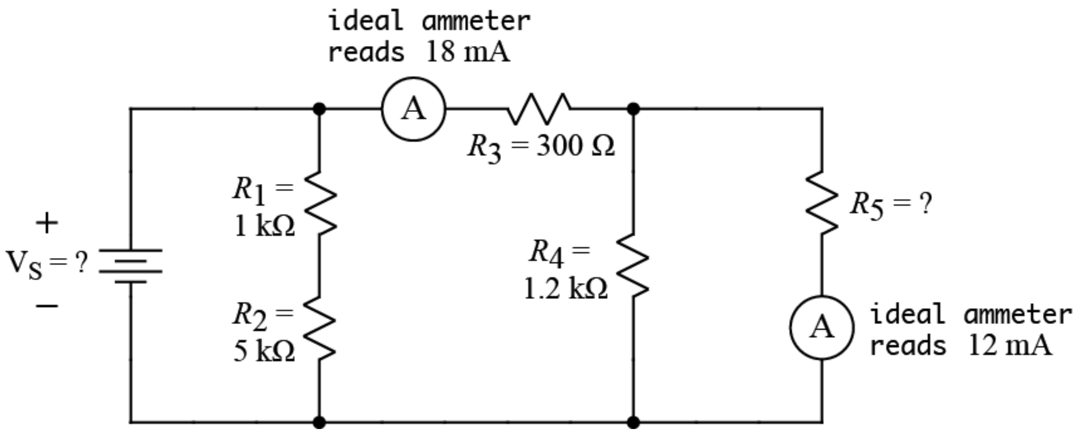
1.



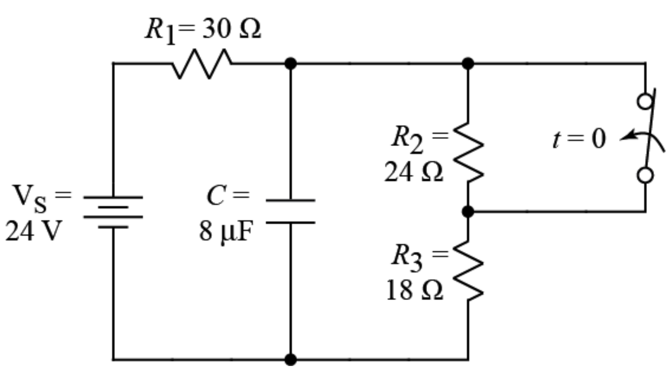
Find the values of the following quantities of the above circuit.

a) R_5

b) V_S

c) P_S (the power delivered by the V_S source)

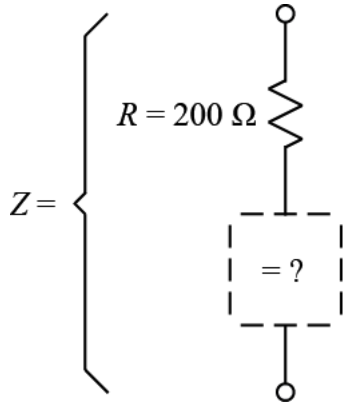
2.



The switch has been open for a long time and is closed (as shown) at $t = 0$.

Find the initial and final conditions and write the full expression for $v_C(t)$, including all the constants that you find.

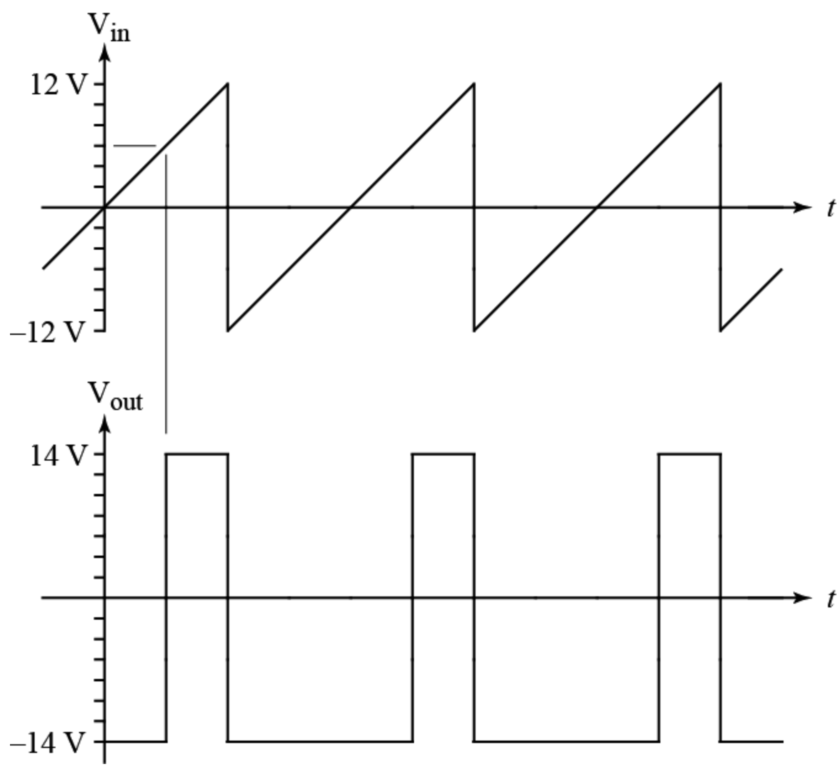
3.



The total impedance of the above circuitry is $Z = |Z|e^{j40°}$. We don't know the magnitude of Z, but its phase angle is +40°. Z is made of a 200Ω resistor in series with one other part. What is that part? Give the type and value of the part, and draw the combination.

$\omega = 3000$ rad/sec

4.



Using op-amps, power supplies, and resistors, draw a circuit to produce V_{out} from V_{in}. (Assume you have a function generator that produces V_{in} for you to use.) Show all relevant information in your circuit, including power supply voltages for op-amps.

5. Write a Matlab® function called `grades` that prints out the letter grade for a student based on the percent of possible points the student has earned during a semester. Use the classic grade scale used for this course (see Syllabus): 93% or higher = A, 90% or higher = A-, 87% or higher = B+, 83% or higher = B, etc.

6. Write a Matlab function called `RCplot` that plots the voltage on a capacitor versus time. Specifically, `RCplot` does the following:
   i) Accepts three input values: `Vzero`, `Vinf`, and `tau` representing the initial voltage on the capacitor, the final voltage on the capacitor, and the time constant in the standard formula for capacitor voltage: $vC = v\inf + (vzero - v\inf)e^{-t/\text{tau}}$
   ii) Test whether `tau` is negative and, if so, prints an error message and returns to the calling program.
   iii) Creates an array called `t` containing time values from 0 to 1 ms (i.e., 0.001 sec) (inclusive) spaced by 1 μsec (i.e., 10^{-6} seconds).
   iv) Creates an array called `vC` containing capacitor voltage for each time in array `t`. (Use the standard formula for v_C, above.)
   v) Plots v_C versus t as a blue line on an x-y plot.
   vi) Labels the x-axis as "time", the y-axis as "voltage", and titles the plot "Capacitor Voltage".

7. Write a Matlab® script file that does the following:
   i) Loads the sound file for Handel's Messiah into variable `y`.
   ii) Shortens `y` to 8000 samples.
   iii) Computes the Fast Fourier Transform (FFT) of `y` and stores it in `yfft`. (The values in `yfft` represent frequency content for frequencies 0 to 7999 Hz.)
   iv) Multiplies the samples in `yfft` by the following function:

$$F(f) = \begin{cases} 1 + \dfrac{f}{2000} & 0 \le f \le 3999 \\ 1 + \dfrac{8000 - f}{2000} & 4000 \le f \le 7999 \end{cases}$$

   where f is the frequency of the sample in `yfft`.
   v) Takes the inverse FFT of the modified `yfft` and stores it in `yout`.
   vi) Plays the sound in `yout`.

8.
```
function mat_dist = word_dist(mat)

nrows = size(mat,1);
mat_dist = zeros(nrows);

  for ind1 = 1:size(mat,1)
    for ind2 = 1:size(mat,1)
      mat_dist(ind1,ind2) = sum(abs(mat(ind1,:)-mat(ind2,:)));
    end
  end
end
```

For the above Matlab® function, find the result of the following commands:

```
>> D = [1, 0, 1, 0; 0, 0, 1, 1; 1, 0, 0, 1; 0, 0, 0, 1];
>> wd = word_dist(D);
>> wd(find(wd(:,1)>0),:)
```

9.
```
function sys_out = conv_v(sys_in,imp_resp)
  sys_in2 = [sys_in, zeros(1,length(imp_resp)-1)];
  for ind = 1:length(sys_in);
    sys_out(ind) = sum(sys_in2(ind:ind+length(imp_resp)-1)...
                  .* imp_resp(end:-1:1));
  end
end
```

For the above Matlab® function, find the result of the following commands:

```
>> vin = [3, 2, 6, 2, 8, 0, 1];
>> h = [1, 0, -1];
>> vout = conv_v(vin,h)
```