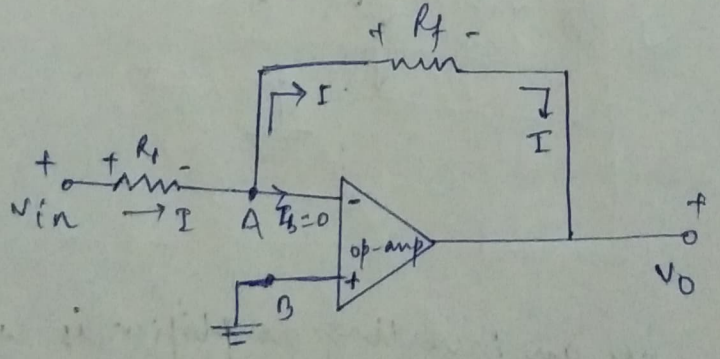
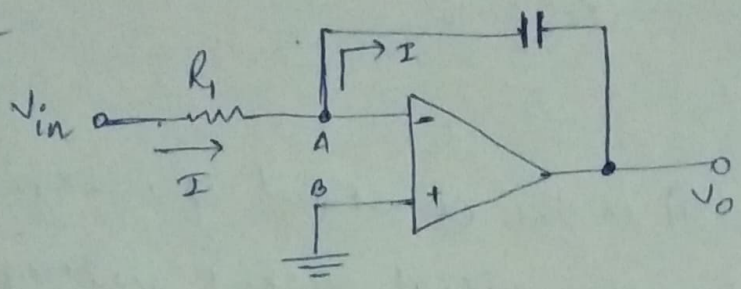
Ans:-

- The output is inverted with respect to input, which is indicated by minus sign. for inverting amplifier.
- The voltage gain depends on the ~~ratio~~ ratio of the two resistances. Hence, selecting $R_f$ and $R_1$, the required value of gain can be ~~as~~ easily obtained.
- If the ratio of $R_f$ and $R_1$ is K, which is other than one, the circuit is called Scale Changer.
- Inverting amplifier functions as scale changer through small signals with constant gain



Ques 10. Draw the circuit diagram of the op-amp integrator and derive the expression for its output voltages and list all the applications of it.

Ans :-




Op-amp integrator

From the input side we can write,

$$I = \frac{V_{in} - V_A}{R_1} = \frac{V_{in}}{R_1}$$

From output side, we can write,

$$I = C_f \frac{d(V_A - V_0)}{dt}$$

i.e. $$I = -C_f \frac{dV_0}{dt}$$

Equating the two equations (1) and (2)

$$\frac{V_{in}}{R_1} = -C_f \frac{dV_0}{dt}$$

Integrating both sides,

$$\int_0^t \frac{V_{in}}{R_1} dt = -C_f \int \frac{dV_0}{dt} \cdot dt$$

i.e. $\int_0^t \frac{V_{in}}{R_1} dt = -C_f V_o$

$\therefore V_o = -\frac{1}{R_1 C_f} \int_0^t V_{in} dt + V_o(0)$

where $V_o(0)$ is the constant of integration, indicating the initial output voltage.

The applications of op-amp integrator are as follows:-

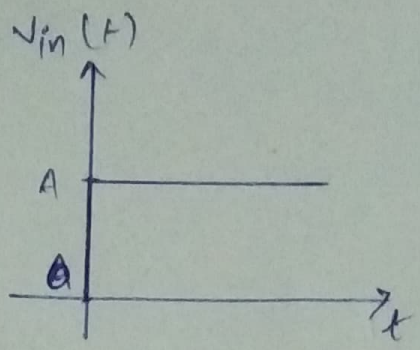
1) Calculus operations in analog computers.
2) ramp generators
3) wave shaping circuits,
4) A/D converters.
5) In solving the differential equations.

Ques 11: Draw the output waveforms of op-amp differentiator if its input waveform is

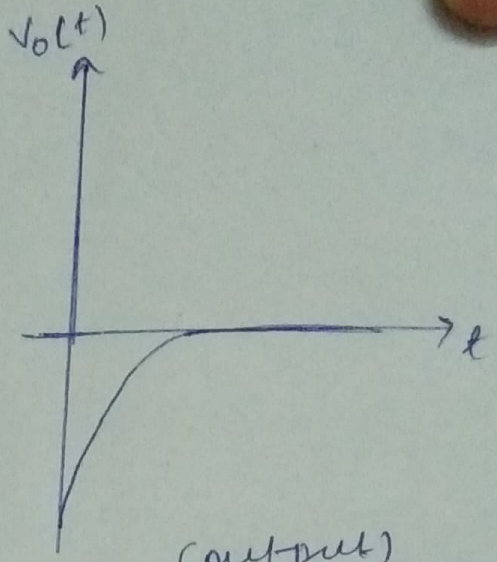
(a) Step signal
(b) Square wave
(c) Sine signal.

Ans: (a)

Step signal

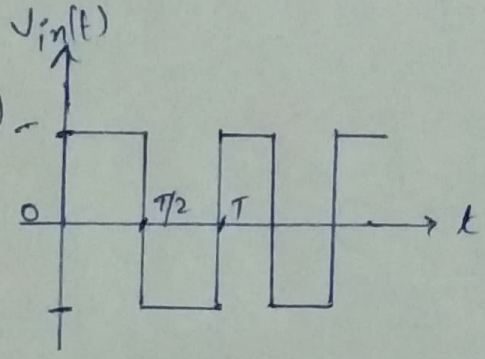



(input)

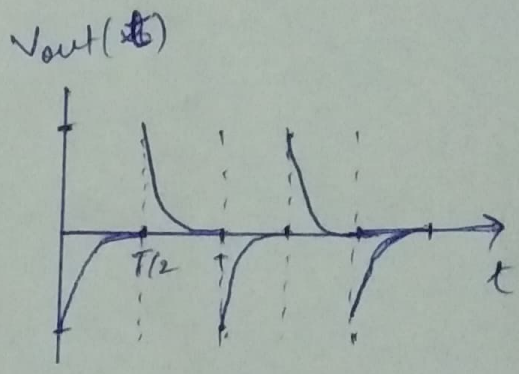



(output)

(b) Square wave

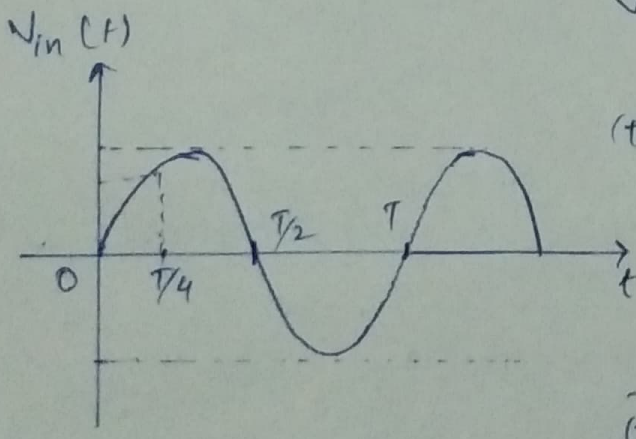



Input

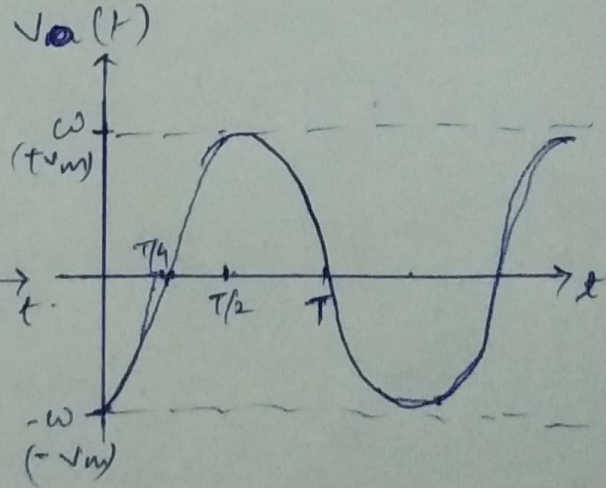



output

(c) Sine signal.




Input




output.