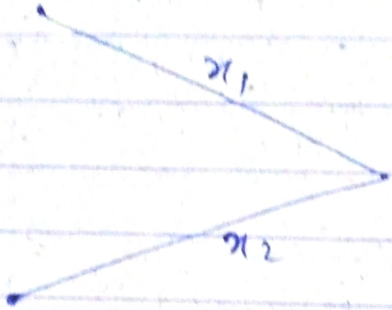
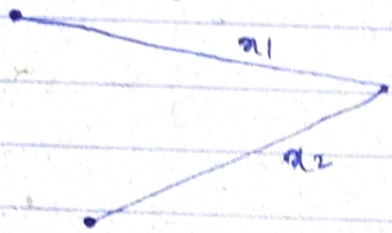
Beats →



$$\Delta\phi = k(x_2 - x_1) + (\phi_2 - \phi_1)$$



$$\Delta\phi = (\omega_2 - \omega_1)t + k_2 x_2 - k_1 x_1 + \phi_2 - \phi_1$$

जब 2 source incoherent होंगे तो किसी भी एक जगह पर Maxima Minima, Maxima Minima दोनों बनेंगे जब Maxima बनेगे तो हमें loud sound सुनाई देगा। अगर ये loud sound सुनने का Processor 1 sec में 10 से कम बार होता है तो हमें ये बात समझ में आती है पर जो इससे ज्यादा होता है तो हम differciate नहीं कर पाते हैं पर जब ये कम होता है तो हमें समझ में आता है और उसे हम बोलते हैं Beats. और ऐसा कितनी 1 बार में होता है उसे बोलते हैं Beat frequency.

so beat frequency is basically No. of times of formation of maxima at a particular position in 1s.

~~$\Delta\phi =$~~

$$\Delta\phi = (\omega_2 - \omega_1)t + \underbrace{k_2 x - k_1 x + \phi_2 - \phi_1}_{0}$$

$A\sin(\omega_1 t + k_1 x)$

Analysis at (0,0)

$A\sin(\omega_1 t)$

$A_2 \sin(\omega_2 t)$

$A\sin(\omega_2 t + k_2 x)$

Maxima $\Delta\phi = 0, 2\pi, 4\pi, \ldots$

$\Delta\phi = (\omega_2 - \omega_1)t$

at $t = 0$ $\Delta\phi = 0$ (Maxima Ist)

for IInd $\Delta\phi^{2nd} = 2\pi = (\omega_2 - \omega_1)t$

$2\pi = 2\pi(f_2 - f_1)t_2$

$t_2 = \dfrac{1}{f_2 - f_1}$

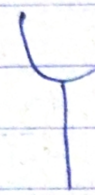
for IIIrd

$4\pi = 2\pi(f_2 - f_1)t_3$

$t_3 = \dfrac{2}{f_2 - f_2}$

$$t_3 - t_2 \text{ or } t_2 - t_1 = \frac{1}{f_2 - f_1}$$

Beat frequency = $f_2 - f_1$



→ Prongs → file (छील दे) f ↑

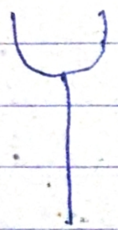
Tunning fork

← wax (मोम) f ↓

अगर string में tension ↑ ⇒ f ↑

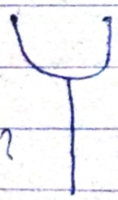
" " " ↓ ⇒ f ↓

Qn



500 Hz

B.f = 5



f = x → file Now BF = 8

What is the frequency of II Tuning fork

An

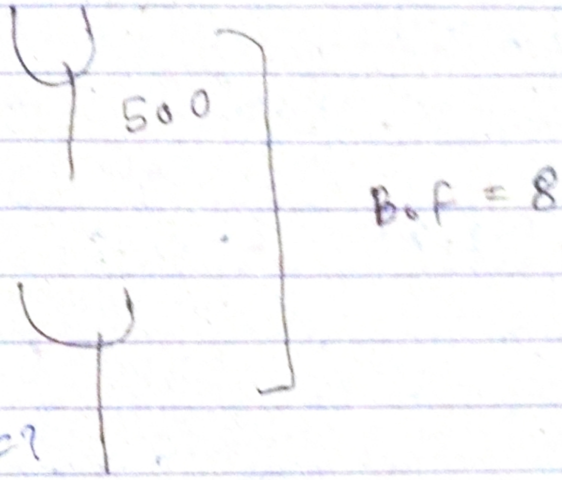
$5 = 500 - x$

↙ 495 ↘ 505 (✓)

~~जो close है उसी को consider करो~~

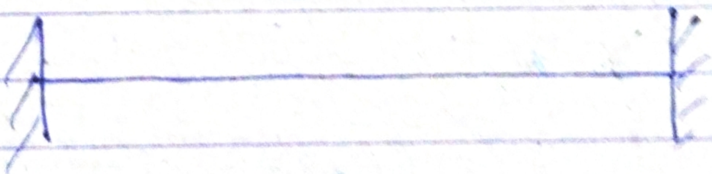
wax → new BF = 2

Q–



Sol^n 492 508

Q–



DATE: / /

$A \sin(\omega_1 t + k_1 x)$

at origin $= A \sin 2\pi f_1 t + A \sin(2\pi f_2 t)$

$A \sin(\omega_2 t + k_2 x)$

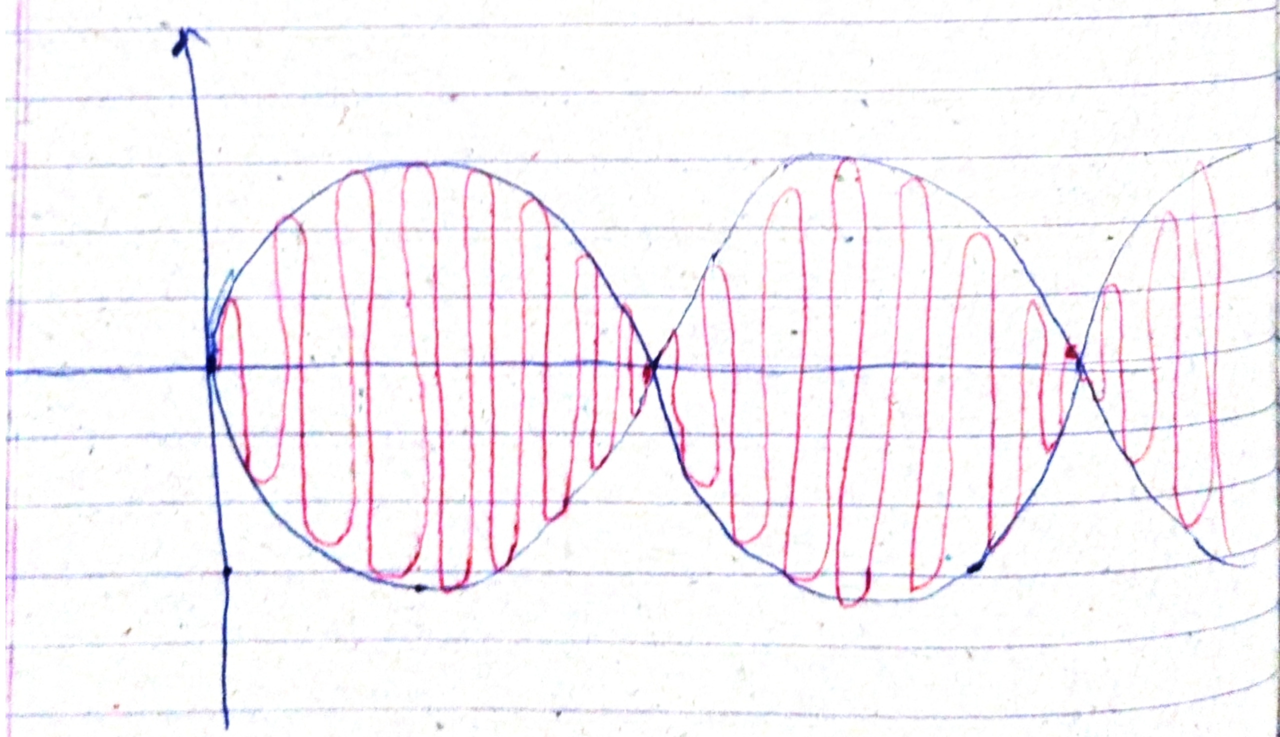
$= 2A \sin\left(2\pi\left(\frac{f_1+f_2}{2}\right)t\right) \cos\left(2\pi\left(\frac{f_1-f_2}{2}\right)t\right)$

let $f_1 = 99 Hz$ $f_2 = 101 Hz$

Amplitude

$= 2A \cos(2\pi \cdot 1 \cdot t) \sin(2\pi\, 100 t)$

$\downarrow$ $\frac{f_1-f_2}{2}$ $\downarrow$ $\left(\frac{f_1+f_2}{2}\right)$



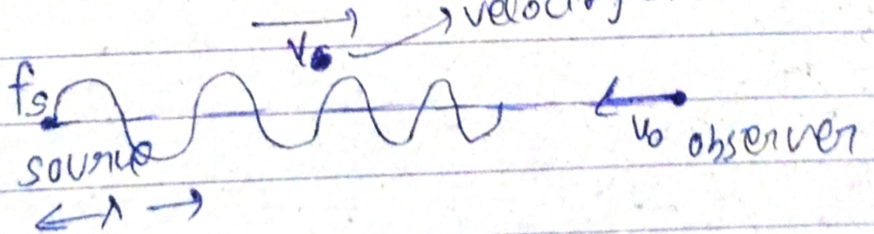
Q— 3 source हैं एक की frequency (n-1), n, (n+1) हैं।
कितनी Beat सुनाई देगी in 1 s में
what is the beat frequency?

Dropler effect →

हमे Reality में 3 वजह से sound different सुनाई देती हैं

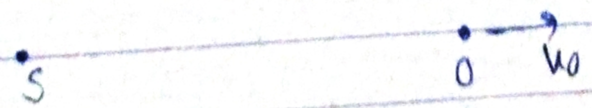
i → wave form
ii → Loudness
iii → frequency

Due to the moment of source and observer frequency heard by the observer is different. from what frequency is sent by source and this phenomenon of change in frequency leads to the change in sound and this is known as Dropler effect



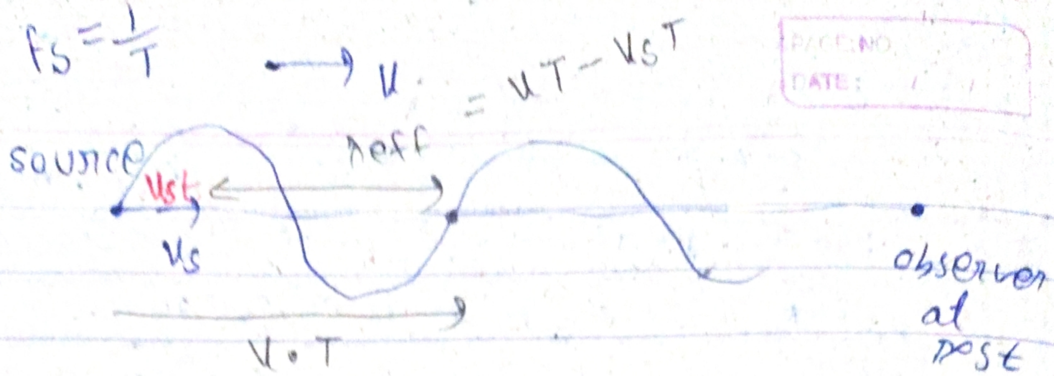
$$f_s = \frac{v}{\lambda}$$

$$f_o = \frac{v + v_o}{\lambda} = \frac{(v + v_o) f_s}{v}$$



$$f_o = \left(\frac{v - v_o}{v}\right) f_s$$

$f_s = \frac{1}{T}$



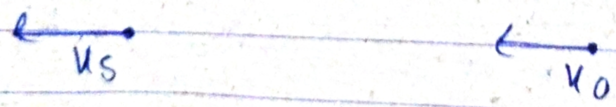
$$f_o = \frac{u}{\lambda_{eff}}$$

$$= \frac{u}{uT - V_s T} = \left(\frac{u}{u - V_s}\right) f_s$$

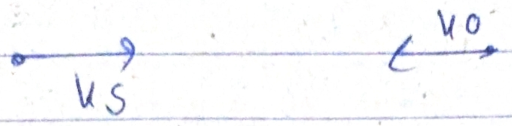
$$\boxed{f_o = \left(\frac{u}{V - V_s}\right) f_s}$$

* अगर observe की रफ्तार आती है और नीचे source की।
पास आएंगे तो f बढ़ेगी अपर + और नीचे '-'
दूर जाएंगे तो f↓ अपर - और नीचे '+'
* जब source move करता है तो λ में change आता है
* जब observer move करता है तो u में change आता है।

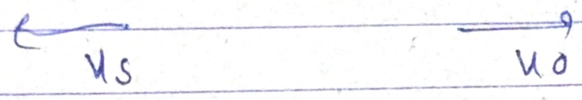
Ques



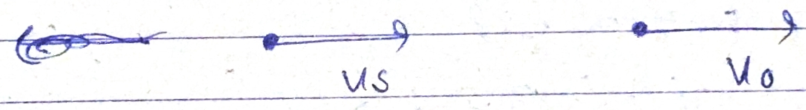
$$f_o = \left(\frac{V + V_o}{V + V_s}\right) f_s$$



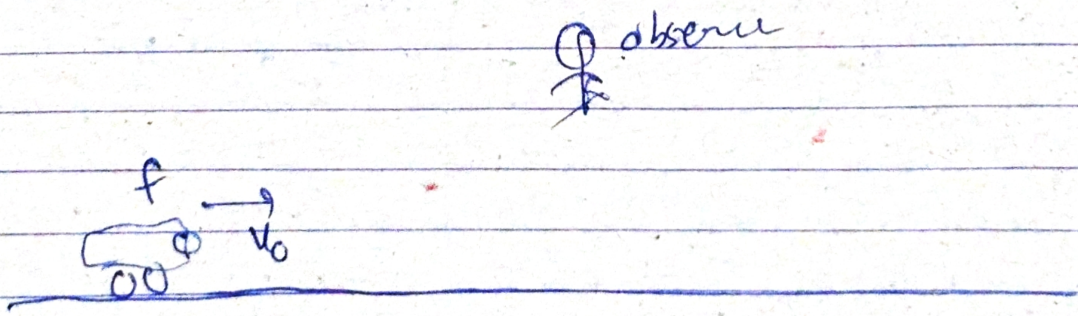
$$f_o = \left(\frac{u + v_o}{u - v_s}\right) f_s$$



$$f_o = \left(\frac{u - v_o}{u + v_s}\right) f_s$$



$$f_o = \left(\frac{u - v_o}{u - v_s}\right) f_s$$



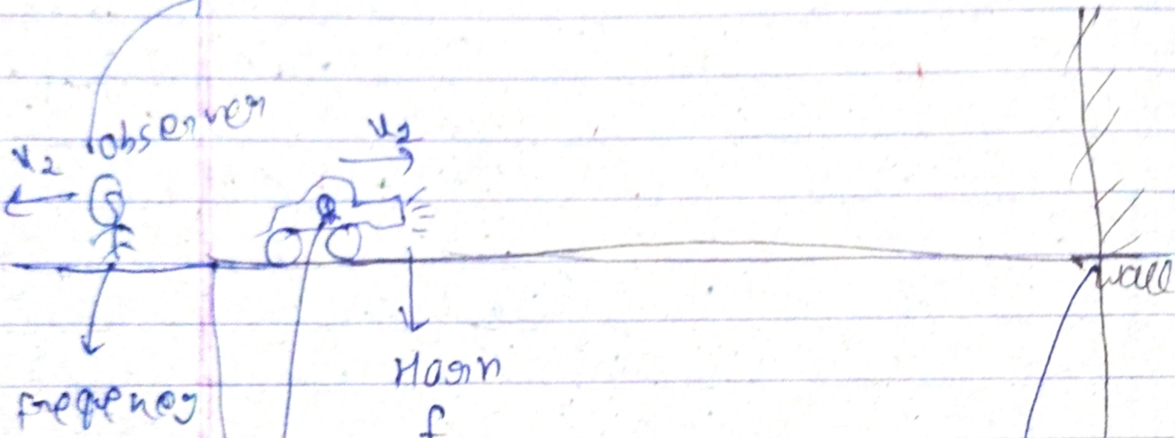
u = velocity of sound

change in frequency for observer

$$f_i = \left(\frac{u}{u - v_s}\right) f_s \qquad f_{final} = \left(\frac{u}{u + v_s}\right) f_o$$

$$\Delta f = \frac{2 v v_s}{v^2 - v_s^2} f$$

f heard by observer Direct from car. $= \left(\frac{v - v_2}{v + v_1}\right) f$



Horn
f

frequency heard by observer (टकराने वाली)

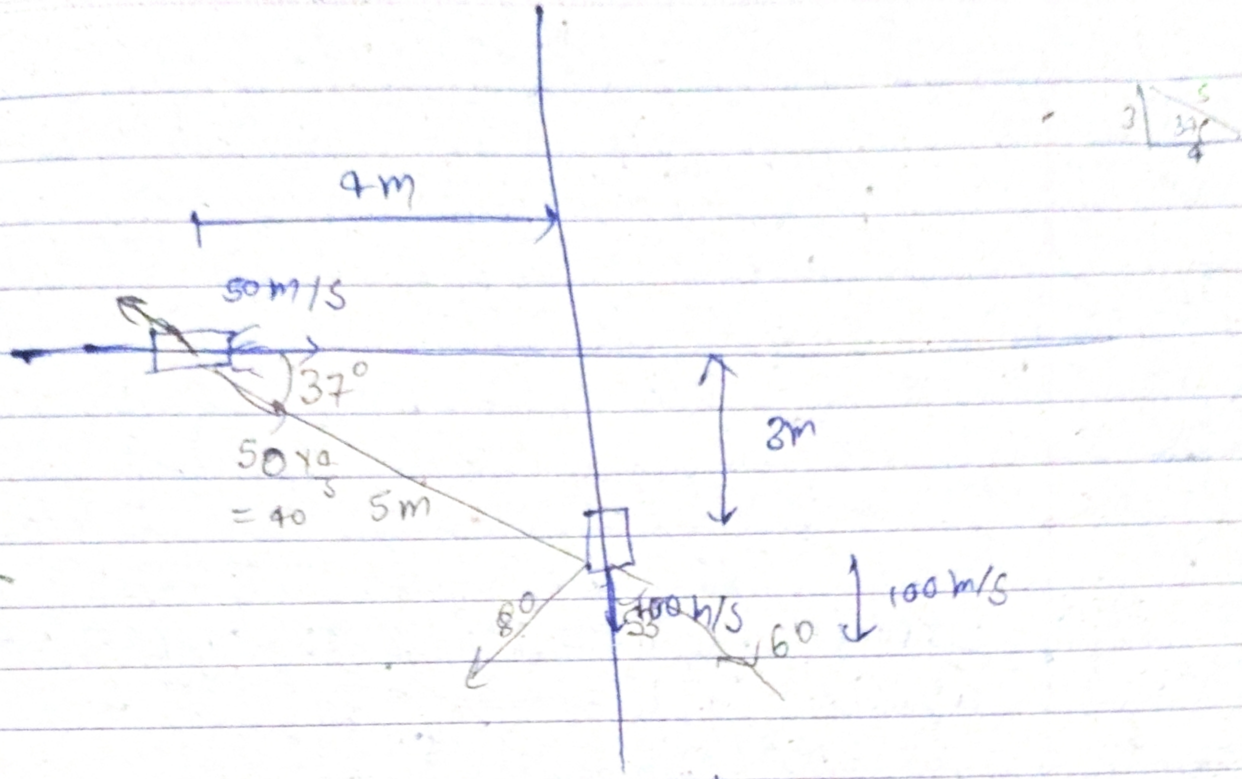
$= \left(\frac{v - v_2}{v - v_1}\right) f$

frequency heard by driver (टकराने वाली)

$= \left(\frac{v + v_1}{v - v_1}\right) f$

$\left(\frac{v}{v - v_1}\right) f = f'$

(टकराने वाली जो दीवार है उसे पहले एक stationary observer की तरह माने फिर stationary source की तरह).



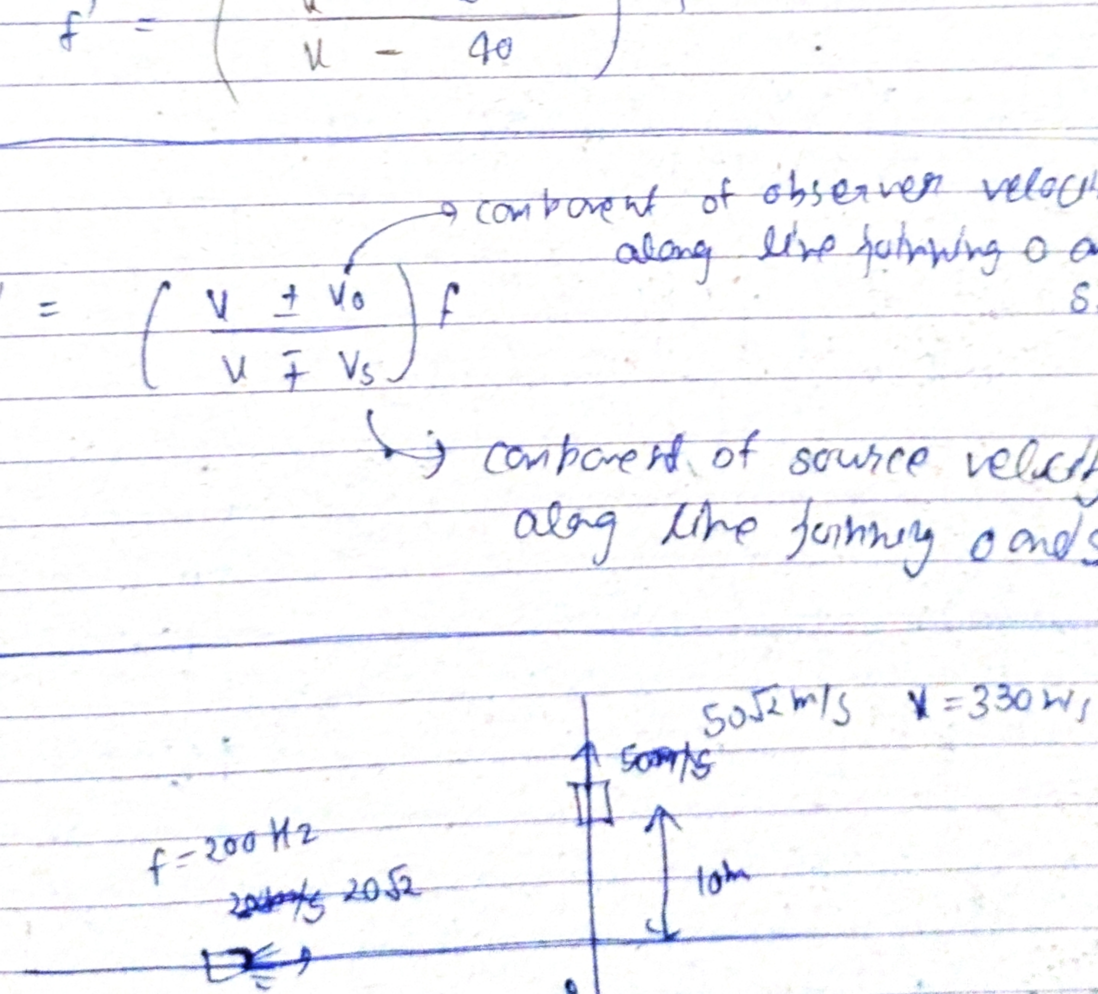
$$f' = \left(\frac{v - 60}{v - 40} \right) f$$

$$f' = \left(\frac{v \pm v_0}{v \mp v_s} \right) f$$

→ v_0: component of observer velocity along line joining O and S.

→ v_s: component of source velocity along line joining O and S.

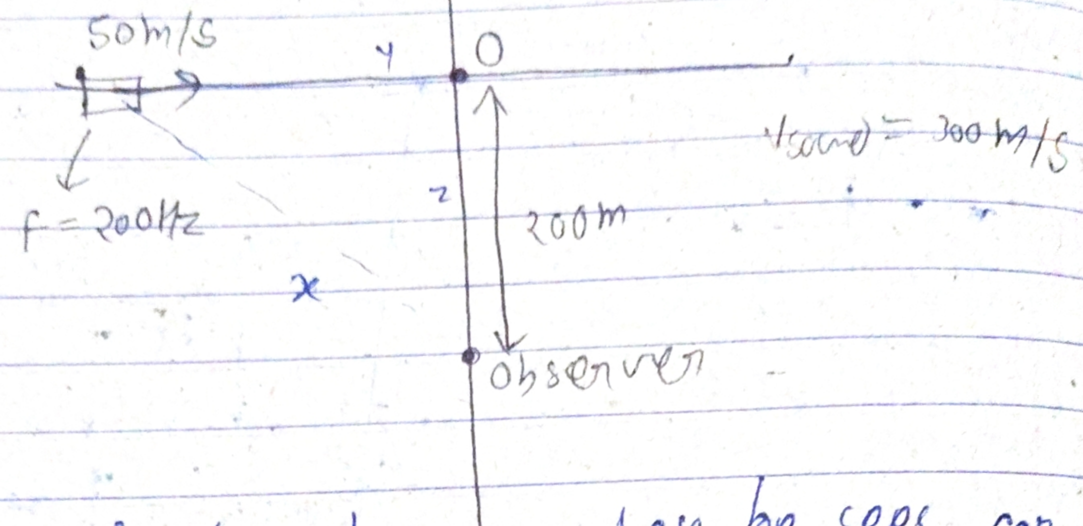
Q.



$$f' = \left(\frac{v - 50}{v - 20} \right) 200$$

$$= \frac{280}{310} \times 200 = 180.6$$

ex:



Q. (a) f Hearts by observer when he sees car at O:

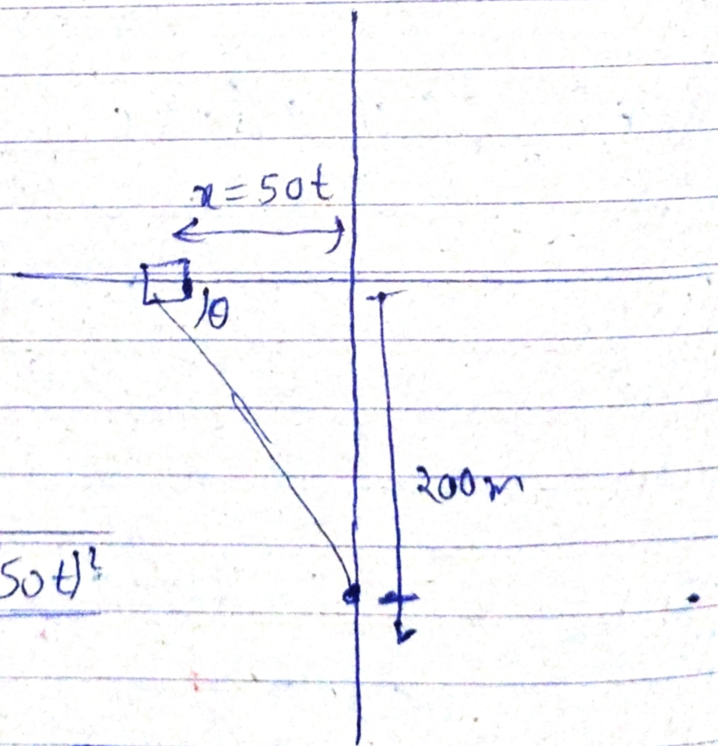
Ans $$f' = \left(\frac{v}{v - 50\cos\theta}\right) f$$

$x^2 = y^2 + z^2$ $\quad \therefore \frac{dy}{dt} = 50$

$2x\frac{dx}{dt} = 2y\frac{dy}{dt}$

$x\frac{dx}{dt} = y\frac{dy}{dt}$

$\frac{dx}{dt} = \frac{y}{x} 50$



$$t = \frac{\sqrt{(200)^2 + (50t)^2}}{300}$$

t आ जाएगा तो θ आ जाएगा

$t^2 (300)^2 = (200)^2 + (50t)^2$

$t^2 (300^2 - 50^2) = 200^2$

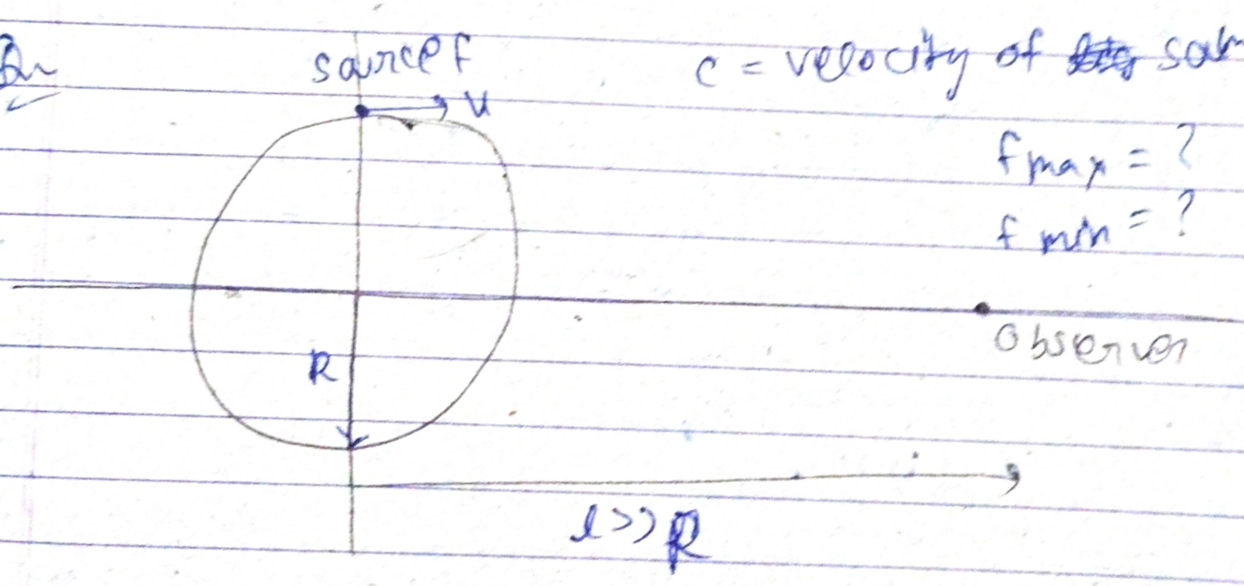
$t^2 = \frac{200 \times 200}{300 \times 300 - 50 \times 50} =$

(b) what is the distance of car from O when observer Heardz 200 f.

$t = \frac{200}{300} = \frac{2}{3}$

$d = 50 \times \frac{2}{3} = \frac{100}{3}$ m Ans.

Q.



c = velocity of sound

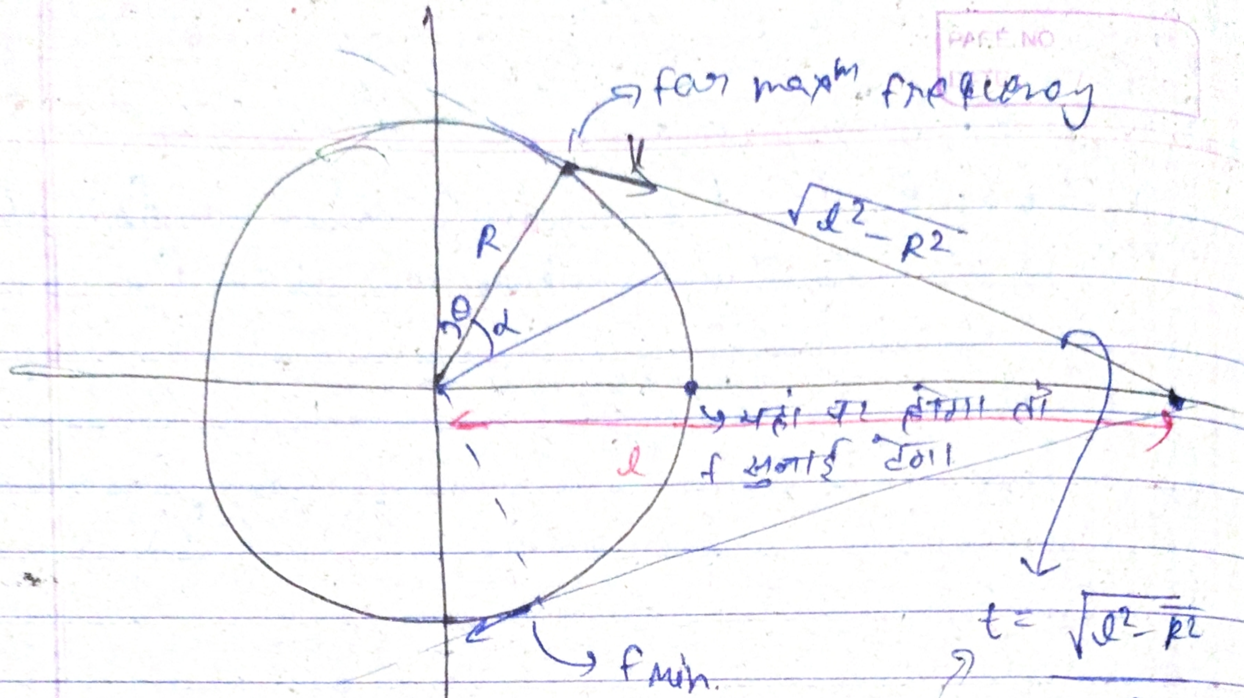
$f_{max} = ?$

$f_{min} = ?$

$f_{max} = \left(\frac{c}{c-v}\right) f$

$f_{min} = \left(\frac{c}{c+v}\right) f$

ex

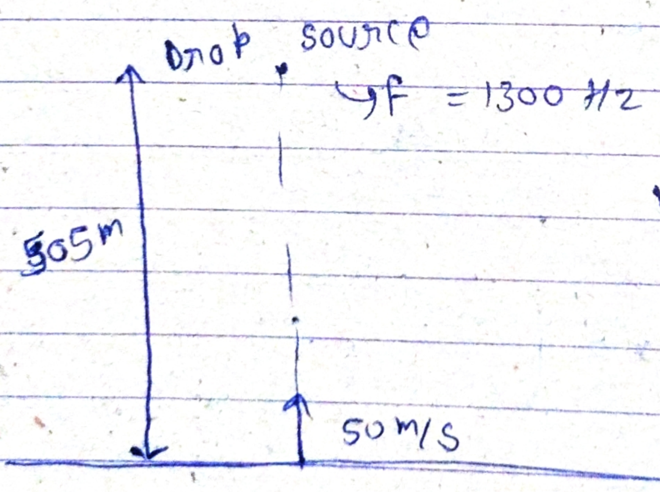


$$t = \frac{\sqrt{l^2 - R^2}}{c}$$

$$\alpha = \frac{vt}{R}$$

---

ex



$V_{sound} = 300\ m/s$

find frequency heard by dector at 5s.