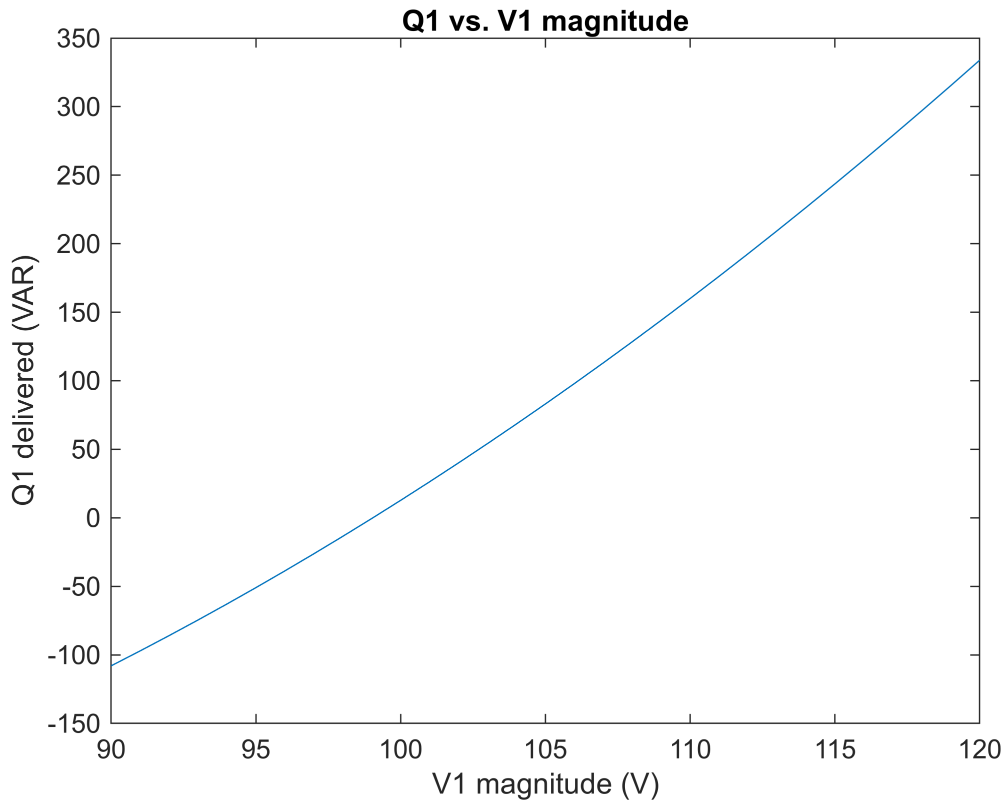
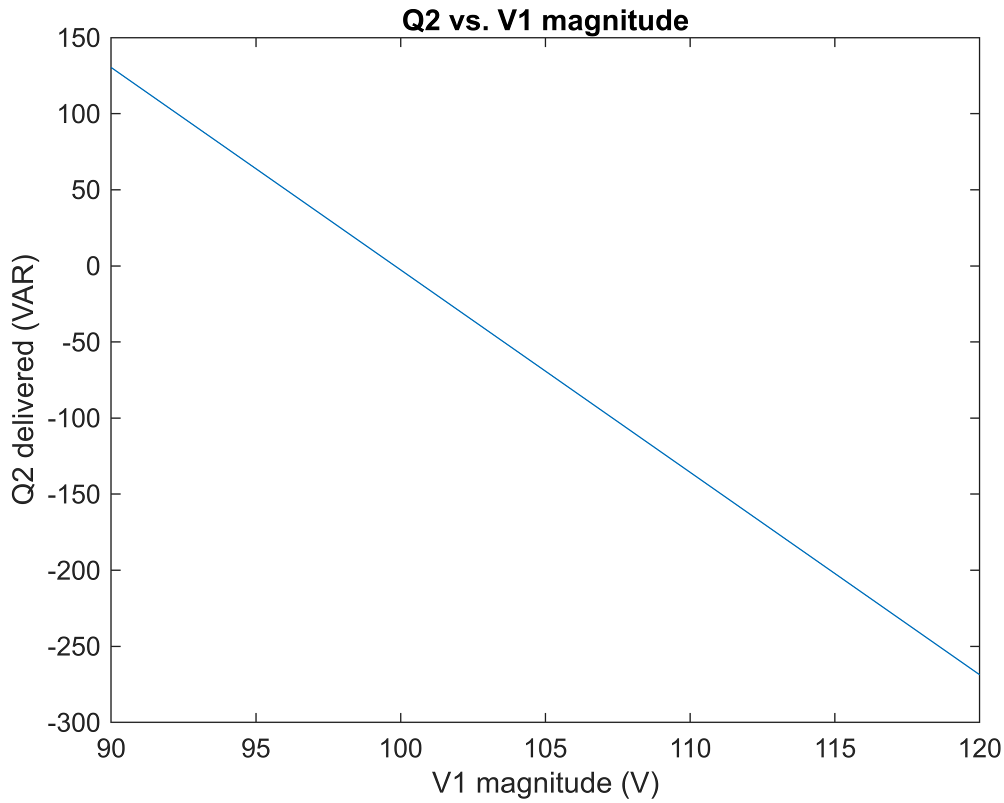
```
% a) Compute the complex power at point 1 and 2 and power losses of the line
V2 = 100;                                  % source V2 (V)
ZL = 0.5 + 7.5i;                           % line impedance (ohms)
magnitude = [90:120];                      % V1 magnitude from 75% (90) to 100% (120)
V1 = magnitude*(cosd(-5) + sind(-5)*i);    % source V1 (V)
VL = V1 - V2;                              % voltage across line impedance, ZL (V)
I12 = VL/ZL;                               % line current, I12 (A)
I21 = -I12;                                % line current, I21 (A)

P1 = real(V1.*conj(I12));          % real power delivered at point 1, Q1 (W)
Q1 = imag(V1.*conj(I12));          % reactive power delivered at point 1, Q1 (VAR)
P2 = real(V2.*conj(I21));          % real power delivered at point 2, Q2 (W)
Q2 = imag(V2.*conj(I21));          % reactive power delivered at point 2, Q2 (VAR)
PL = real(VL.*conj(I12));          % real power absorbed at line impedance (W)
QL = imag(VL.*conj(I12));          % reactive power absorbed at line impedance (VAR)


% b) Tabulate the reactive powers and plot Q1 Q2, QL, versus voltage magnitude V1.
T = table(rot90(magnitude, 3), rot90(Q1, 3), rot90(Q2, 3), rot90(QL, 3),
'VariableNames', {'V1 magnitude (V)', 'Q1 delivered (VAR)', 'Q2 delivered (VAR)',
'QL absorbed (VAR)'});
disp(T)
```

V1 magnitude (V)	Q1 delivered (VAR)	Q2 delivered (VAR)	QL absorbed (VAR)
90	-107.98	130.35	22.367
91	-97.101	117.05	19.946
92	-85.956	103.75	17.79
93	-74.545	90.445	15.9
94	-62.869	77.144	14.275
95	-50.927	63.843	12.916
96	-38.72	50.542	11.822
97	-26.247	37.241	10.994
98	-13.509	23.94	10.431
99	-0.50505	10.639	10.134
100	12.764	-2.6616	10.103
101	26.299	-15.963	10.336
102	40.099	-29.264	10.836
103	54.165	-42.564	11.6
104	68.496	-55.865	12.631
105	83.093	-69.166	13.926
106	97.955	-82.467	15.487
107	113.08	-95.768	17.314
108	128.48	-109.07	19.406
109	144.13	-122.37	21.764
110	160.06	-135.67	24.387
111	176.25	-148.97	27.276
112	192.7	-162.27	30.43
113	209.42	-175.57	33.85
114	226.41	-188.87	37.535
115	243.66	-202.18	41.485
116	261.18	-215.48	45.701
117	278.96	-228.78	50.183
118	297.01	-242.08	54.93
119	315.32	-255.38	59.942
120	333.9	-268.68	65.22

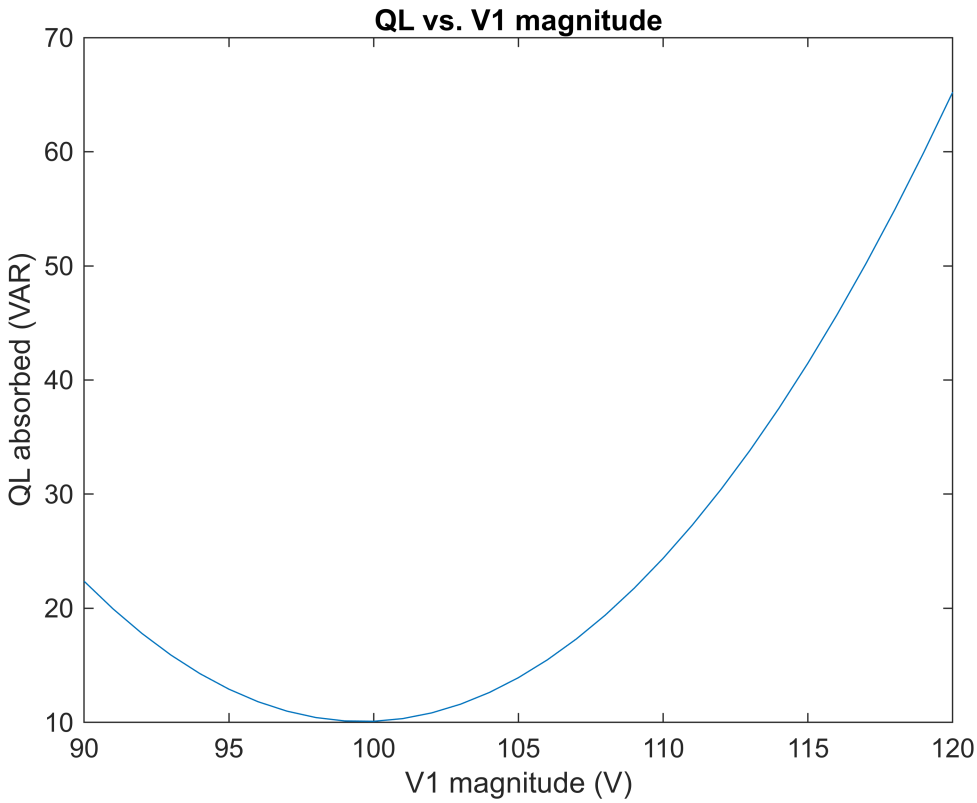
```
% Q1 vs. V1 plot
plot(magnitude, Q1)
title('Q1 vs. V1 magnitude')
xlabel('V1 magnitude (V)')
ylabel('Q1 delivered (VAR)')
```




```
% Q2 vs. V1 plot
plot(magnitude, Q2)
title('Q2 vs. V1 magnitude')
xlabel('V1 magnitude (V)')
ylabel('Q2 delivered (VAR)')
```




```
% QL vs. V1 plot
plot(magnitude, QL)
title('QL vs. V1 magnitude')
xlabel('V1 magnitude (V)')
ylabel('QL absorbed (VAR)')
```




```
% c) Make comments on the results

% The first plot (almost linear) shows that reactive power is first
% absorbed (negative) by point 1 before the magnitude of V1 reaches
% about 99V. Point 1 then delivers reactive power (positive) to the
% rest of the circuit.

% The second plot (linear) shows that reactive power is first delivered
% (positive) by point 2 till the magnitude of V1 reaches about 100V.
% Point 2 then absorbs reactive power (absorbs) from the rest of the circuit.

% The third plot shows that the line impedance only absorbs reactive power
% (always positive). However, this curve is parabolic where its lowest
% point is at 10 VAR and about 99-100V. Therefore, when points 1 and 2
% deliver the least amount of reactive power (from 99V to 100V), the line
% impedance is capable of absorbing all of the reactive power. This is
% because both points have similar voltage magnitudes (about 100V) and the
% line impedance is large enough to aborb the small phase difference of 5
% degrees between the two points.
```