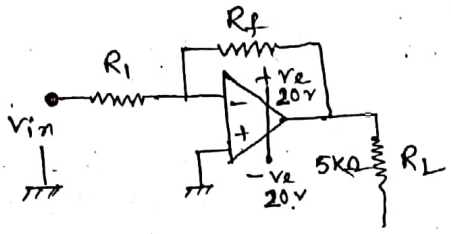
Q. Determine the maximum operating frequency for the circuit diagram. The slew rate is 0.5 V/μS, V_{pp} = ~~8V~~ 16V (Given). (CU 2000)



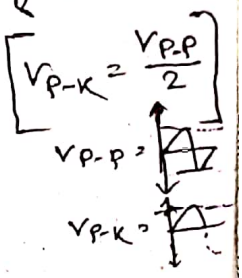
[peak to peak]

Ans: As the maximum output voltage (V_{PP}) = ~~8V~~ 16V

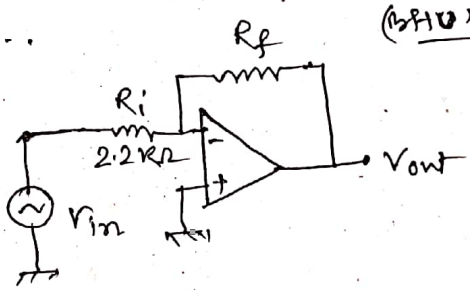
So, therefore maximum operating frequency (f_{max})

$$f_{max} = \frac{\text{Slew Rate}}{2\pi V_{p-k}} = \frac{0.5\ V/\mu S}{2\pi \times 8} = \frac{500}{2\pi \times 8}\ KHz = 9.95\ KHz.$$

$$V_{p-k} = \frac{V_{p-p}}{2}$$



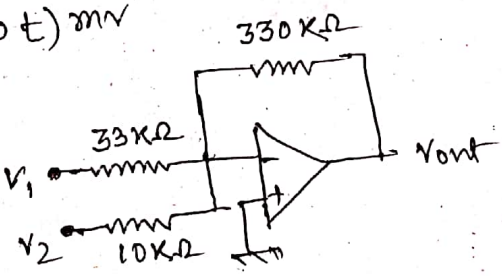
Q 2. For Given OPAMP configuration.. Determine the value of Rf required to produce a closed loop voltage gain of −100 (BHU '09)



Ans: $A_{CL} = -\frac{R_f}{R_i} \Rightarrow -100 = -\frac{R_f}{2.2}$

$R_f = 100 \times 2.2\ K\Omega = 220\ K\Omega$

Q 3. Calculate the output voltage for the circuit diagram. The inputs are $V_1 = 50 \sin(1000t)$ mV, $V_2 = 10 \sin(3000t)$ mV (CU 2006)



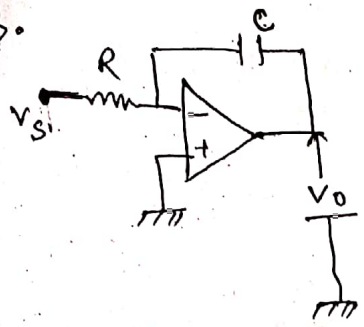
Ans: The o/p voltage of the circuit —

$$V_{out} = -\left(\frac{R_f}{R_1} V_1 + \frac{R_f}{R_2} \cdot V_2\right)$$

$$= -\left[10V_1 + 33V_2\right] = -\left[10 \times 50 \sin(1000t) + 33 \times 10 \sin(3000t)\right] \text{ mV}$$

$$= -\left[0.5 \sin(1000t) + 0.33 \sin(3000t)\right] V$$

Q.



Suppose a sinusoidal signal $V_S = 10 \sin 2000\pi t$ mV is applied to the input of the OPAMP integrator $R = 1.M\Omega$ and $C = 1\mu F$. Find the output voltage ? (DU)

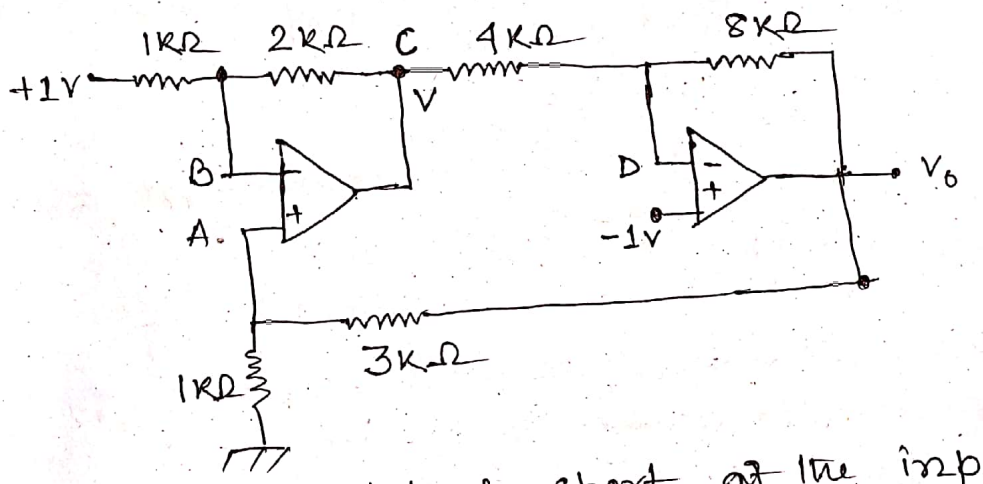
Ans!

$$V_0 = -\frac{1}{RC}\int_0^t V_S\,dt = \frac{1}{(1\mu F)(1M\Omega)}\int_0^t 10\sin 2000\pi t\,dt \text{ mV}$$

$$= -0.10\left[\frac{-\cos 2000\pi t}{2000\pi}\right]_0^t \text{ mV}$$

$$= \frac{1}{200\pi}\left[\cos 2000\pi t - 1\right] \text{ mV}$$

Q. Find the output voltage V_0 in the circuit. (Gate 01)



Ans: Due to the virtual short at the input of the OPAMP we must have,

- $V_B = V_A = \frac{V_0 \times 1}{1+3} = \frac{V_0}{4}$
- $V_D = -1V$

So, let the voltage at C be V

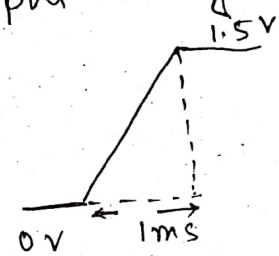
Now Assuming infinite input impedence of the OPAMP s, we can say that almost same current passes through the resistor 1KΩ and 2KΩ

∴ So, $\frac{1-V_B}{1K\Omega} = \frac{V_B - V}{2K\Omega} \Rightarrow \boxed{\frac{1-V_0/4}{1} = \frac{V_0/4 - V}{2}}$ —(1)

Similarly, $\frac{V-V_D}{4} = \frac{V_D - V_0}{8} \Rightarrow \boxed{\frac{V+1}{4} = \frac{-1-V_0}{8}}$ —(1')

from solving above two eqn we get $V_0 = 0.4V$

Q 6. A ramp voltage of 1.5V/ms is applied to an OP-AMP differentiator with $R = 2K\Omega$ and $C = 0.01\mu F$ Find the output voltage and its waveform.



Ans: From figure, $\frac{dV_s}{dt} = 1.5\ V/ms$, within the 1ms range

$= 0$; outside the 1ms range.

Now, the output,

$V_0 = -RC\frac{dV_s}{dt}$

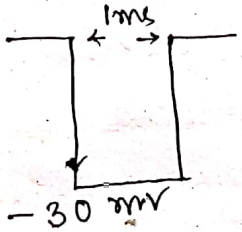
$= -(0.01\mu F)(2K\Omega) \times 1.5\ V/ms$

$= -0.03V$

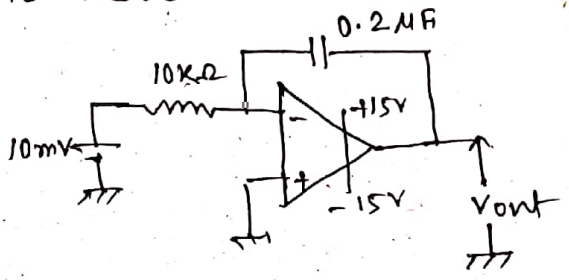
$= -30mV$ with in the 1ms range.

and, $V_0 = 0$, without 1ms range.

Thus the resultant waveform,



Q.7. For the integrator circuit. How long it take for the output to reach saturation? (DU 09)



Soln:

Output voltage, $V_{out} = -\frac{1}{RC}\int_0^t V_{in}\,dt$

As, the input voltage $V_{in}(= 10mV)$ is constant

$V_{out} = -5t$ volts

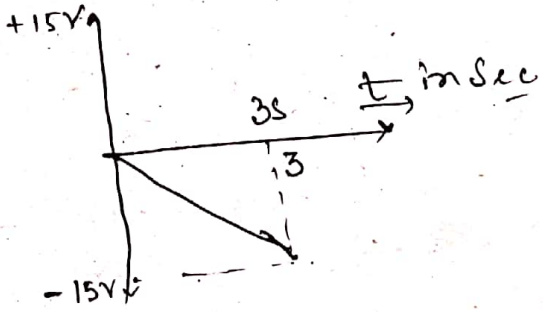
Now, the theoritical saturation voltage is 15V as it is the negetive supply

$V_S = -15V$

So, $V_S = V_{out}$

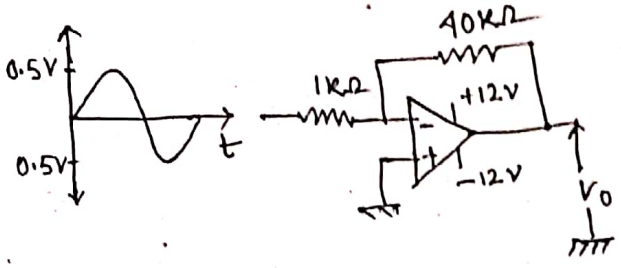
$-15 = -5t$

$t = 3S$



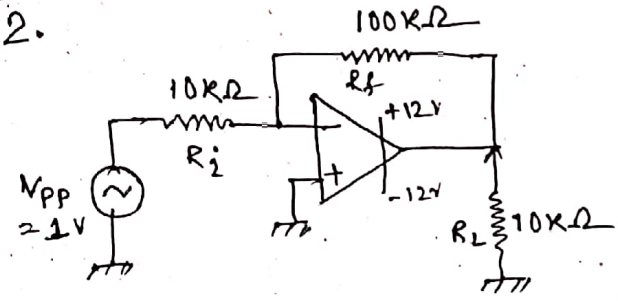
Assignment: 5×4 = 20 Mark

Q1. Find the output voltage for the circuit? (1 and output wave from also drawn) (IISC '02)



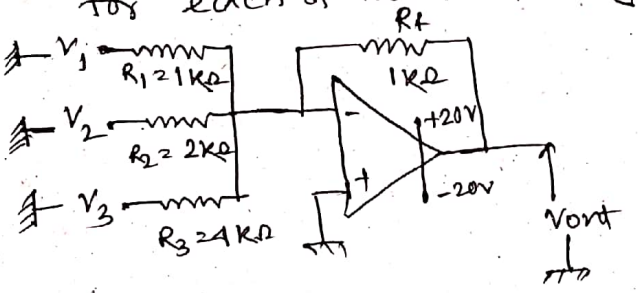
V_o = ? (4)

Q2.



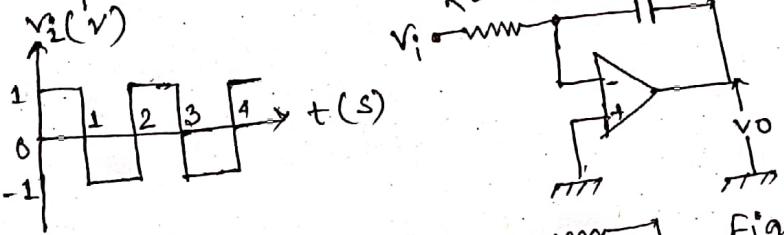
For the circuit.
i) What is the closed loop gain?
ii) Input impedence of the circuit?
iii) the maximum operating frequency when slew Rate is 0.5 V/μs. (4)

Q3. Determine the output voltage from the circuit for each of the following input combinations. (4)



V_1 (V)	V_2 (V)	V_3 (V)
+10	0	+10
0	+10	+10
+10	+10	+10

Q4. For the OPAMP integrator and the square wave input. Find the output voltage (Draw wave from output) (4) [CU Entrance Test]



Q5.

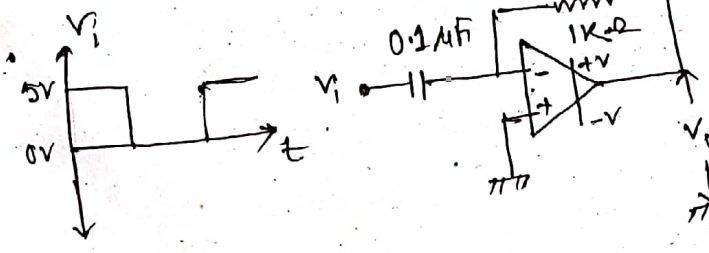


Figure shows the square wave input to a differentiator circuit. Find the output voltage if input goes from 0V to 5V in 0.1 ms. [RAT]