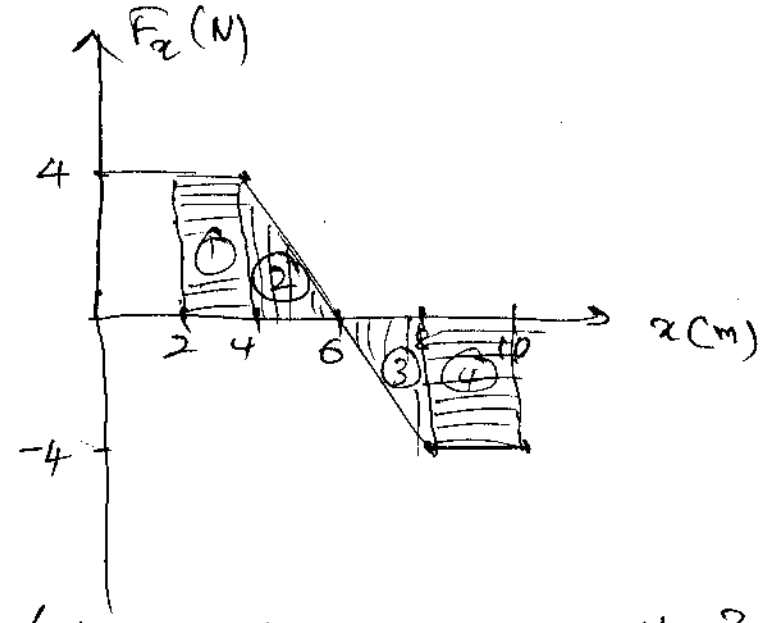
Exam 2 011

solutions for Q1 → Q6

1.




What v at $x = 10$ m $\equiv V_{10}$ ?

It is a varying force F. Question can easily be solved using Work-KE theorem, (as it should) very quickly.

$$W_{net} = \Delta K$$

(There is only one force)

$$\int_{x=x_i}^{x_f} F_x dx = \frac{1}{2} m (v_f^2 - v_i^2)$$

v at $x = 2$ m is given & we are asked to find v at $x = 10$ m ($v_{10}$). So let $x_i = 2$ m $x_f = 10$ m

$$\int_{x=2}^{x=10} F_x dx = \frac{1}{2} m (v_{10}^2 - v_2^2)$$

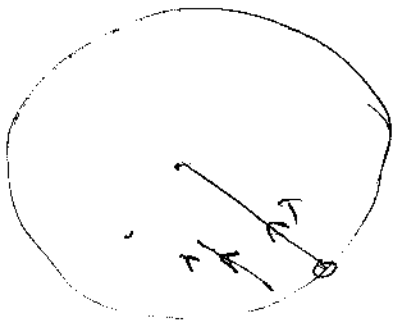
$$A_1 + A_2 + A_3 + A_4 = \frac{1}{2} m (v_{10}^2 - v_2^2)$$

Note $A_1 + A_3 = 0$ & $A_2 + A_4 = 0$ !

$\Rightarrow \quad 0 = \frac{1}{2} m (v_{10}^2 - v_2^2)$

$\Rightarrow \boxed{v_{10} = v_2 = 5.0 \text{ m/s}}$

92)




horizontal circle
$R = 0.5$ m
$T = 16$ N

$\Sigma F_r = m a_r$

$T = m \frac{v^2}{R}$

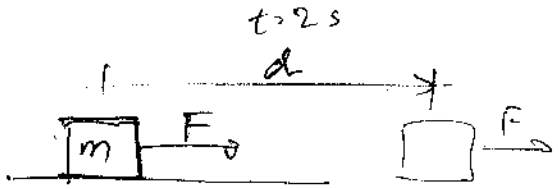
$\left(\frac{1}{2} x\right) TR = mv^2 \left(x \frac{1}{2}\right)$

$\Downarrow$

$\frac{1}{2} TR = \frac{1}{2} mv^2 = KE$

$\boxed{KE_{max} = \frac{1}{2} TR = \frac{1}{2}(16)(0.5) = 4 \text{ (J)}}$

Q3




$m = 2$ kg

$F = 50$ N

$v_0 = 0$

$t = 2$

$P(t=2) = \frac{dW}{dt} = \vec{F} \cdot \vec{v} = F v_2$

$v_2$ = velocity at $t = 2.0$ s

$v_2 = v_0 + at$ const 'F' $\Rightarrow$ const 'a'

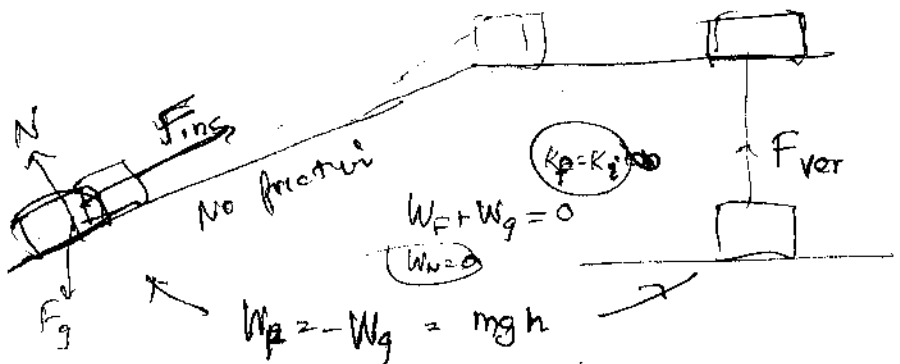
but $a = F/m$

$v_2 = \frac{F}{m} t$

$P = F\left(\frac{F}{m} t\right) = \frac{F^2}{m} t = \frac{(50)^2}{2}$

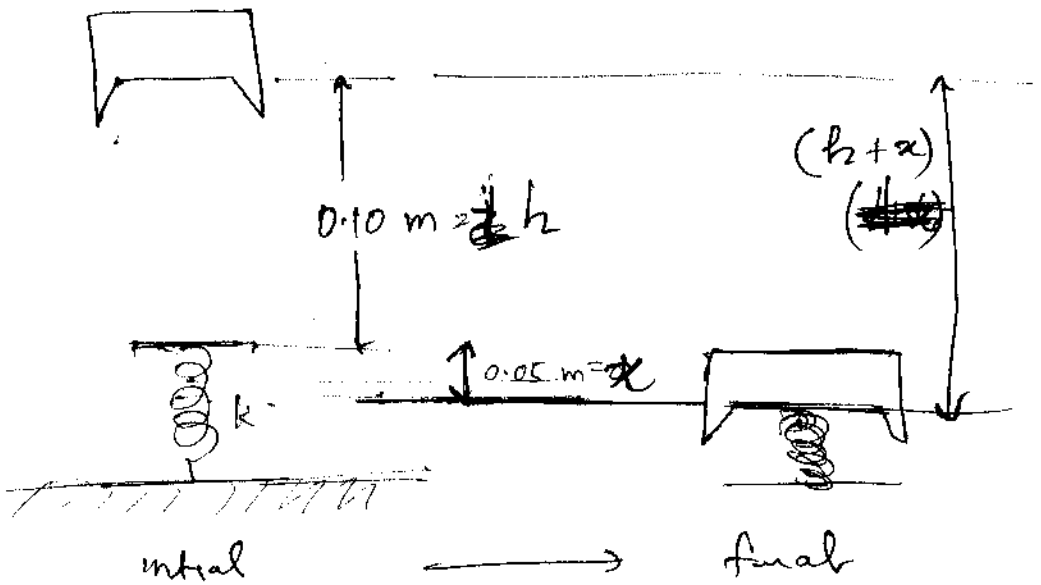
$\boxed{P = 2500 \text{ W}}$ (J/s)

Q4




$F_{inc} = F_g \sin\theta$ $\quad$ $F_{ver} = F_g$

(95)




$$W_{ex} = \Delta K + \Delta U + \Delta E_{th}$$

system = block + spring + Earth.

$W_{ex} = 0$ for this system

initial & final are as shown in figure above.

$\Delta E_{th} = 0$ as no friction

$$0 = \Delta K + \Delta U$$

$$0 = \Delta K + \Delta U_g + \Delta U_s$$

$$0 = \frac{1}{2}m(0^2 - v^2) + mg\{-(h+x)\} + \frac{1}{2}k(x^2 - 0^2)$$

$$mg(h+x) = \frac{1}{2}kx^2$$

$$k = \frac{2mg(h+x)}{x^2} = \frac{2(2)(9.80)(0.10+0.05)}{(0.05)^2}$$

$$k = 2352 \text{ (N/m)}$$

$$k = 2350 \text{ N/m}$$

Q6

$W_c = -\Delta U$

$\Delta U = -W_c = -(+50)$

$\boxed{\Delta U = -50\ J}$