ECE 35, Fall 2024

Quiz 1

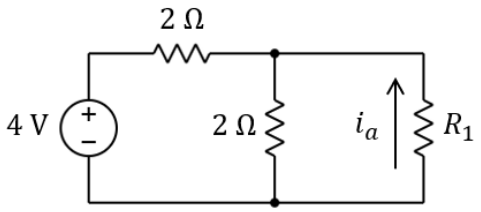
/ 12

Your sequence number	
Last name	
First + middle name(s)	
PID	

Instructions:

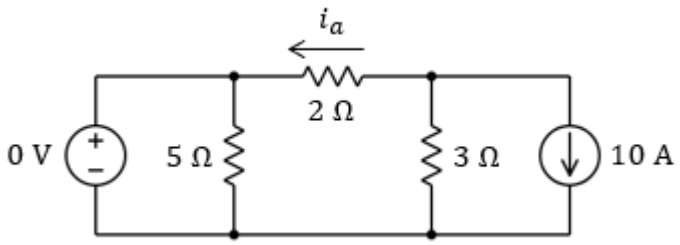
- Read each problem completely and thoroughly before beginning
- All calculations need to be done on these sheets
- Write your answers in the answer boxes for each question. Make sure you list units!
- Answers without supporting calculations will receive zero credit

(1) *(1 point)* How can you connect an ammeter to measure i_a, which is the current through resistor R_1? **Redraw** the circuit so that it shows how to connect the ammeter. Do not forget to indicate the red and black terminals.



(2) *(2 points)* What is the current i_a?

i_a [ ]



(3) *(4 points)* In the problem below, the voltmeter is ideal.

(a) What is the reading *X* of the voltmeter?

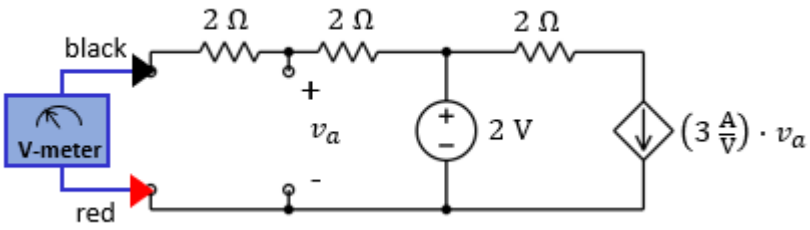
(b) What is the power P_1 supplied by the independent source?

(c) What is the power P_2 supplied by the dependent source?

X ____

P_1 ____

P_2 ____

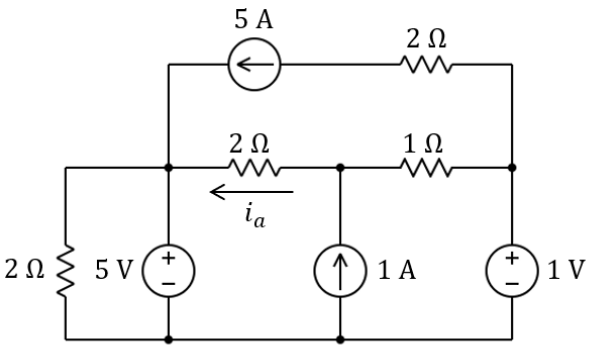


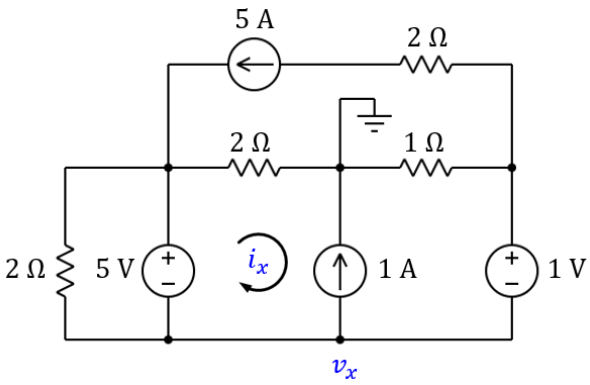
(4) *(5 points)* For this problem, you can use any analysis method you like. To maximize your opportunity for partial credit, lay out your equations first before solving.
Hint: Think carefully about your analysis method.

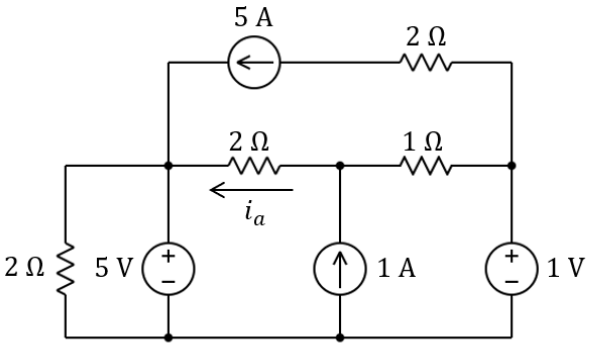
(a) What is the current i_a in the circuit on the left? i_a [ ]

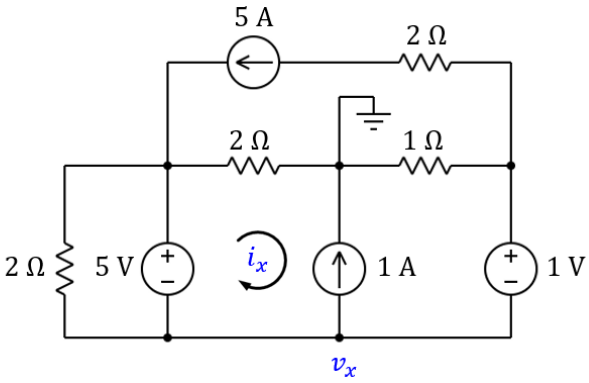
(b) What is the node voltage v_x in the circuit on the right? This is the same circuit as the one on the left, just with the ground added. v_x [ ]

(c) What is the mesh current i_x in the circuit on the right? i_x [ ]






5 A
2 Ω
2 Ω
1 Ω
i_a
2 Ω
5 V
1 A
1 V


5 A
2 Ω
2 Ω
1 Ω
i_x
2 Ω
5 V
1 A
1 V
v_x

ECE35 Equation Sheet

Basics: $i \triangleq \frac{dq}{dt}$ $v_{ab} \triangleq \frac{dw}{dq}$ $R = \rho\frac{l}{A}$

Capacitors: $C = \epsilon \cdot \frac{A}{d}$ $Q = C \cdot v$ $w_C = \frac{1}{2}Cv^2$

Inductors: $L = \mu \cdot \frac{N^2 A}{l}$ $B \sim i$ $w_L = \frac{1}{2}Li^2$

AC power: $p(t) = \frac{1}{2}V_m I_m \cdot \cos(\theta_v - \theta_i) + \frac{1}{2}V_m I_m \cdot \cos(2\omega t + \theta_v + \theta_i)$

$P = \frac{1}{2}V_m I_m \cos(\theta_v - \theta_i)$ $Q = \frac{1}{2}V_m I_m \sin(\theta_v - \theta_i)$ $X_{rms} = \sqrt{\frac{1}{T}\int_0^T x(t)^2 dt}$

Trigonometry:

$\sin(-\alpha) = -\sin(\alpha)$ $\cos(-\alpha) = \cos(\alpha)$

$\sin(\pi - \alpha) = \sin(\alpha)$ $\cos(\pi - \alpha) = -\cos(\alpha)$

$\sin\left(\frac{\pi}{2} - \alpha\right) = \cos(\alpha)$ $\cos\left(\frac{\pi}{2} - \alpha\right) = \sin(\alpha)$

$\sin\left(\alpha - \frac{\pi}{2}\right) = -\cos(\alpha)$ $\cos\left(\alpha - \frac{\pi}{2}\right) = \sin(\alpha)$

$\sin(2\alpha) = 2\sin(\alpha)\cos(\alpha)$ $\cos(2\alpha) = \cos^2(\alpha) - \sin^2(\alpha)$

$\sin(\alpha \pm \beta) = \sin(\alpha)\cos(\beta) \pm \cos(\alpha)\sin(\beta)$

$\cos(\alpha \pm \beta) = \cos(\alpha)\cos(\beta) \mp \sin(\alpha)\sin(\beta)$

$\sin(\alpha)\sin(\beta) = 0.5 \cdot (\cos(\alpha - \beta) - \cos(\alpha + \beta))$

$\cos(\alpha)\cos(\beta) = 0.5 \cdot (\cos(\alpha - \beta) + \cos(\alpha + \beta))$

$\sin(\alpha)\cos(\beta) = 0.5 \cdot (\sin(\alpha - \beta) + \sin(\alpha + \beta))$

α:	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$
sin(α):	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
tan(α):	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	∞