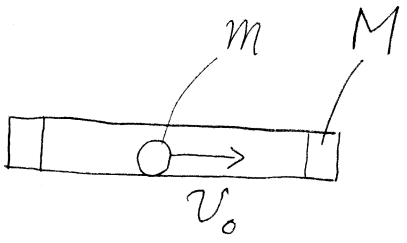
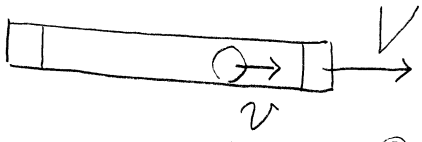
13

(1)





$$mv_0 = mv + MV \quad \cdots ①$$

$$e = -\frac{v - V}{v_0} \quad \cdots ②$$

②より $ev_0 = -v + V \quad \cdots ②'$

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①＋②′×m　$(1+e)mv_0 = (M+m)V$　$V = \dfrac{(1+e)m}{M+m}v_0$

リング

①−②′×M　$(m-eM)v_0 = (m+M)v$　$v = \dfrac{m-eM}{m+M}v_0$

質点

質点が受ける力積 $= mv - mv_0$

$$= \left(\frac{m-eM}{m+M} - 1\right)mv_0$$

$$= \frac{-eM-M}{m+M}mv_0$$

$$= -\frac{(e+1)Mm}{m+M}v_0$$

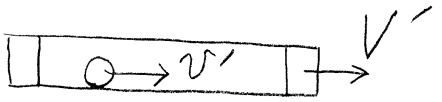
(2)　$\dfrac{a}{v_0} + \dfrac{2a}{V-v}$　　$V-v$は②式からev_0

$$= \frac{a}{v_0} + \frac{2a}{ev_0}$$

$$= \left(1 + \frac{2}{e}\right)\cdot\frac{a}{v_0}$$

(13−2)

(3) 2回の衝突後



$$mv + MV = mv' + MV' \quad \cdots ③$$

$$e = -\frac{v' - V'}{v - V} \quad \cdots ④$$

③は式①とあわせて,

$$mv_0 = mv' + MV' \quad \cdots ③'$$

④×②

$$e^2 = \frac{v' - V'}{v_0} \quad \cdots ④'$$

④'より

$$e^2 v_0 = v' - V' \quad \cdots ④''$$

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③'−④''×m

$$(1 - e^2) m v_0 = (M + m) V'$$

$$V' = \frac{(1 - e^2) m}{M + m} v_0$$

時間は, ④''から, $\dfrac{2a}{e^2 v_0}$

(4) $mv_0 = (m + M) V_\infty$

$$V_\infty = \frac{m}{m + M} v_0$$

リング

$$\frac{1}{2} m v_0^2 - \frac{1}{2}(m + M) \cdot \left(\frac{m}{m + M} v_0\right)^2$$

$$= \left(1 - \frac{m}{m + M}\right) \cdot \frac{1}{2} m v_0^2$$

$$= \frac{1}{2} \frac{Mm}{m + M} v_0^2$$