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Module 14 Alex Yeoh Table 11

```
sympref('FloatingPointOutput',false); format short; format compact
```

4.33

```
clear all
syms I4 va RL
[va]=solve(-I4+va/10+va/(10+RL), va)
VTh = limit(va*RL/(10+RL), RL, Inf)
```

```

subs(VTh,I4,4)
%note: testVThEq is the same as VTh above (if the equation is desired) and
%testVTh is the same as ans when I4 is given a value. This way of doing
%things allows for I4 to still be symbolic and easily exchangable and the
%equation for VTh when I4 is symbolic to be easily found without the need
%to do a voltage divider before plugging it into a limit equation. However,
%this process seems to fail when there is no voltage divider equation
%needed for the limit.
testVThEq=subs(va,RL,Inf)
testVTh=subs(va,[RL,I4],[Inf,4])
% Find a second load-point, Pick RL = 5
V5 = subs(va,[RL,I4],[5,4]);
RTh = simplify((VTh - V5)/(V5/5))
IatR5 = (VTh-V5)/RTh
subs(IatR5,I4,4)
%

va =
I4/(1/(RL + 10) + 1/10)
VTh =
10*I4
ans =
40
testVThEq =
10*I4
testVTh =
40
RTh =
(25*I4)/12 - 5
IatR5 =
(10*I4 - 24)/((25*I4)/12 - 5)
ans =
24/5

```

4.37

```

clear all
syms I2 V120 va vb RL
[va, vb]=solve(I2+(va-vb)/40+va/12+va/RL, -I2+(vb-vb)/40+(vb-V120)/20, va, vb)
VTh=limit(va,RL,Inf)
subs(VTh,[I2,V120],[2,140])
% Find a second load-point, Pick RL = 10
V10 = limit(va,RL,10)
subs(V10,[I2,V120],[2,140])
RTh = simplify((VTh - V10)/(V10/10))
%

va =
(RL*V120 - 40*I2*RL)/(6*(RL + 10))
vb =
(2400*I2 + 120*V120 + 13*RL*V120 + 200*I2*RL)/(18*(RL + 10))
VTh =
V120/6 - (20*I2)/3
ans =

```

```

10
V10 =
V120/12 - (10*I2)/3
ans =
5
RTh =
10

```

4.39

```

clear all
syms I3 V24 va vb vc RL
[va, vb, vc]=solve((va-vb)/16+I3+va/RL, (vb-vb)/16+vb/5+(vb-vc)/10, -I3+(vc-
vb)/10+(vc-V24)/10, va, vb, vc)
VTh=limit(va,RL,Inf)
subs(VTh,[I3,V24],[3,24])
% Find a second load-point, Pick RL = 10
V10 = limit(va,RL,10)
subs(V10,[I3,V24],[3,24])
RTh = simplify((VTh - V10)/(V10/10))
%

va =
(RL*V24 - 90*I3*RL)/(5*(RL + 20))
vb =
(160*I3 + 16*V24 + RL*V24 - 10*I3*RL)/(5*(RL + 20))
vc =
(580*I3 + 58*V24 + 3*RL*V24 + 20*I3*RL)/(5*(RL + 20))
VTh =
V24/5 - 18*I3
ans =
-246/5
V10 =
V24/15 - 6*I3
ans =
-82/5
RTh =
20

```

4.47

```

clear all
syms V30 va vx RL
[va, vx]=solve((va-V30)/12+va/60+2*vz+va/RL, va-vx, va, vx)
VTh=limit(va,RL,Inf)
subs(VTh,V30,30)
% Find a second load-point, Pick RL = 10
V10 = limit(va,RL,10)
subs(V10,V30,30)
RTh = simplify((VTh - V10)/(V10/10))
%

va =

```

```

(5*RL*V30)/(6*(21*RL + 10))
vx =
(5*RL*V30)/(6*(21*RL + 10))
VTh =
(5*V30)/126
ans =
25/21
V10 =
(5*V30)/132
ans =
25/22
RTh =
10/21

```

4.50 position of 5# and 4A were swapped and 4A was included in the node equations

```

clear all
syms I2 I4 V12 va vb RL
[vb,va]=solve(-I2+vb/4+(vb-(V12+va))/6, ((va+12)-vb)/6-I4+va/RL, vb, va)
VTh=limit(va,RL,Inf)
subs(VTh,[RL,I2,I4,V12],[Inf,2,4,12])
% Find a second load-point, Pick RL = 5
V5 = limit(va,RL,5)
subs(V5,[RL,I2,I4,V12],[5,2,4,12]);
RTh = simplify((VTh - V5)/(V5/5))
IatR5 = (VTh-V5)/RTh
subs(IatR5,[I2,I4,V12],[2,4,12])
%

vb =
(2*(36*I2 - 12*RL + 6*V12 + RL*V12 + 6*I2*RL + 6*I4*RL))/(3*(RL + 10))
va =
(2*RL*(6*I2 + 15*I4 + V12 - 30))/(3*(RL + 10))
VTh =
4*I2 + 10*I4 + (2*V12)/3 - 20
ans =
36
V5 =
(4*I2)/3 + (10*I4)/3 + (2*V12)/9 - 20/3
RTh =
10
IatR5 =
(4*I2)/15 + (2*I4)/3 + (2*V12)/45 - 4/3
ans =
12/5

```

4.52

```

clear all
syms V6 va io RL

```

```

[va, io]=solve(20*io+va/2000+va/RL, V6/3000-io, va, io)
VTh=limit(va,RL,Inf)
subs(VTh,V6,6)
% Find a second load-point, Pick RL = 10
V10 = limit(va,RL,10)
subs(V10,V6,6)
RTh = simplify((VTh - V10)/(V10/10))
%

va =
-(40*RL*V6)/(3*(RL + 2000))
io =
V6/3000
VTh =
-(40*V6)/3
ans =
-80
V10 =
-(40*V6)/603
ans =
-80/201
RTh =
2000

```

4.53

```

clear all
syms V18 va vb vo RL
[va, vb, vo]=solve(0.25*vo+(va-vb)/2+va/RL, -0.25*vo+(vb-vb)/2+vb/3+(vb-
V18)/6, vb-vo, va, vb, vo)
VTh=limit(va,RL,Inf)
subs(VTh,V18,18)
% Find a second load-point, Pick RL = 10
V10 = limit(va,RL,10)
subs(V10,V18,18)
RTh = simplify((VTh - V10)/(V10/10))
%

va =
(RL*V18)/(6*(RL + 3))
vb =
(V18*(RL + 2))/(3*(RL + 3))
vo =
(V18*(RL + 2))/(3*(RL + 3))
VTh =
V18/6
ans =
3
V10 =
(5*V18)/39
ans =
30/13
RTh =
3

```

4.71

```
clear all
syms V8 va vo RL
[va, vo]=solve((va+120*vo)/10000+va/40000+va/RL, 8*1000/(3000+1000)-vo, va,
    vo)
VTh=limit(va,RL,Inf)
subs(VTh,V8,8)
% Find a second load-point, Pick RL = 10
V10 = limit(va,RL,10)
subs(V10,V8,8)
RTh = simplify((VTh - V10)/(V10/10))
%

va =
-(192*RL)/(RL + 8000)
vo =
2
VTh =
-192
ans =
-192
V10 =
-64/267
ans =
-64/267
RTh =
8000
```

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