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Code: ACMA 4009
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- ①
- a) Temperature: Kelvin (K) or Celsius (C)
 - b) Luminous intensity: Candela (Cd)
 - c) Volume: Cubic metre (m³)
 - d) Displacement: Metre (M)
 - e) Time: Second (S)

② Given that "Pressure" is defined as

$$\text{Pressure} = \text{Force} / \text{Area}$$

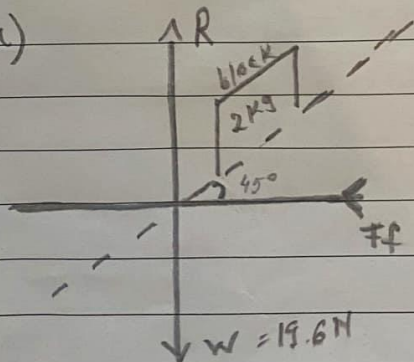
$$\text{Force} = \text{Kg} \cdot \text{m/s}^2 \text{ (Newton)}$$

$$\text{Area} = \text{m}^2 \text{ (Sqm)}$$

$$\Rightarrow \text{Kg} \cdot \text{m}^{-1} \cdot \text{s}^{-2}$$

③

a)



b) $F_f = \mu R$

μ = coefficient of friction

R = normal reaction force

$$W = 19.6 \text{ N}$$

$$\cos 45^\circ = \frac{\sqrt{2}}{2}$$

$$R = 19.6 \times \frac{\sqrt{2}}{2} = 13.86 \text{ N}$$

$$\Rightarrow F_f = 13.86 \text{ N}$$

③ c) The $F_f = W_{\text{parallel}} \Rightarrow$ reason is that the body is in limiting equilibrium meaning that it is on the verge of sliding but remains stationary

Newton first law applies, all forces along the axis (parallel and perpendicular to the incline) must balance

$$d) R = W \cos 45^\circ$$

$$W = 19.6 \text{ N}$$

$$\cos 45^\circ = \frac{\sqrt{2}}{2}$$

$$R = 19.6 \times \frac{\sqrt{2}}{2} = 13.86 \text{ N}$$

④ $\text{I} = x^2 - 5x + 6 = 0$
 $x(x-2) - 3(x-2) = 0$
 $x-2 = 0 \Rightarrow x_1 = 2$
 $x-3 = 0 \Rightarrow x_2 = 3$

$\text{II} \quad x^2 + 7x + 6 = 0$
 $(x+1)(x+6) = 0$
 $x+1 = 0 \Rightarrow x = -1$
 $x+6 = 0 \Rightarrow x_2 = -6$

$\text{III} \quad x^2 + 10x = -25$
 $x^2 + 10x + 25 = 0$
 $x^2 + 10x + 25 = (x+5)(x+5) = (x+5)^2$
 $(x+5)^2 = 0$
 $x+5 = 0$
 $x = -5$
 $x_1 = -5$

(4)

IV $x^2 - 2x - 15 = 0$

$$x^2 - 2x - 15 = (x-5)(x+3) = 0$$

$$x-5=0 \Rightarrow x_1=5$$

$$x+3=0 \Rightarrow x_2=-3$$

V

$$2x^2 + 3x + 1 = 0$$

$$2x^2 + 3x + 1 = 2x^2 + 2x + x + 1$$

$$(2x^2 + 2x) + (x + 1)$$

$$2x(x+1) + 1(x+1)$$

$$(2x+1)(x+1) = 0$$

$$2x+1=0 \Rightarrow 2x=-1 \Rightarrow x=-1/2$$

$$x+1=0 \Rightarrow x=-1 \Rightarrow x=-1$$

$$x = -1/2$$

$$x_2 = -1$$

(5)

I $x^2 - 4x - 1 = 0$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-1)}}{2}$$

$$x = 4 \pm \sqrt{16 - 4 \cdot 1 \cdot (-1)}$$

$$x = 4 \pm \frac{\sqrt{20}}{2}$$

$$x = \frac{4 \pm 2\sqrt{5}}{2}$$

$$x = \frac{4}{2} + \frac{2\sqrt{5}}{2} \Rightarrow x = 2 + \sqrt{5}$$

$$x = 2 - \sqrt{5} \Rightarrow x = 2 - \sqrt{5}$$

(5)

II

$$2x^2 + 3x - 1 = 0$$

$$x = \frac{-3 \pm \sqrt{9 - 4(2)(-1)}}{2(2)}$$

$$x = \frac{-3 \pm \sqrt{9+8}}{4}$$

$$x = \frac{-3 \pm \sqrt{17}}{4}$$

$$x = \frac{-3 + \sqrt{17}}{4}$$

$$x_2 = \frac{-3 - \sqrt{17}}{4}$$

(6)

I

$$\frac{3(x+1)}{2} = \frac{x+2}{4}$$

$$6x - 6 = x + 2$$

$$5x - 6 = 2$$

$$5x = 8$$

$$x = 8/5$$

$$\text{II} \quad 2x + 5y = 7$$

$$3x + 2y = 5$$

$$2x = 7 - 5y$$

$$x = \frac{7 - 5y}{2}$$

$$\frac{3(7 - 5y)}{2} + 2y = 5$$

$$\frac{21 - 15y}{2} + 2y = 5$$

$$21 - 15y + 4y = 10$$

$$21 - 11y = 10$$

$$-11y = -11$$

$$y = 1$$

$$x = \frac{7 - 5(1)}{2}$$

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

$$x = 1$$

(7)

$$a) \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{3} + \frac{1}{6}$$

$$\frac{1}{R} = \frac{2}{6} + \frac{1}{6}$$

$$\frac{1}{R} = \frac{3}{6}$$

$$R = 2 \text{ ohms}$$

$$\text{Total resistance} = 6 + 2 \text{ Ohms} = 8 \text{ Ohms} \\ \text{8 Ohms} \\ (12V)$$

$$b) I_2 = \frac{E}{R_2}$$

$$I_2 = \frac{8}{6} = 1.33A$$

$$c) P = IV$$

$$I_{\text{total}} = 4A$$

$$P = 8V \times 4A = 32W \text{ (watts)}$$