a)

$$x = t^2 - 4t + 6.$$

$$v = \frac{dx}{dt} = 2t - 4.$$

$$0 = 2t - 4$$

$$t = 2\,s$$

At $t = 2\,s$, particle ~~at~~ is at rest and reverse its position so

$$\left.\begin{aligned} x\big|_{t=0} &= 6\,m \\ x\big|_{t=2s} &= 2\,m \end{aligned}\right] 4\,m$$

$$\left.\begin{aligned} x\big|_{t=2s} &= 2\,m \\ x\big|_{t=3s} &= 3\,m \end{aligned}\right] 1\,m.$$

Distance $= (4+1)\,m = 5\,m$

Displacement $= (4-1)\,m = 3\,m$ ..

~~a~~ (b)

$$a = \frac{dv}{dt} = \frac{dv}{dx} \cdot \frac{dx}{dt}$$

$$= \frac{dv}{dx} \cdot v$$

$$= v \cdot \frac{dv}{dx}.$$

(b)

$$x = 10t - 2t^2.$$

$$v = \frac{dx}{dt} = 10 - 4t.$$

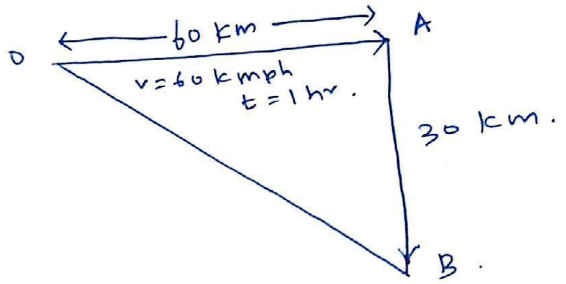
$v = 0$; ~~10 = 4t~~ $10 - 4t = 0$

$$t = 2.5\,s$$

e)

Displacement of Car $= \sqrt{60^2 + 30^2}$

$= 30\sqrt{5}$ km



Distance OA = Speed × Time

$= 60 \times 1 = 60$ km.

a)

$$V_{av} = \frac{\text{Distance}}{\text{time}}$$

$$= \frac{\text{Speed} \times \text{time}}{\text{time}}$$

$$= \frac{v_1 \times \frac{t}{3} + v_2 \times \frac{2t}{3}}{\frac{t}{3} + \frac{2t}{3}}$$

$$V_{av} = \frac{\frac{v_1}{3} + \frac{2v_2}{3}}{1} = \frac{v_1 + 2v_2}{3}.$$

d) $\sqrt{x} = t + 7$

$x = (t+7)^2 = t^2 + 49$

$$\frac{dx}{dt} = 2t + 14.$$

$v = 2t + 14$

$v \propto t$

$$a = \frac{dv}{dt} = 2\,m\,s^{-2} \text{ constant}.$$

(b). Distance travelled in 5^{th} half second

$S_{2.5} - S_2 = \frac{1}{2} \times 2 \times (2.5)^2 - \frac{1}{2} \times 2 \times (2)^2$

$= 2.25\ m.$

(c) $t = \sqrt{\frac{x+a}{b}}$

$(x+a) = bt^2.$

$x = -a + bt^2.$

$S = S_1 + ut + \frac{1}{2}at^2.$

$S_1 = -a\ ;\ u = 0$ acceleration $= 2b.$

7. (b) V_{max} = area of ΔOAB.

$= \frac{1}{2} \times 11 \times 10$

$= 55\ ms^{-1}.$

(b). $\frac{dx}{dt} = v = -1 - 2t$

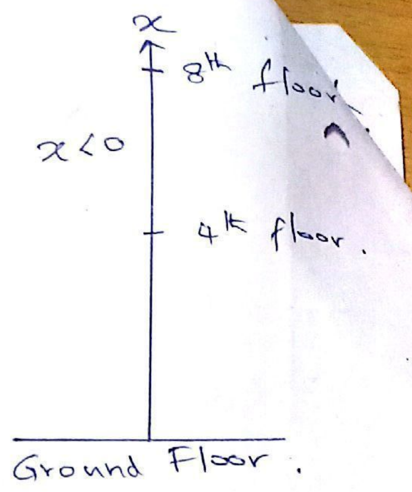
comparing with $v = u + at$

we have, $u = -1\ ms^{-1}$ and $a = -2\ ms^{-2}.$

At $t = 0$, $x = 1\ m$ Then u and a both are negative. Hence, x-co-ordinate of particle will go on decreasing.

26.

(a) As the lift is coming in downward directions displacement will be negative, we have to see whether the motion, displacement will be negative. When the lift reaches 4th floor and about to stop, hence motion is retarding in nature hence.



$x < 0$; $a > 0$, As the displacement is negative direction, velocity will also be negative (ie.) $v < 0$

This can be shown on the adjacent graph.

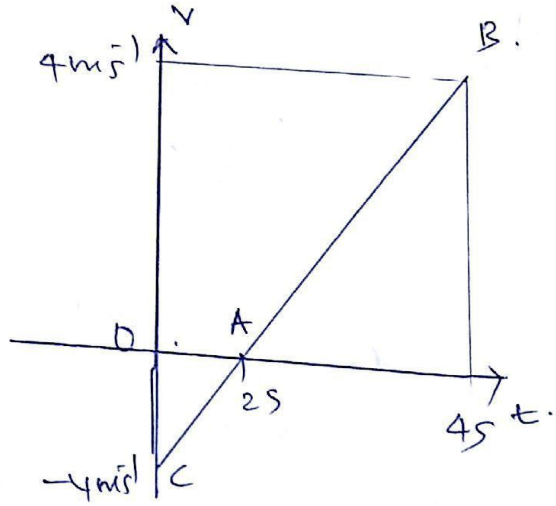
(b) given

$$x = (t-2)^2.$$

$$v = \frac{dx}{dt}$$

$$= \frac{d}{dt}(t-2)^2$$

$$= 2(t-2)\ ms^{-1}.$$



$$a = \frac{dv}{dt}.$$

$$= 2\ ms^{-1}.$$

When $t = 0$; $v = -4\ ms^{-1}$

$t = 2s$; $v = 0\ ms^{-1}$

$t = 4s$; $v = 4\ ms^{-1}$.

Distance travelled = area of the graph

= |area OAC| + area ABD

$= \frac{1}{2} \times 9 \times 2 + \frac{1}{2} \times 2 \times 4.$

= 8 m.

(d) $s \propto u^2$; If u becomes 3 times.

then s will become 9 times (ie) $9 \times 20 = 180$ m

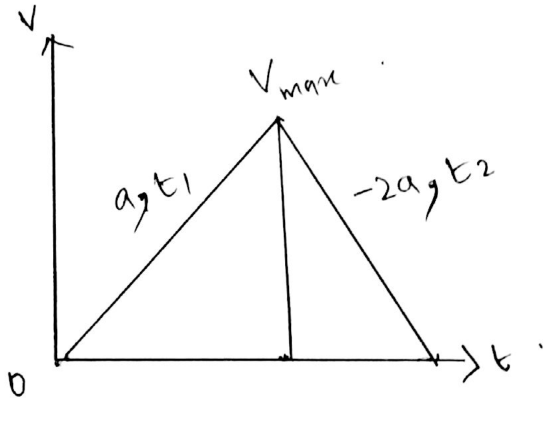
(a) $a = \frac{v-(-u)}{t} = \frac{v+u}{t}$

$= \frac{\sqrt{2gh_1} + \sqrt{2gh_2}}{t}$

$= \frac{\sqrt{2 \times 10 \times 5} + \sqrt{2 \times 10 \times 10}}{0.01}$

$= 2414 \ ms^{-2}$.

(d).



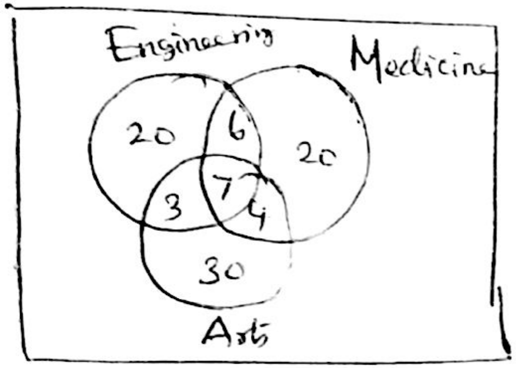
$t_1 = \frac{v}{a}$; $t_2 = \frac{v}{2a}$

$t_1 + t_2 = 9$

$\frac{v}{a} + \frac{v}{2a} = 9$

$\frac{3v}{2a} = 9 \Rightarrow \frac{v}{a} = 6$.

2 $n(U) = 100$



3 2) did not like $= n(U) - n(A \cup B \cup C)$

$= 100 - (7+3+4+6+2$

$= 100 - 90 = 10$

3) only one group $20+20+30 = 70$

2 $\left.\begin{array}{l} A \cap B = A \cap C \\ A \cup B = A \cup C \end{array}\right\} \Rightarrow B = C$

3 2 $A = \{2, 3\}$ $\quad B = \{2, 4\}$ $\quad C = \{4, 5\}$

$B \cap C = \{4\}$

$n(A \times (B \cap C)) = n(A) \times n(B \cap C)$

$= 2 \times 1 = \underline{2}$

1 2 $A = \{(0,1)(1, e)(2, e^2) \ldots\ldots (-1, \frac{1}{e}) (-2, \frac{1}{e^2}) \ldots\ldots\}$

$B = \{\ldots\ldots (-2, e^2)(-3, e^3) \ldots\ldots (0, 1) (1, \frac{1}{e}) (2, 1/e^2) \ldots\ldots$

$A \cap B = \{(0,1)\}$

$n(A \cap B) = 1$

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Explanation

Let $x \notin p$ $\quad x$ is a composite number

Suppose $x \in S$

$2^x - 1 = m \quad (m - \text{prime})$

$2^x = m+1$

which is not possible

$\therefore \quad 2^4 =$ cannot be prime number $\neq m+1$

$2^6 = 64 \neq m+1$

$2^8 = 256 \neq m+1$

$\therefore \quad x$ is not composite nos.

$\Rightarrow x \in p \Rightarrow x \in S$

$\Longrightarrow S \subset P$

$\{1,2,3\} \subset A$ and $\{4,6\} \subset B$

Since $A \times B$ has 6 elements, Therefore A has 3 elements and B has 2 elements $\therefore A = \{1,2,3\}$, $B = \{4,6\}$.

---

3) W.T.S $(A \times B) \cap (C \times D) = (A \cap C) \times (B \cap D)$

$(A \times B) \cap (B \times A) = (A \cap B) \times (B \cap A)$

$\Rightarrow (A \times B) \cap (B \times A) = (A \cap B) \times (A \cap B)$

Given $A \cap B$ has n elements

$\therefore (A \cap B) \times (A \cap B)$ has n^2 elements

$\therefore (A \times B) \cap (B \times A)$ has n^2 elements in common.

---

(1) Here R is not a reflexive relation because a line cannot be perpendicular to itself.

Let $l_1 R l_2$. Then $l_1 R l_2 \Rightarrow l_1 \perp l_2 \Rightarrow l_2 \perp l_1 \Rightarrow l_2 R l_1$

$\therefore$ It is symmetric.

R is not transitive, because if $l_1 \perp l_2$ and $l_2 \perp l_3$ then l_1 may be parallel to l_3.

---

(3) clearly $(1,1)$, $(2,2)$, $(3,3)$, $(4,4)$ are not in R.

$\therefore$ it is not reflexive.

$(2,3) \in R$ but $(3,2) \notin R$. $\therefore R$ is not symmetric.

$(1,3) \in R$ and $(3,1) \in R$ But $(1,1) \notin R$.

$\therefore R$ is not transitive.

---

(4) Here corresponding to each $a \in A$ the ordered pair $(a,a) \in R$. $\therefore R$ is reflexive.

$(6,12) \in R$ but $(12,6) \notin R$ $\therefore R$ is not symmetric

clearly R is transitive.

---

6. (2) The number of equivalance relations is 5.

7. (3) The number of reflexive relations $= 2^{3(3-1)} = 2^6 = 64$

8. (4) The number of symmetric relations $= 2^{\frac{3(3+1)}{2}} - 1 = 2^6 - 1 = 63$

9. (2) If $(a,b) \in R$ then $(b,a) \in R^{-1} \Rightarrow R$ is symmetric

10. (4) Since 3 elements in common.

$\therefore (A \times B) \cap (B \times A)$ has 9 elements.

[2] 5

$R_1 = \{(1,1), (2,2), (3,3)\}$

$R_2 = \{(1,1), (2,2), (3,3), (1,2) (2,1)\}$

$R_3 = \{(1,1), (2,2), (3,3), (1,3), (3,1)\}$

$R_4 = \{(1,1), (2,2), (3,3), (2,3), (3,2)\}$

$R_5 = \{\{1,2,3\} \Leftrightarrow A \times A = A^2\}$

$\therefore$ Max no. of equivalence relations on the $A = \{1,2,3\} = 5$

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