

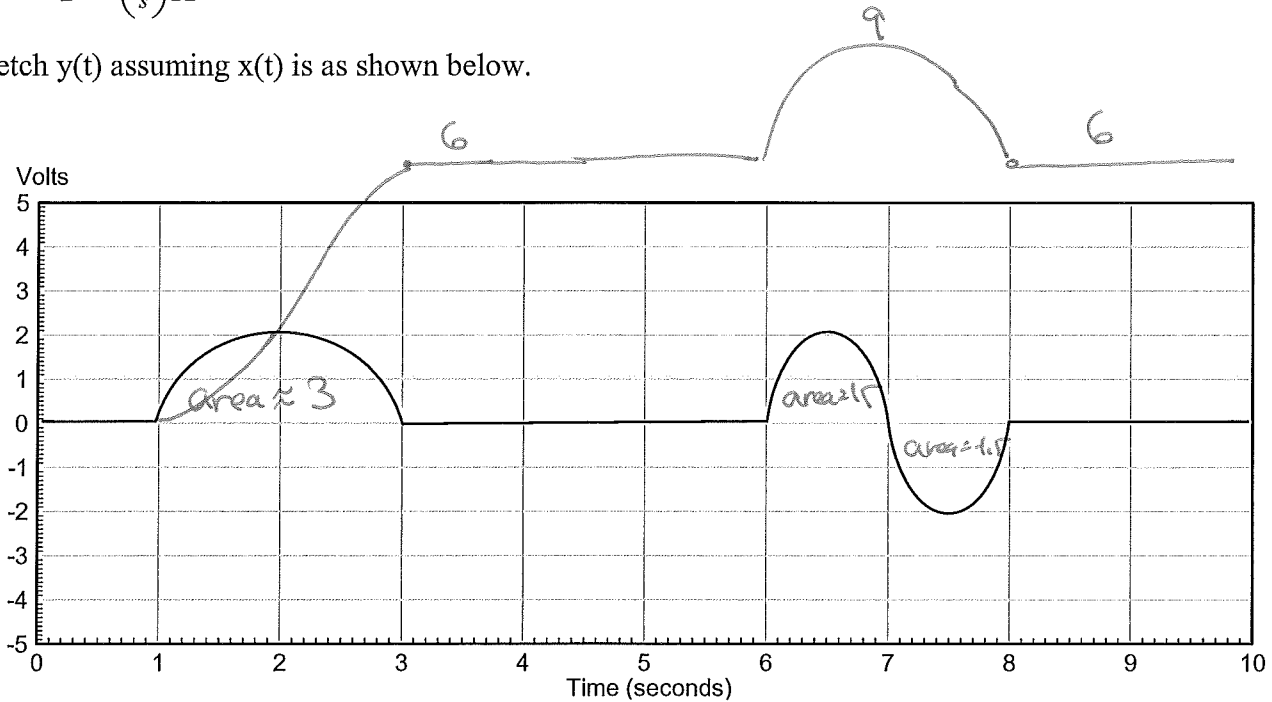
ECE 321 - Quiz #3: Name _____

Filters. April 21, 2016

1a) An integrator circuit has the following transfer function:

$$Y = \left(\frac{2}{s}\right)X$$

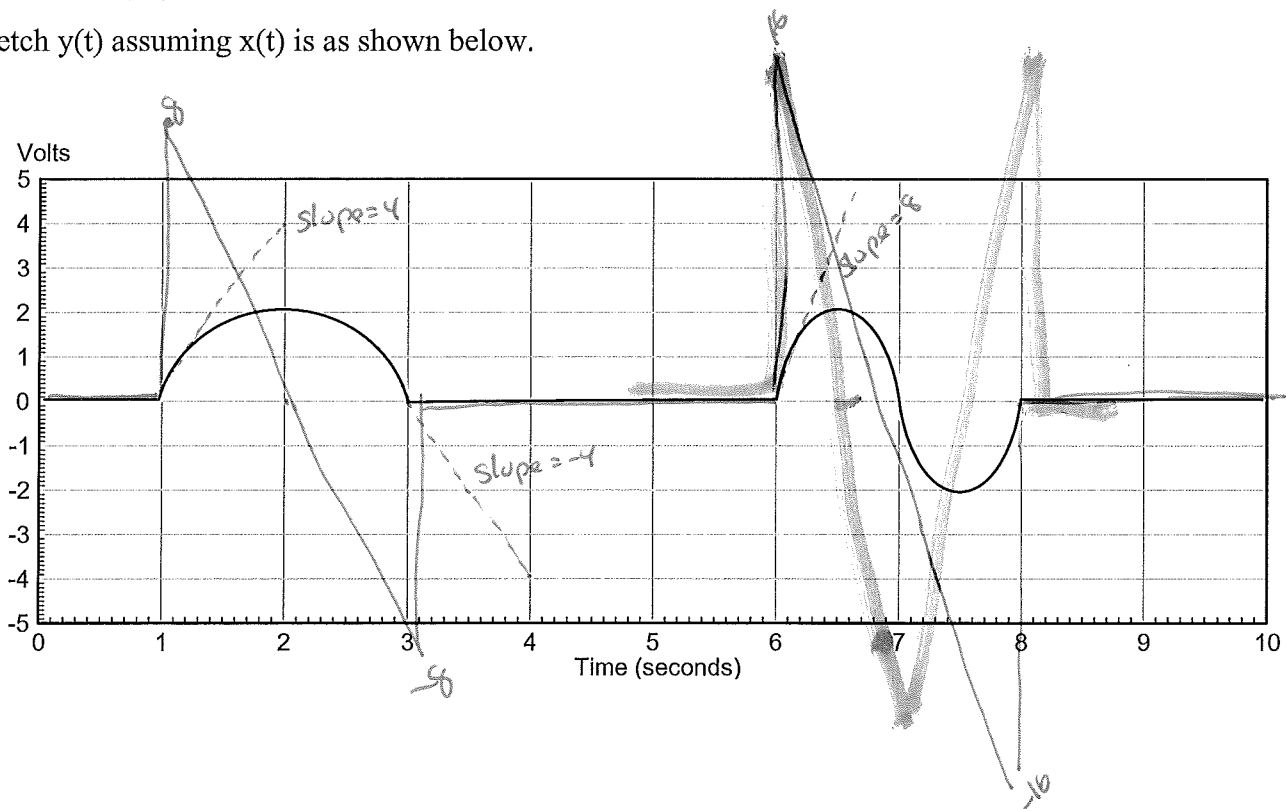
Sketch $y(t)$ assuming $x(t)$ is as shown below.



1b) A differentiator circuit has the following transfer function:

$$Y = (2s)X$$

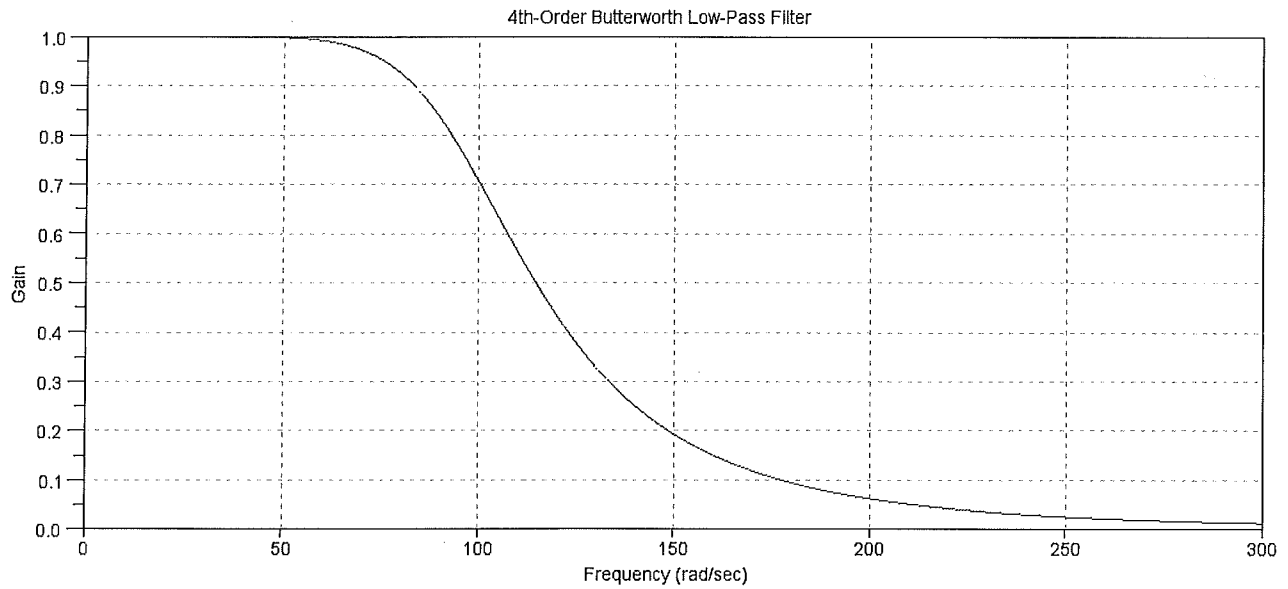
Sketch $y(t)$ assuming $x(t)$ is as shown below.



2) Give the transfer function for a 4th-order Butterworth filter with

- A DC gain of one and
- A corner at 100 rad/sec

$$G(s) = \frac{100^4}{(s+100 \angle \pm 22.5^\circ)(s+100 \angle \pm 67.5^\circ)}$$



3) The transfer function for a 3rd-order Chebychev filter with a corner at 1 rad/sec is

$$Y = \left(\frac{\alpha}{(s+0.85)(s+1.21\angle 69^\circ)(s+1.21\angle -69^\circ)} \right) X = \left(\frac{\alpha}{(s+0.85)(s^2+0.86s+1.46)} \right) X$$

Give the transfer function for a 3rd-order Chebychev filter with

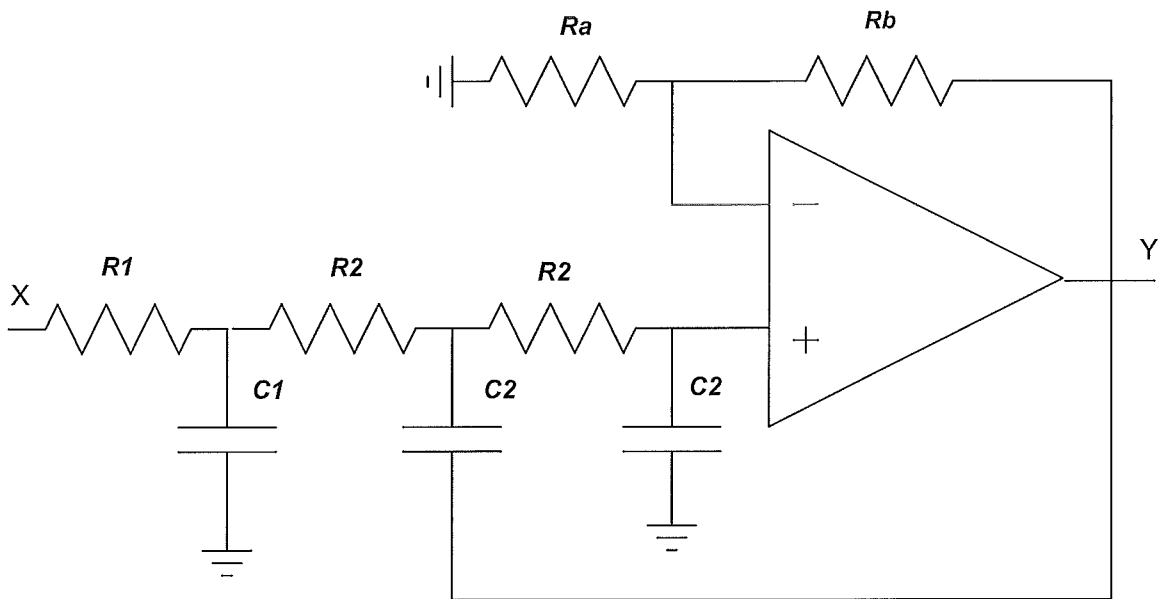
- A corner at 100 rad/sec and
- A DC gain of 10

$$\frac{10 \cdot (85)(121)^2}{(s+85)(s+121\angle 69^\circ)(s+121\angle -69^\circ)}$$

4) Determine R and C to implement the following Chebychev filter:

$$Y = \left(\frac{\alpha}{(s+170)(s+206 \angle \pm 69^\circ)} \right) X = \left(\frac{\alpha}{(s+170)(s^2+172s+206^2)} \right) X$$

R1	C1	R2	C2	Ra	Rb
5882	1uF	4854	1uF	100K	116.5K



$$\left(\frac{1/R_1 C_1}{s+1/R_1 C_1} \right) \left(\frac{k \left(\frac{1}{R_2 C_2} \right)^2}{s^2 + \left(\frac{3-k}{R_2 C_2} \right) s + \left(\frac{1}{R_2 C_2} \right)^2} \right) \quad k = 1 + \frac{R_b}{R_a}$$

$$(3-k)(206) = 172$$

$$3-k = .835$$

$$k = 2.165$$

$$\frac{R_b}{R_a} = 1.165$$

