LAWS OF MOTION

1)

$$v = u + at$$

$$a = \frac{F}{m}$$

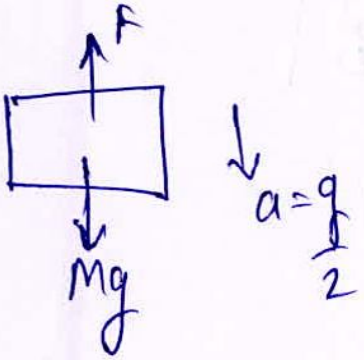
$$v = u + \left(\frac{F}{m}\right) \times t.$$

$$2 = 0 + \left(\frac{F}{5}\right) \times 2$$

$$\boxed{F = 1\ N}$$ Ans (1)

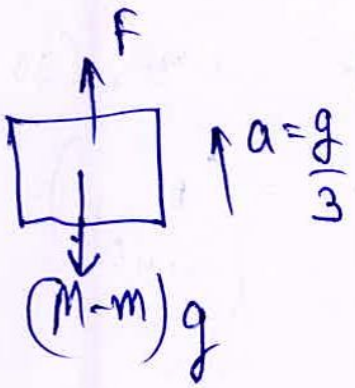
$\boxed{g = 10}$

2)



$$Mg - F = Ma = M\left(\frac{g}{2}\right)$$

$$F = \frac{Mg}{2}$$



$$F - (M-m)g = (M-m)a$$

$$(M-m)\frac{g}{3}$$

$$\rightarrow \frac{Mg}{2} - (M-m)g = (M-m)\frac{g}{3}$$

$$\rightarrow m\left(-\frac{1}{2} + 1 + \frac{1}{3}\right) = m\left(1 + \frac{1}{3}\right)$$

$$Mg = 160$$

$$M = 16$$

$$\rightarrow m = \frac{5}{8}M = \frac{5}{8} \times 16 = \boxed{10\ Kg = m}$$

Ans 2

3) Ans (3)

4) Ans (4)

5) Ans (2)

6) Ans (3)

7) Ans (3)

8) Ans (2)

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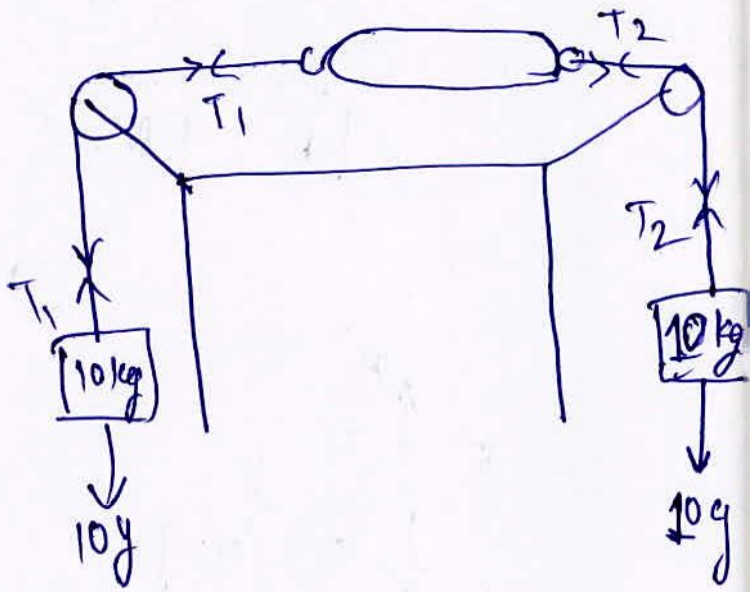
9)

$T_1 = T_2 = 10g$ ⇒

$\therefore$ reading $= 10g$

$= 10$ kg-wt.

Ans (2)



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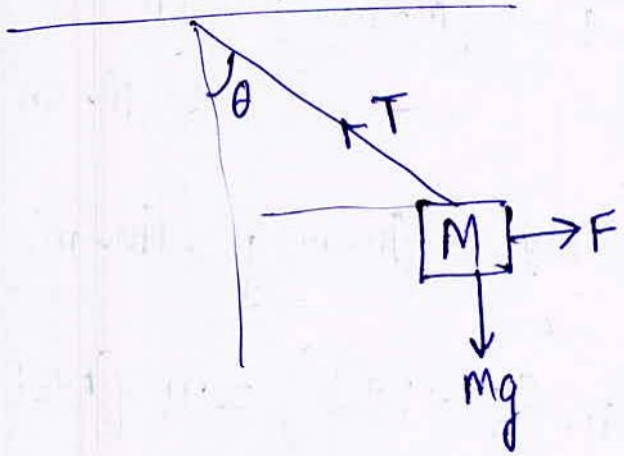
10)



$F = T \cos(90 - \theta)$

$T = \left(\frac{F}{\sin\theta}\right)$

Ans (2)

(11.)

$-1\,(4g - T = 4a)$

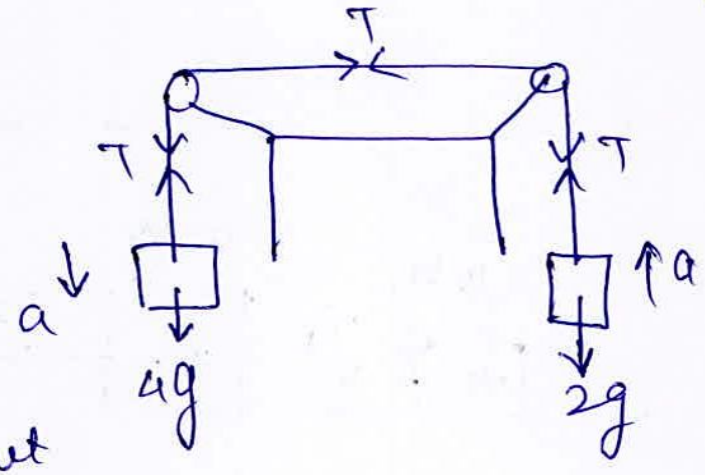
$2\,(T - 2g = 2a)$

$3T - 8g = 0$

$T = \frac{8}{3}g = 2.67$ kg-wt

Ans(1)

(2)



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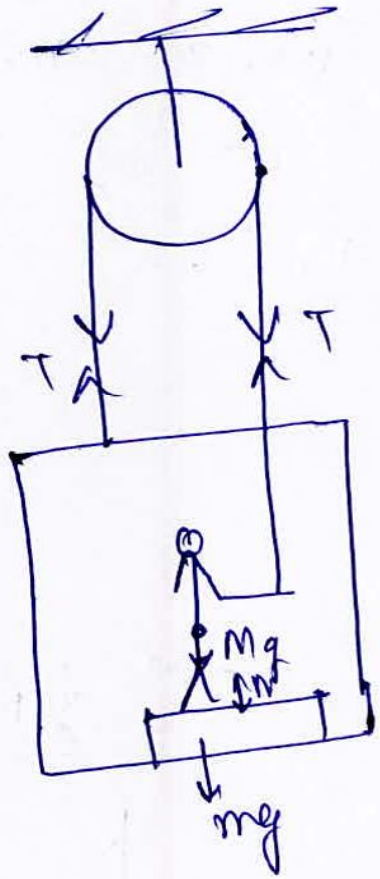
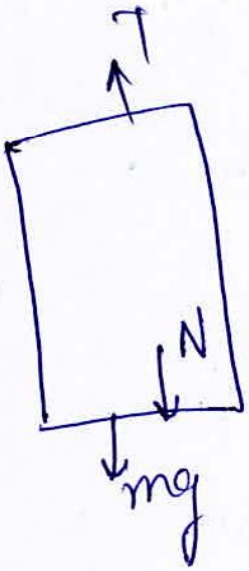
(12)



$m = 30$ $\quad M = 60$



$\rightarrow +x\,(T - N - mg = 0)$

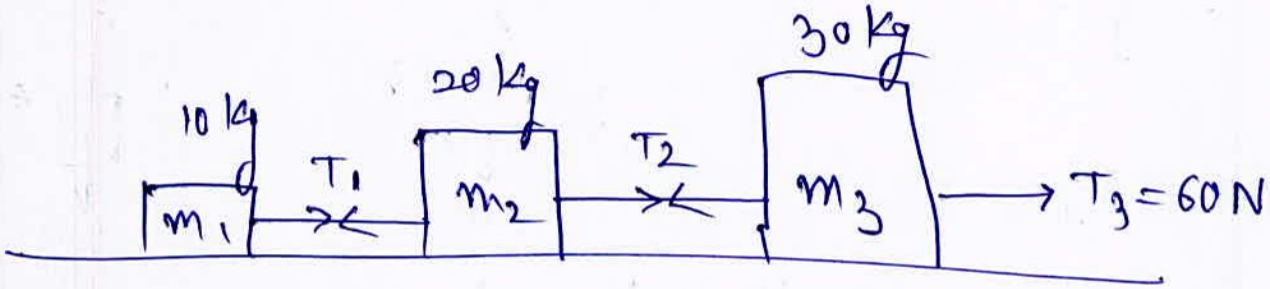
$T + N - Mg = 0$

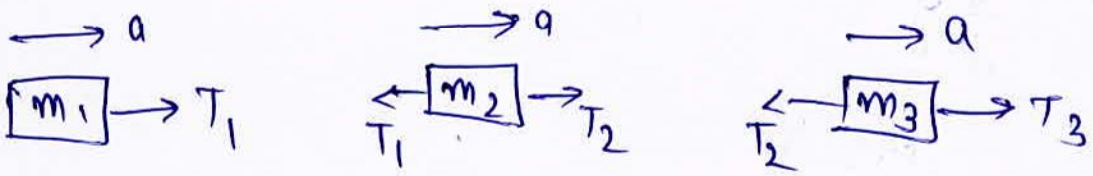
$2N = (M - m)\,g$

$N = 15g = 150\ N$

Ans(1)

(3)





$T_1 = m_1 a$.

$T_2 - T_1 = m_2 a$.

$T_3 - T_2 = m_3 a$.

$\rightarrow T_2 = (m_1 + m_2) a$

$\boxed{T_2 = 30\ N}$ Ans (3)

$T_3 = (m_1 + m_2 + m_3) a$.

$60 = 60 \times a$

$(a = 1)$.

---

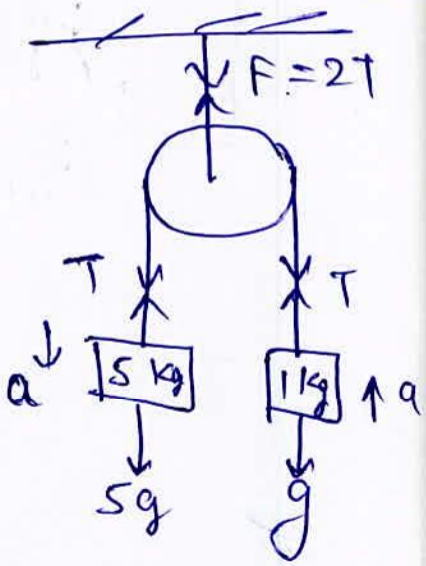
14) $-5(T - g = a)$

$5g - T = 5a$.

$-6T + 10g = 0$.

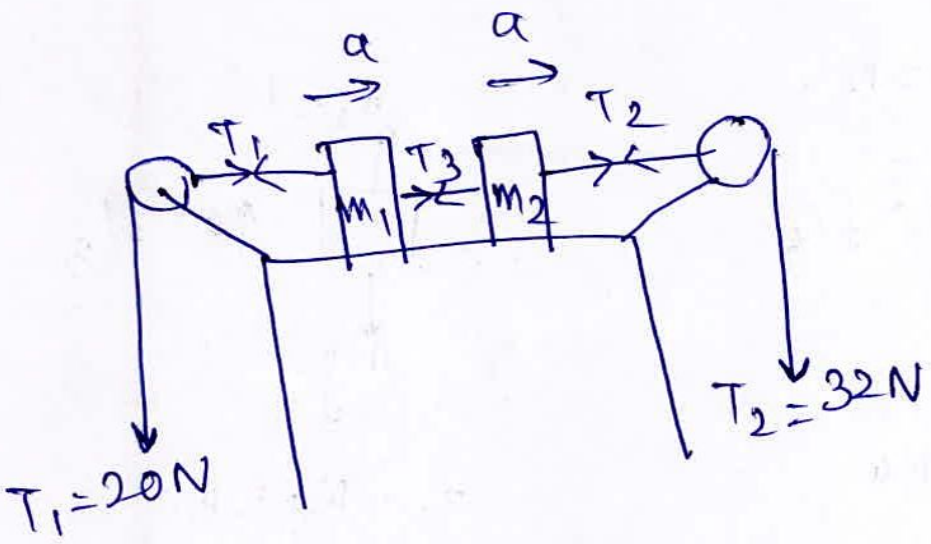
$F = 2T = \frac{10}{3} g = 3.33\ kg\ wt$.

Ans (2)



(3)

15)



$m_1 = \frac{3}{30} \times 10 = 1kg$

$m_2 = \frac{3}{30} \times 20 = 2kg$

$T_3 - T_1 = m_1 a \Rightarrow T_3 - 20 = a$.

$T_2 - T_3 = m_2 a \Rightarrow 32 - T_3 = 2a$.

$12 = 3a$

$a = 4$.

$T_3 = 24$.

Ans (3)

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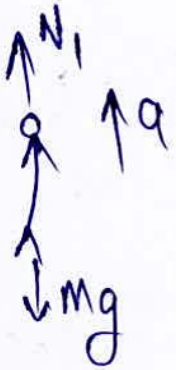
16)



$N_1 - Mg = Ma$

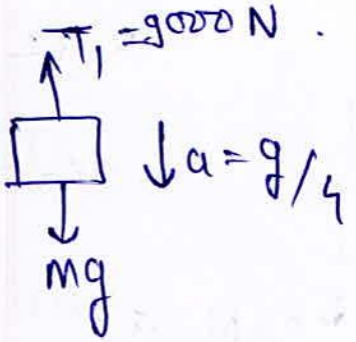
$Mg - N_2 = Ma$.

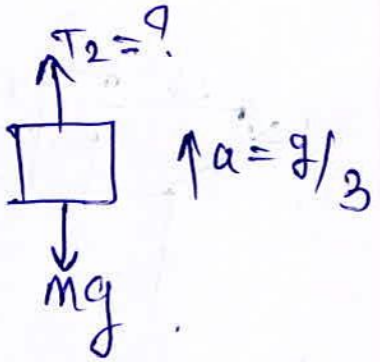
$900 - Mg = Mg - 300$

$\rightarrow 1200 = 2Mg \rightarrow$ $M = 60kg$

Ans (2)

17)





$Mg - T_1 = Ma$

$\frac{3}{4}Mg = Mg - \frac{Mg}{4} = 9000$

$Mg = 12000\ N$

$T_2 - Mg = Ma$.

$T_2 = \frac{4}{3}Mg$.

$\boxed{T_2 = 16000N}$

Ans (1)

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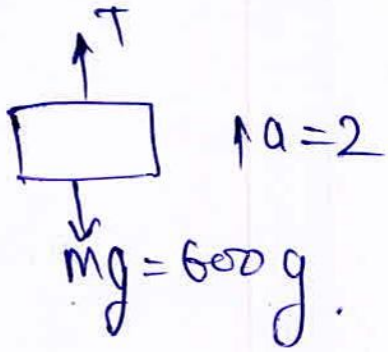
18) $T - Mg = Ma$.

$T = 600\,(9.8 + 2)$

$T = 7080\ N$

Ans (1)



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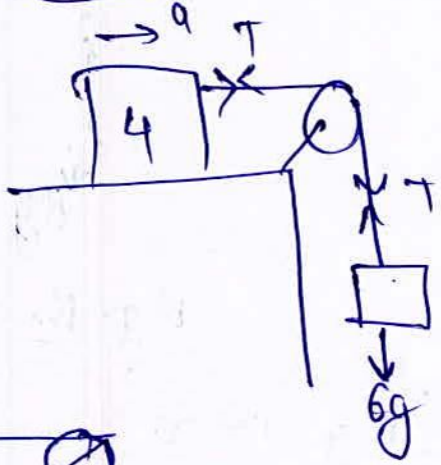
19)



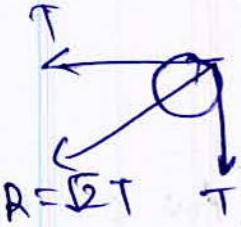
$-4(T = 4a)$

$6g - T = 6a$

$(6g - 2T = 2a)$

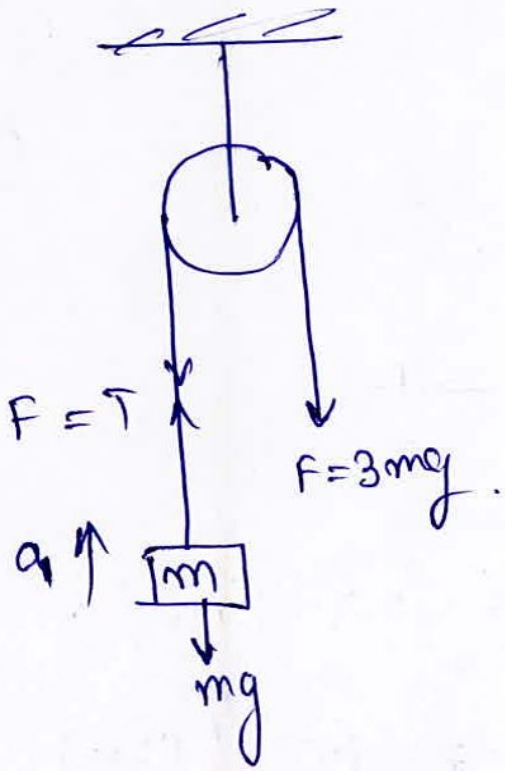
$6g - T\left(1 + \frac{6}{4}\right) = 0$

$T = \frac{6g}{2.5} = 2.4g = 24N$



$R = \sqrt{2}T = 24\sqrt{2}N = R$ Ans (2)

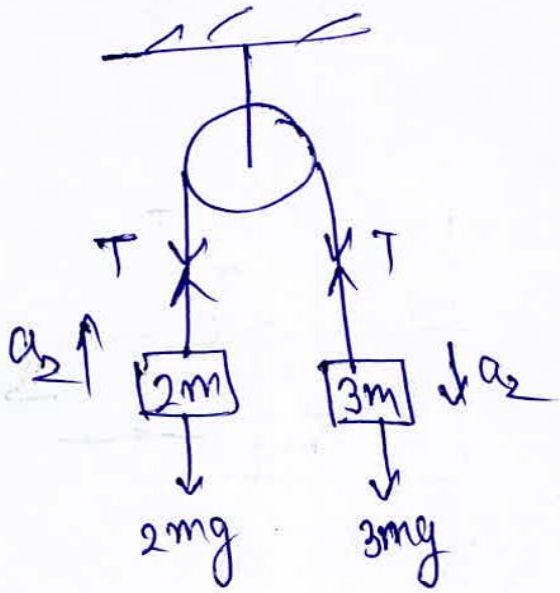
20)



$T - mg = ma_1$

$2mg = ma_1$

$a_1 = 2g$.



$3mg - T = (3m)a_2$

$T - 2mg = (2m)a_2$

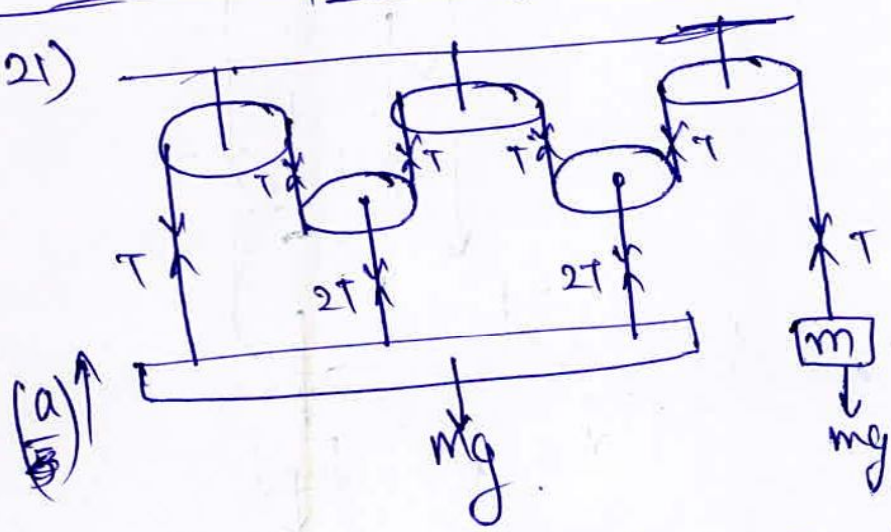
$mg = (5m)a_2$

$a_2 = g/5$.

$\frac{a_1}{a_2} = \frac{2g}{g/5} = \frac{10}{1}$

Ans (3)

21)



$5 \times (mg - T = ma \times 5)$.

$5T - Mg = M\left(\frac{a}{5}\right)$

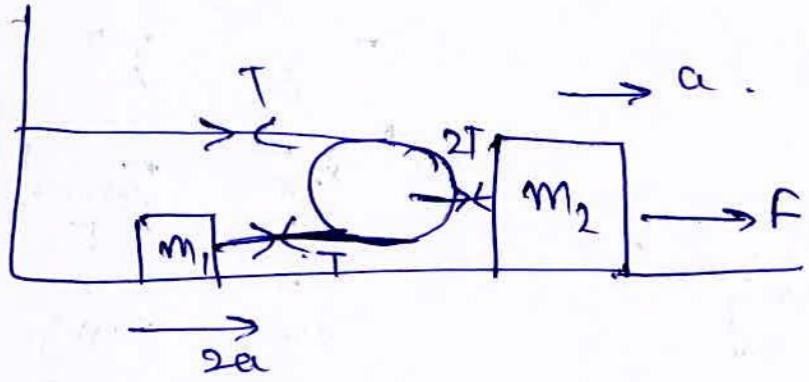
$(5m - M)g = (25m + M)a$

$a = \frac{(5m - M)g}{(25m + M)}$

$\left(\frac{a}{5}\right)(5T) = T \times (a \times 5)$

Ans (1)

22)



$F - 4m_1 a = m_2 a$ $\Leftarrow$ $F - 2T = (m_2)\, a$.

$F = (4m_1 + m_2)\, a$. $\quad T = (m_1)\,(2a)$

$$a = \frac{F}{(4m_1 + m_2)} \rightarrow \boxed{T = (m_1) \times 2 \times \frac{F}{(4m_1 + m_2)}}$$

Ans (3)

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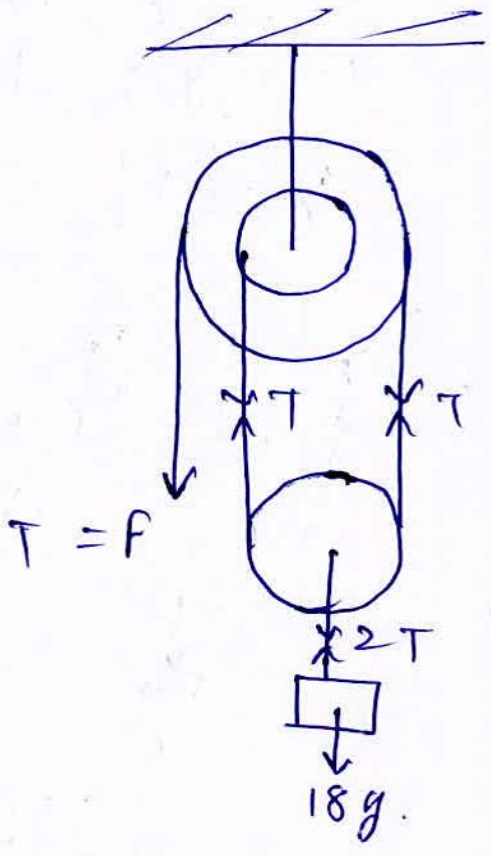
23)

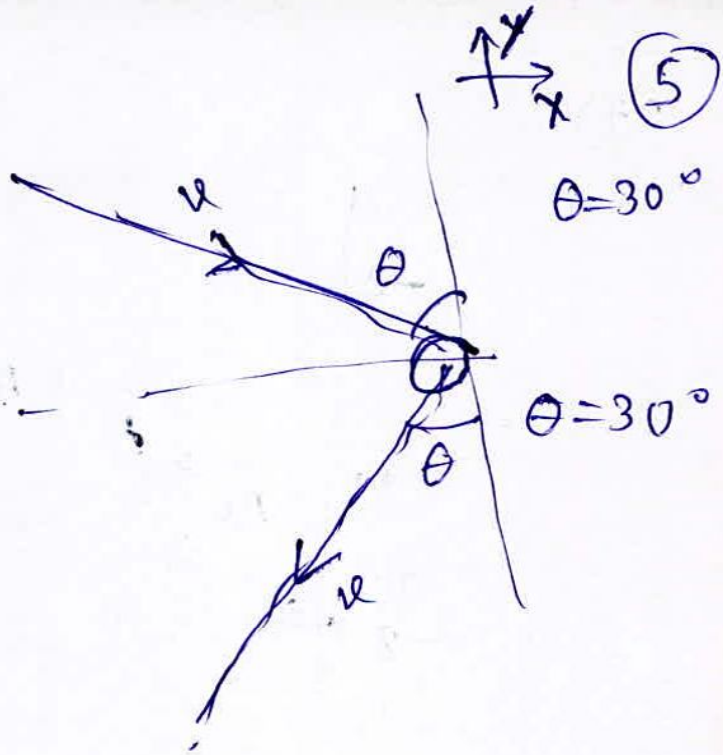
$2T = 18g$

$F = T = 9g = 90\,N$

Ans (2)



24)



$$u = (v\sin\theta)\hat{i} - (v\cos\theta)\hat{j}$$

$$v = (-v\sin\theta)\hat{i} - (v\cos\theta)\hat{j}$$

$$\Delta v = |u - v|$$

$$= 2v\sin\theta$$

$$\Delta P = m\Delta v = \frac{600}{1000} \times 2 \times 8 \times \frac{1}{2}$$

$$\boxed{\Delta P = 3\ N}$$

Ans (4)

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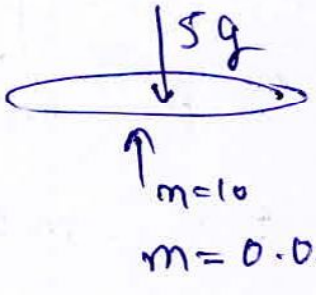
25)



$m = 0.05g$.

$$5g = n\frac{m}{t} \times \Delta v$$

$$5 \times 10 = 10 \times \frac{50}{1000} \times 2v$$

$$\boxed{v = 50\ m/s}$$

---

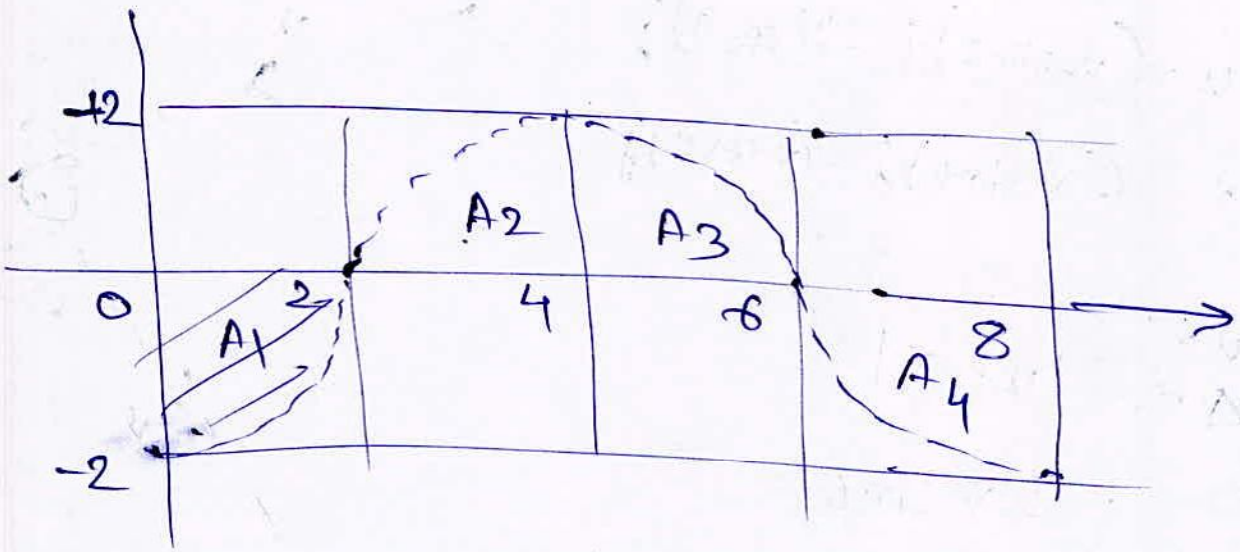
26) $P_x = mv_x = 2t^2 + 6$ | $P_y = mv_y = \frac{3t^2}{2} + 3$

$ma_x = m\frac{dv_x}{dt} = 4t$ | $ma_y = m\frac{dv_y}{dt} = 3t$

$$F = m\sqrt{a_x^2 + a_y^2} = (5t) = 10$$

Ans (3)

27)



$\Sigma A = A_1 + A_2 + A_3 + A_4$

$= \left(-\frac{\pi 2^2}{4}\right) + \left(\frac{\pi 2^2}{4}\right) + \left(\frac{\pi 2^2}{4}\right) + \left(\frac{-\pi 2^2}{4}\right)$

$\Sigma F \cdot t = 0 \text{ N.s}$ Ans (2)

28) $P = mv = at^3 + bt$

$F = ma = m\frac{dv}{dt} = 3at^2 + b$

$F \propto t^2$

Ans (1)

29) $F = m\frac{dv}{dt} = \frac{200}{1000} \times \frac{(20-0)}{0.5}$

$= 8N$

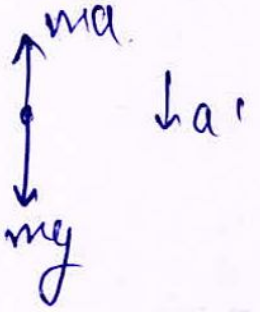
Ans (1)

30)

1) wrt observer on ground coin is freely falling.

$\therefore$ acc^n = g

2) wrt passenger in plane.



$m a' = mg - ma$

$\boxed{a' = (g - a)}$

Ans (1)

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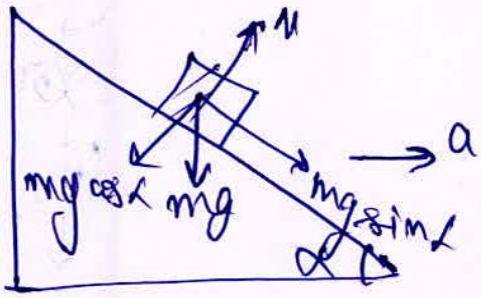
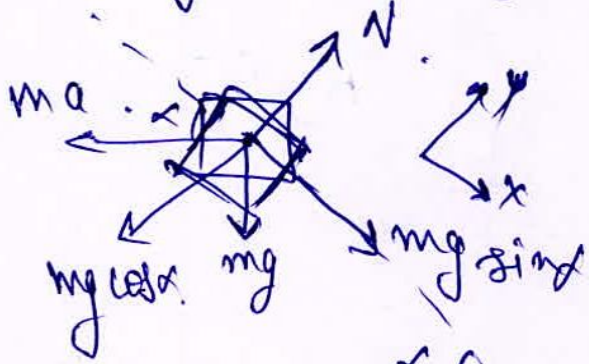
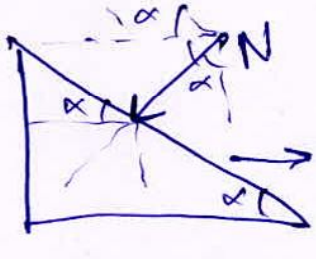
31)

$N = m(g\cos\alpha + a\sin\alpha)$







$N \sin\alpha = Ma$.

$x \rightarrow mg\sin\alpha = ma\cos\alpha$

$\boxed{a = g\,\text{Tan}\alpha}$

Ans (4)

32)

$u = 0$

$t = 1s$

$a = 1 m/s^2$

$v = u + at$

$= 0 + 1 \times 1$

$v = 1 m/s$

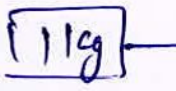
$p = m \Delta v$

$= 1 \times (1 - 0)$

$p = 1$

$u = 0$

$a = 1 m/s^2$



$s = 1 m$

$v^2 = u^2 + 2as$

$= 0 + 2 \times 1 \times 1$

$v = \sqrt{2} m/s$

$p' = m \Delta v$

$= 1 \times (\sqrt{2} - 0)$

$= \sqrt{2}$

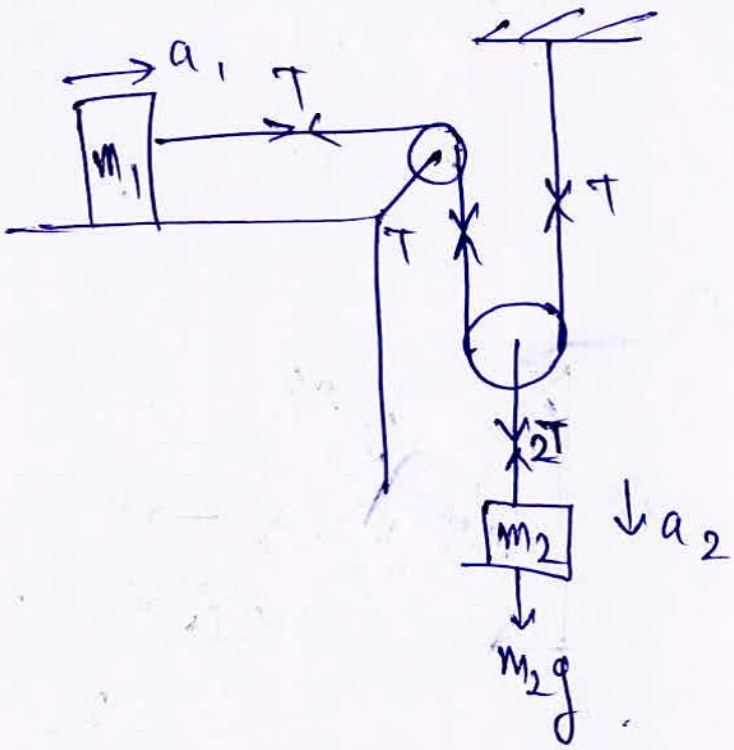
$\frac{p}{p'} = \frac{1}{\sqrt{2}}$ Ans (2)

33)

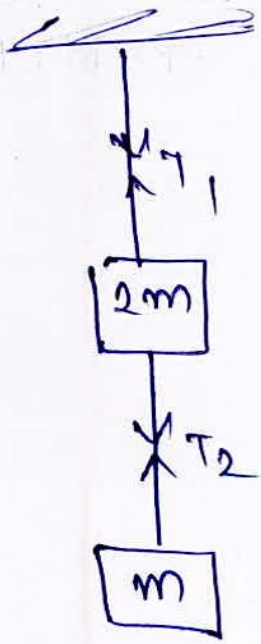
$T(a_1) = 2T(a_2)$

$a_1 = 2a_2$

Ans (2)



34)



Initially

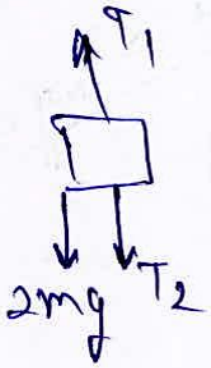
$T_1 = 2mg + T_2$

$T_2 = mg$

$T_1 = 3mg$

Then

$T_2 = 0$



$-T_1 + T_2 + 2mg = (2m)a_1$

$mg - T_2 = (m)a_2$

$mg = ma_2$

$a_2 = g$

$-3mg + 2mg = (2m)a_1$

$\frac{-mg}{2m} = a_1$

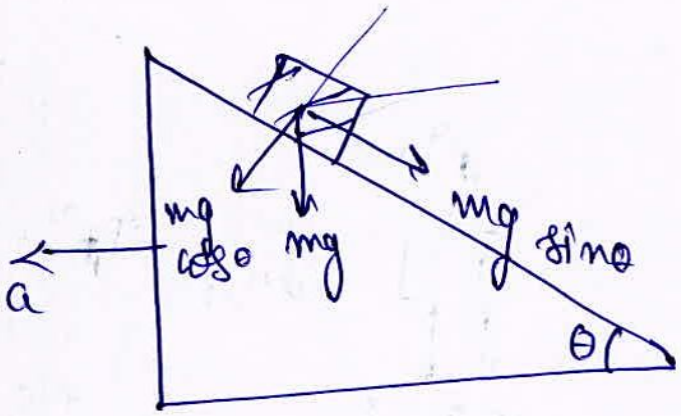
$a_1 = \frac{-g}{2}$

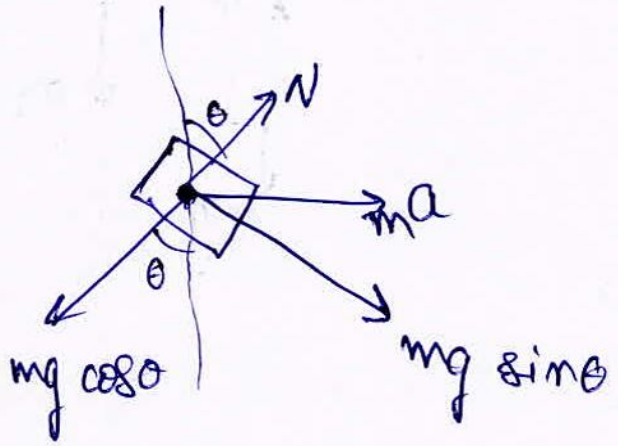
$a_1 = \left(\frac{g}{2}\right)\uparrow$

Ans (3)

EXERCISE
PROBLEM

35)





→ $N + ma\sin\theta - mg\cos\theta = 0$

for $a = g$ (freely fall)

$N = 0$

$a\sin\theta = g\cos\theta$

$$\boxed{a = g\cot\theta}$$

Ans(4)

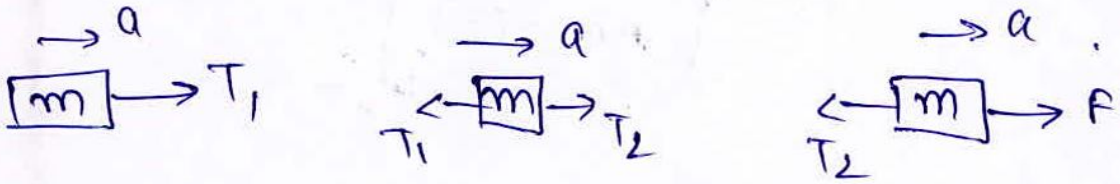
LAWS OF MOTION

WINDOWS TO JEE MAIN

1)

$\rightarrow \quad F = (3m)\,a \rightarrow a = \frac{F}{3m} = 5$

$\rightarrow$



$$T_1 = ma = \frac{66}{1000} \times 5 = 0.33\ N$$

Ans (1)

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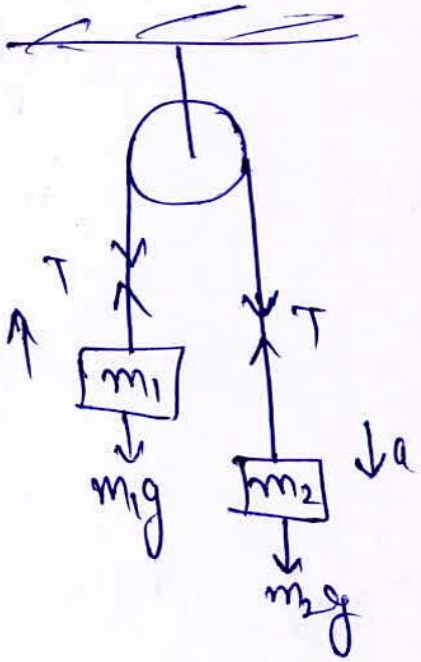
2)



$$m_2 g - T = m_2 a.$$

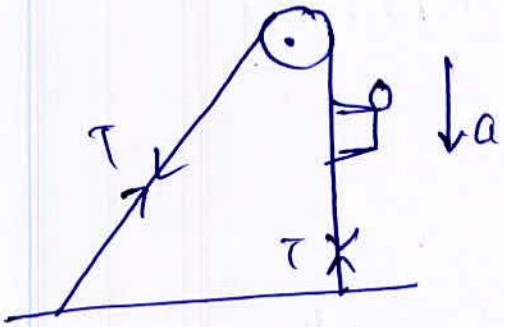
$$T - m_1 g = m_1 a.$$

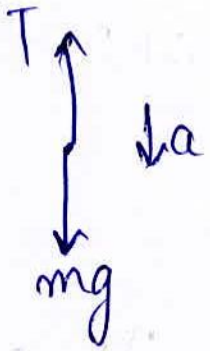
$$\frac{(m_2 - m_1)g}{(m_1 + m_2)} = \frac{a}{g} = \frac{1}{8}$$

$$\frac{m_2}{m_1} = \frac{2m_2}{2m_1} = \frac{1+8}{8-1} = \frac{9}{7}$$

Ans (2)

3)





$mg - T = ma$.

$a = 10 - \frac{360}{60} = 4\ m/s^2$

Ans - (3)

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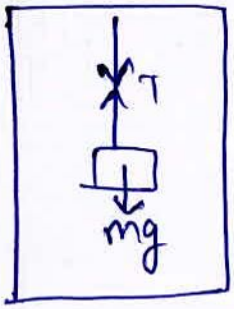
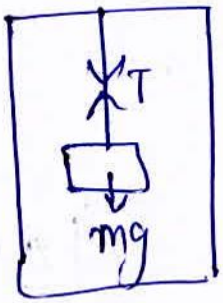
4)



$T = mg = 49N$.

$m = \frac{49}{9.8} = 5\ kg$.



$a = 5$.

$T + ma = mg$

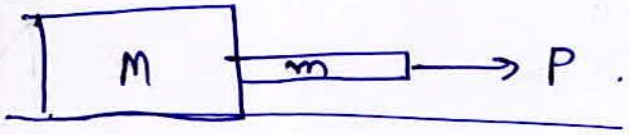
$T = mg - ma$.

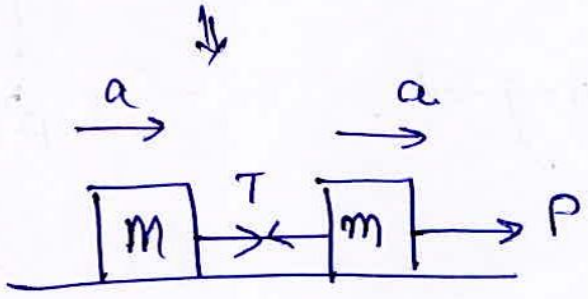
$= 49 - 5 \times 5$

$T = 24\ N$

Ans (4)

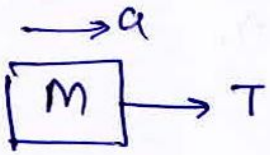
5)

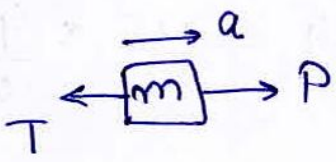




$\rightarrow \quad P = (M+m)\,a \rightarrow a = \left(\frac{P}{M+m}\right)$

$\rightarrow$





$T = Ma$.

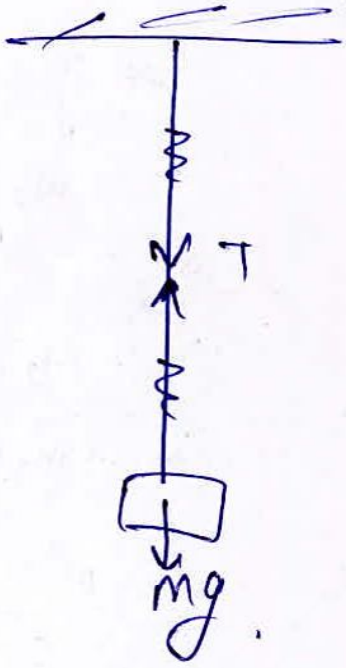
$$T = \frac{PM}{(M+m)}$$

6)

$T = Mg$

Reading $= M$ kg

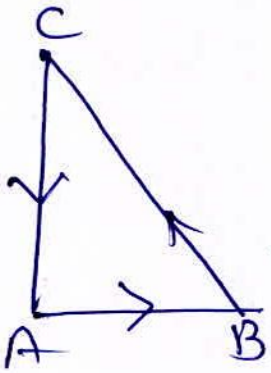
Ans (4)



7) $\vec{F}_{AB} + \vec{F}_{BC} + \vec{F}_{CA} = 0$.

$\therefore \Sigma F = 0$

$\therefore \vec{v} \rightarrow$ unchanged.



Ans (3)

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10) $F = n\, m\, \Delta v$.

$144 = n \times \frac{40}{1000} \times 1200$

$n = 3$

Ans (4)

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11)

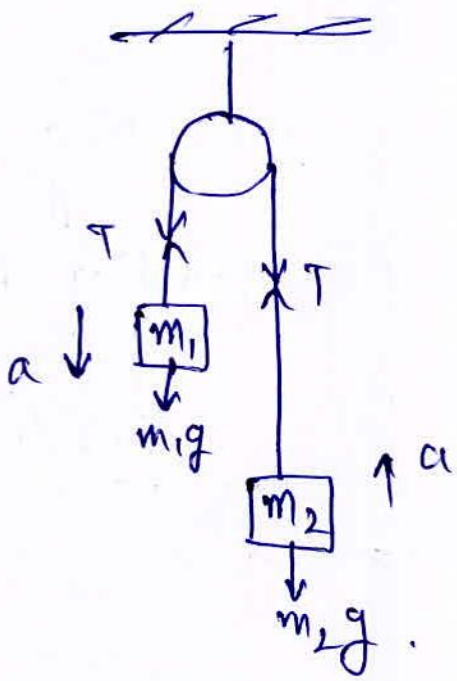
$m_1 g - T = m_1 a$

$T - m_2 g = m_2 a$.

$\rightarrow \frac{(m_1 - m_2)}{(m_1 + m_2)} g = a$

$\rightarrow a = \frac{0.2}{9.8} \times 9.8 = 0.2 \text{ m/s}^2$

Ans (1)



13) $|a| = \left|\frac{F}{m}\right| = \left|\frac{-Kx}{m}\right| = \frac{Kx}{m} = \frac{15 \times 20}{0.3} = 10$

Ans (4)

15) $F = m\frac{dv}{dt}$

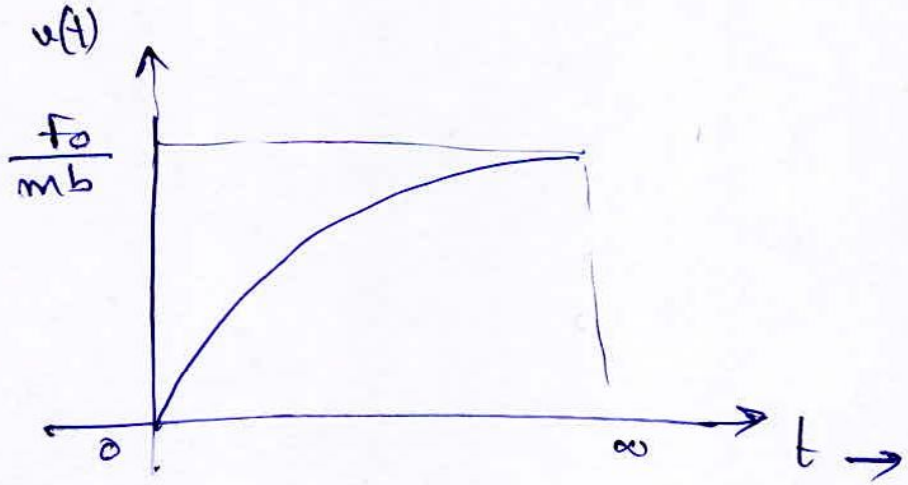
$= \frac{150}{1000} \times \frac{20}{0.1}$

$F = 30\,N$ Ans (1)

17) $F(t) = m\frac{dv}{dt} = F_0 e^{-bt}$.

$\int dv = \frac{F_0}{(-b)m} \int e^{-bt}(-b)dt$

$v(t) = \frac{F_0 e^{-bt}}{-mb}$.



Ans (2)