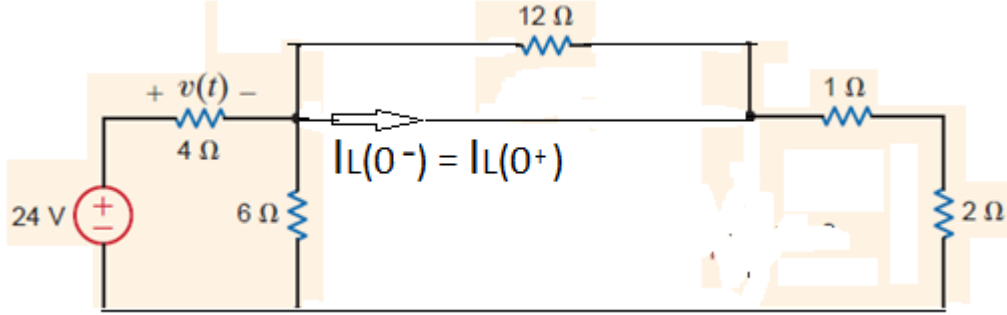
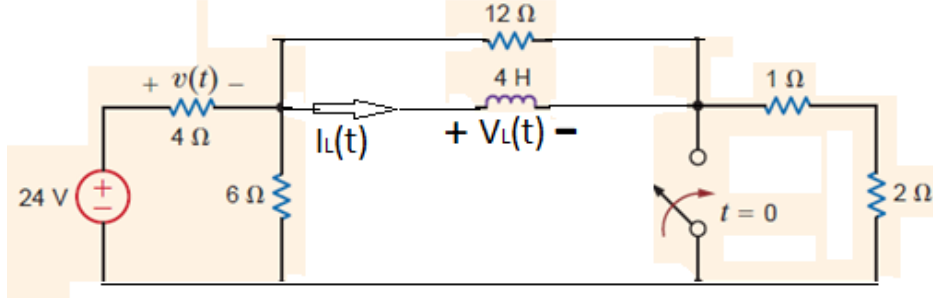
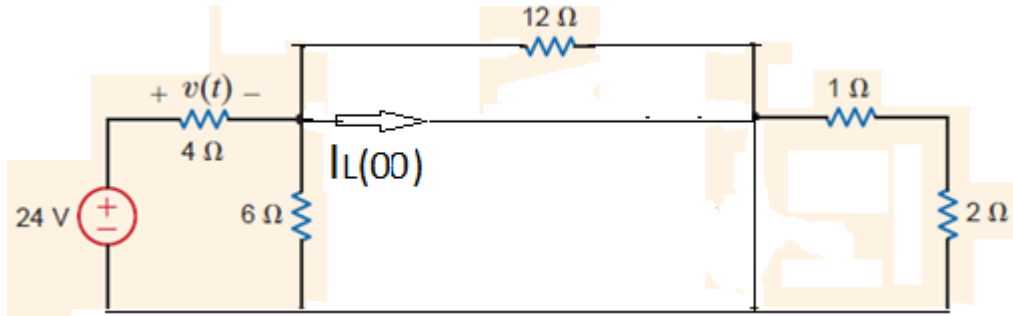


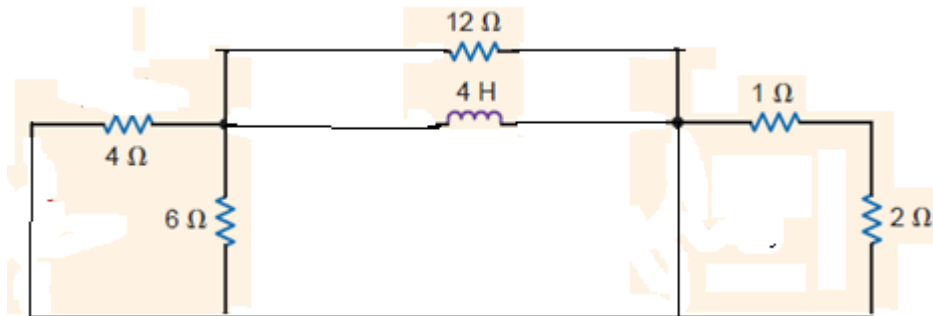
S-1) Anahtar uzun süre açık kaldıktan sonra $t=0$ anında kapatılmıştır.
 $t \geq 0$ için $I_L(t)$, $V_L(t)$ ve $v(t)$ ' yibulunuz.



1.durum
$$I_L(0^-) = \frac{24}{\frac{(2+1) \times 6}{(2+1)+6} + 4} \times \frac{6}{2+1+6} = 2,666A = I_L(+)$$
 5 puan



2.durum
$$I_L(\infty) = \frac{24}{4} = 6A = I_{Lzor}$$
 5 puan



2.durum Zaman sabiti $\tau = L/R_{eş}R_{eş} \Rightarrow$ (2. durumda selften görülen eşdeğer direnç, gerilim kaynağı kısa devre, akım kaynağı açık devre yapılarak bulunur.)

$$R_{eş} = \frac{\left(\frac{4 \times 6}{4+6}\right) \times 12}{\left(\frac{4 \times 6}{4+6}\right) + 12} = 2\Omega$$

$$\tau = \frac{L}{R_{eş}} = \frac{4}{2} \underline{5 \text{ puan}}$$

$$r = -\frac{1}{\tau} = -\frac{1}{r}$$

$$\frac{1}{4} + \frac{1}{6} + \frac{1}{12} + \frac{1}{4.r} = 0$$

$$\frac{1}{3.r} + \frac{1}{2.r} + \frac{1}{r} + \frac{1}{3} = 0$$

$$3.r + 2.r + r + 3 = 0$$

$$6.r + 3 = 0$$

$$r = -\frac{3}{6} = -\frac{1}{2}$$

$$I_L(t) = A.e^{-\frac{t}{\tau}} + I_L(\infty)$$

$$I_L(t) = A.e^{-\frac{t}{2}} + 6$$

$$t = 0 \text{ için } I_L(0^+) = 2,666A$$

$$2,666 = A.1 + 6A = -3,333 \underline{4 \text{ puan}}$$

$$I_L(t) = A.e^{-\frac{t}{\tau}} + I_L(\infty)$$

$$I_L(t) = \left(-3,333.e^{-\frac{t}{2}} + 6\right).u(t) \underline{A5 \text{ puan}}$$

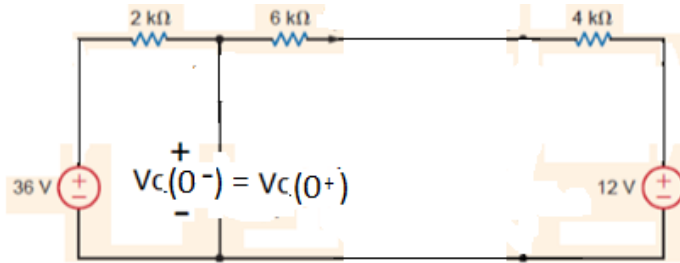
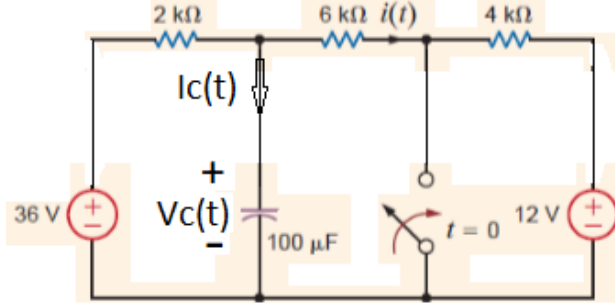
$$V_L(t) = L.\frac{d i_L}{dt} = 4.\left((-3,333).\left(-\frac{1}{2}\right)e^{-\frac{t}{2}}\right) = \left(6,666.e^{-\frac{t}{2}}\right) \underline{5 \text{ puan}}$$

$$V_R(t) + V_L(t) - 24 = 0$$

$$V_R(t) = 24 - V_L(t)$$

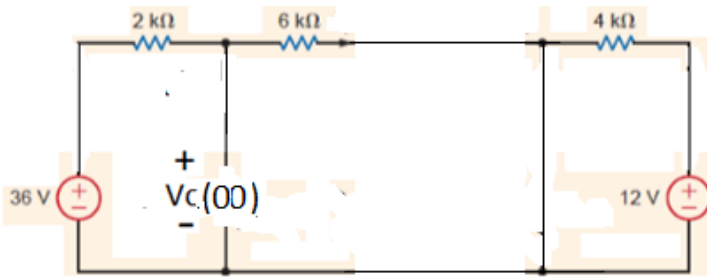
$$V_R(t) = 24 - 6,666.e^{-\frac{t}{2}} \underline{5 \text{ puan}}$$

S-2) Anahtar uzun bir süre açık kaldıktan sonra $t=0$ anında kapatılmıştır. $t \geq 0$ için $V_c(t)$, $I_c(t)$, ve $i(t)$ 'y bulunuz. $C = 100$ mikro farad $= 100 \times 10^{-6} \text{ F}$

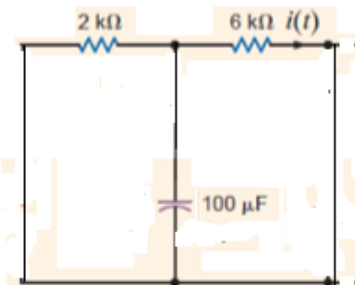


1.durum $-V_c(0^-) + (6000 + 4000) \times \frac{36-12}{(2000+6000+4000)} + 12 = 0$

$V_c(0^-) = (6000 + 4000) \times 0,002 + 12 = 32 = V_c(0^+)$ 5 puan



2.durum $V_c(\infty) = \frac{36}{(2000+6000)} \times 6000 = 27V = V_{c\text{zor}}$ 5 puan



2.durum Zaman sabiti $\tau = R_{eş} \times C R_{eş} \Rightarrow$ (2. durumda kondansatörden görülen eşdeğer direnç, gerilim kaynağı varsa kısa devre, akım kaynağı varsa açık devre yapılarak bulunur.)

$$R_{eş} = \frac{2000 \times 6000}{2000 + 6000} = 1500 \Omega$$

$$\tau = R_{eş} \times C = 1500 \times 100 \times 10^{-6} = 0,155 \text{ puan}$$

$$r = -\frac{1}{\tau} = -\frac{1}{r}$$

$$\frac{1}{2000} + \frac{1}{6000} + \frac{1}{\frac{1}{0,0001 \cdot r}} = 0$$

$$\frac{1}{2000} + \frac{1}{6000} + \frac{0,0001 \cdot r}{1} = 0$$

$$3 + 1 + 0,6 \cdot r = 0$$

$$4 + 0,6 \cdot r = 0$$

$$r = -\frac{4}{0,6} = -6,666$$

$$V_C(t) = A \cdot e^{-\frac{t}{\tau}} + V_C(\infty)$$

$$V_C(t) = A \cdot e^{-\frac{t}{0,15}} + 27$$

A katsayısı başlangıç şartı olan $V_C(0^+)$ 'dan bulunur.

$$t=0 \text{ için } V_C(0^+) = 32V$$

$$32 = A \cdot 1 + 27 \Rightarrow A = 5 \text{ puan}$$

$$V_C(t) = A \cdot e^{-\frac{t}{\tau}} + V_C(\infty)$$

$$V_C(t) = \left(5 \cdot e^{-\frac{t}{0,15}} + 27 \right) \cdot u(t) \text{ V } 5 \text{ puan}$$

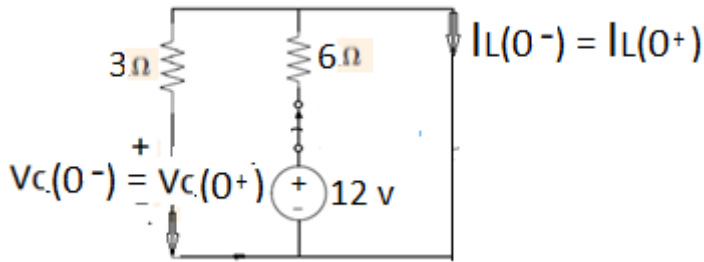
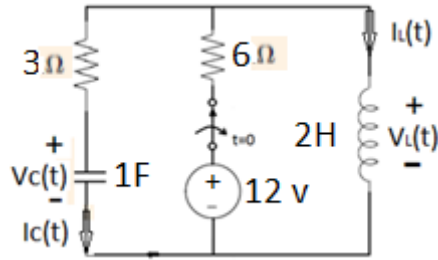
$$I_C(t) = C \cdot \frac{dV_C(t)}{dt} = 100 \times 10^{-6} \cdot \left(5 \cdot \left(-\frac{1}{0,15} \right) \cdot e^{-\frac{t}{0,15}} \right)$$

$$I_C(t) = \left(3,333 \cdot e^{-\frac{t}{0,15}} \right) \text{ mA } 5 \text{ puan}$$

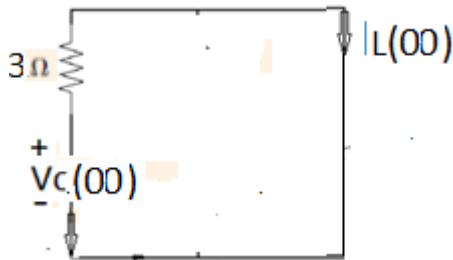
$$-V_c(t) + 6000xi(t) = 0$$

$$i(t) = \frac{V_c(t)}{6000} = \frac{5 \cdot e^{-\frac{t}{0,15}} + 27}{6000} = \left(0,833 \cdot e^{-\frac{t}{0,15}} + 4,5 \right) mA \underline{5 \text{ puan}}$$

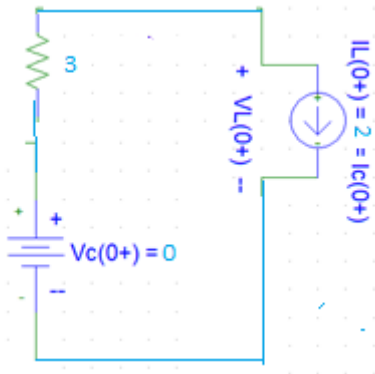
S-3) Anahtar uzun süre uzun kapalı konumda kaldıktan sonra anahtar $t=0$ anında açılmaktadır. $t \geq 0$ için $V_c(t)$, $I_c(t)$, yada $I_L(t)$, $V_L(t)$ yibulunuz.



1.durum $I_L(0^-) = \frac{12}{6} = 2A = I_L(0^+) V_c(0^-) = 0 = V_c(0^+)$



2.durum $I_L(\infty) = 0 = I_{Lzor} V_c(\infty) = 0 = V_{czor}$



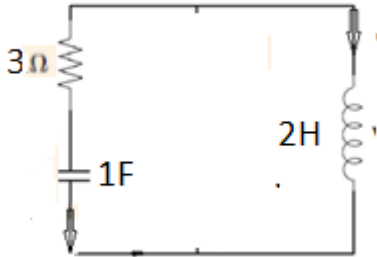
$$V_R(0^+) + V_C(0^+) - V_L(0^+) = 0$$

$$3.I_L(0^+) + V_C(0^+) - V_L(0^+) = 0$$

$$V_L(0^+) = 3xI_L(0^+) - V_C(0^+)$$

$$V_L(0^+) = 3x2 - 0V_L(0^+) = 6$$

$$I_L(0^-) = \frac{12}{6} = 2A = I_L(0^+) = -I_C(0^+) = -2$$



$$2. \text{ durum} \quad \frac{1}{3} + \frac{1}{2.r + \frac{1}{r.1}} = 0 \quad \frac{1}{3} + \frac{r.1}{2.r^2 + 1} = 0$$

$$\frac{1}{3} + \frac{r.1}{2.r^2 + 1} = 0$$

$$2.r^2 + 1 + 3.r = 0 \quad 2.r^2 + 3.r + 1 = 0$$

$$r_1, r_2 = \frac{-b \mp \sqrt{b^2 - 4.a.c}}{2.a} \quad r_1, r_2 = \frac{-3 \mp \sqrt{3^2 - 4.2.1}}{2.2} = \frac{-3 \mp \sqrt{9 - 8}}{4}$$

$$= -0,75 \mp 0,25$$

$$r_1 = -1r_2 = -0,5(r_1 + 1). (r_2 + 0,5) = 0$$

$$I_L(t) = A.e^{r.t} + B.e^{r.t} + I_L(\infty)I_L(t) = A.e^{-1.t} + B.e^{-0,5.t} + 0$$

$$I_L(t) = A.e^{-1.t} + B.e^{-0,5.t} + 0$$

$$t = 0 \text{ için } I_L(0^+) = 2 = A.1 + B.1 + 0A + B = 2$$

$$V_L(t) = L. \frac{d_{iL}}{dt} = 2. ((-1).A.e^{-1.t} + (-0,5).B.e^{-0,5.t})$$

$$t = 0 \text{ için } V_L(0^+) = 6 = 2. ((-1).A.1 + (-0,5).B.1)$$

$$-1.A - 0,5.B = 3A + B = 2$$

$$+1.A + 1.B = 20,5.B = 5B = \frac{5}{0,5} = 10$$

$$A + B = 2A + 10 = 2A = -8$$

$$I_L(t) = A \cdot e^{-1 \cdot t} + B \cdot e^{-0,5 \cdot t} + I_L(\infty)$$

$$I_L(t) = -8 \cdot e^{-1 \cdot t} + 10 \cdot e^{-0,5 \cdot t} + 0$$

$$V_L(t) = L \cdot \frac{d_{iL}}{dt} = 2 \cdot ((-1) \cdot A \cdot e^{-1 \cdot t} + (-0,5) \cdot B \cdot e^{-0,5 \cdot t})$$

$$V_L(t) = 2 \cdot ((-1) \cdot (-8) \cdot e^{-1 \cdot t} + (-0,5) \cdot (10) \cdot e^{-0,5 \cdot t})$$

$$V_L(t) = 16 \cdot e^{-1 \cdot t} - 10 \cdot e^{-0,5 \cdot t}$$

$$V_c(t) = A \cdot e^{r1 \cdot t} + B \cdot e^{r2 \cdot t} + V_c(\infty)$$

$$V_c(t) = A \cdot e^{-1 \cdot t} + H \cdot e^{-0,5 \cdot t} + 0$$

$$t = 0 \text{ için } V_c(0^+) = 00 = A \cdot 1 + B \cdot 1 + 0A + B = 0$$

$$I_C(t) = C \cdot \frac{d_{VC}}{dt} = 1 \cdot ((-1) \cdot A \cdot e^{-1 \cdot t} + (-0,5) \cdot B \cdot e^{-0,5 \cdot t})$$

$$t = 0 \text{ için } I_c(0^+) = -2 - 2 = 1 \cdot ((-1) \cdot A \cdot 1 + (-0,5) \cdot B \cdot 1)$$

$$-1 \cdot A - 0,5 \cdot B = -2A + B = 0$$

$$-1 \cdot A * 0,5 \cdot B = -2$$

$$-1 \cdot A - 0,5 \cdot B = -2$$

$$1 \cdot A + 1 \cdot B = 0$$

$$0,5 \cdot B = -2B = \frac{-2}{0,5} = -4$$

$$A + B = 0A - 4 = 0A = 4$$

$$V_c(t) = A \cdot e^{r1 \cdot t} + B \cdot e^{r2 \cdot t} + V_c(\infty)$$

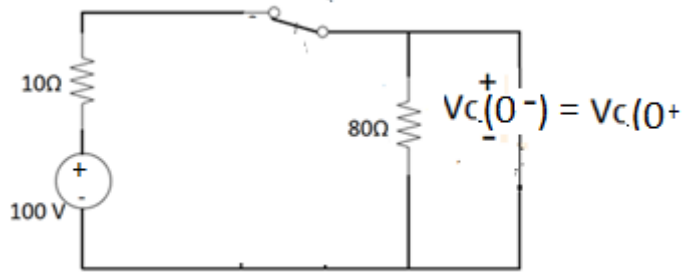
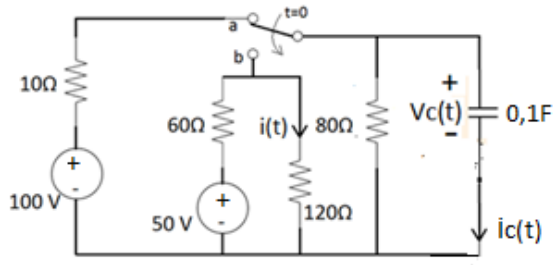
$$V_c(t) = 4 \cdot e^{-1 \cdot t} - 4 \cdot e^{-0,5 \cdot t} + 0$$

$$I_C(t) = C \cdot \frac{d_{VC}}{dt} = 1 \cdot ((-1) \cdot A \cdot e^{-1 \cdot t} + (-0,5) \cdot B \cdot e^{-0,5 \cdot t})$$

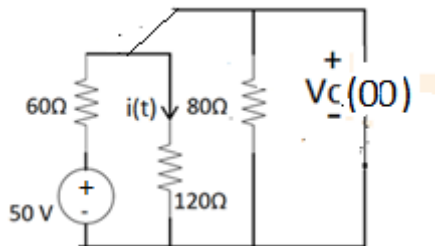
$$I_C(t) = 1 \cdot ((-1) \cdot (4) \cdot e^{-1 \cdot t} + (-0,5) \cdot (-4) \cdot e^{-0,5 \cdot t})$$

$$I_C(t) = -4 \cdot e^{-5 \cdot t} + 2 \cdot e^{-0,5 \cdot t}$$

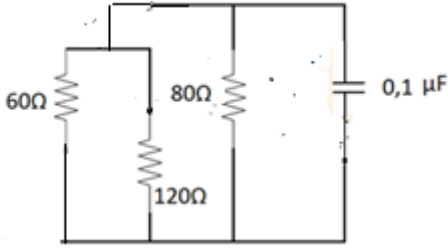
S-4) Aşağıda verilen devrede anahtar uzun bir süre “a” konumunda kaldıktan sonra $t=0$ anında “b” konumuna alınıyor. a) $t \geq 0$ için, $V_c(t)$ ’yi ve $i(t)$ ’yi bulunuz. b) $i(0,3s)$, $V_c(0,7s)$ ’yi hesaplayınız. $C = 0,1F$



1.durum $V_c(0^-) = \frac{100}{(10+80)} \times 80 = 88,888V = V_c(0^+)$ 5 puan



2.durum $V_c(\infty) = \frac{50}{\frac{120 \times 80}{120+80} + 60} \times \frac{120}{120+80} \times 80 = 22,222V = V_c$ 5 puan



2.durum Zaman sabiti $\tau = R_{eş} \times C R_{eş} \Rightarrow$ (2. durumda kondansatörden görülen eşdeğer direnç, gerilim kaynağı varsa kısa devre, akım kaynağı varsa açık devre yapılarak bulunur.)

$$R_{eş} = \frac{\left(\frac{120 \times 80}{120 + 80}\right) \times 60}{\left(\frac{120 \times 80}{120 + 80}\right) + 60} = \frac{2880}{108} = 26,666\Omega$$

$$\tau = R_{eş} \times C = 26,666 \times 0,1 = 2,6665 \text{ puan}$$

$$r = -\frac{1}{\tau} = -\frac{1}{r}$$

$$\frac{1}{60} + \frac{1}{120} + \frac{1}{80} + \frac{1}{\frac{1}{0,1 \cdot r}} = 0$$

$$\frac{1}{60} + \frac{1}{120} + \frac{1}{80} + \frac{0,1 \cdot r}{1} = 0$$

$$4 + 2 + 3 + 24 \cdot r = 0$$

$$9 + 24 \cdot r = 0$$

$$r = -\frac{9}{24} = -0,375$$

$$V_C(t) = A \cdot e^{-\frac{t}{\tau}} + V_C(\infty)$$

$$V_C(t) = A \cdot e^{\frac{-t}{2,666}} + 22,222$$

A katsayısı başlangıç şartı olan $V_C(0^+)$ 'dan bulunur.

$$t=0 \text{ için } V_C(0^+) = 88,888V$$

$$88,888 = A \cdot 1 + 22,222A = 66,6664 \text{ puan}$$

$$V_C(t) = A \cdot e^{-\frac{t}{\tau}} + V_C(\infty)$$

$$V_C(t) = \left(66,666 \cdot e^{\frac{-t}{2,666}} + 22,222 \right) \cdot u(t) \underline{5 \text{ puan}}$$

$$V_C(0,7) = \left(66,666 \cdot e^{\frac{-0,7}{2,666}} + 22,222 \right) V$$

$$V_C(0,7) = (51,271 + 22,222) = 73,493 \underline{5 \text{ puan}}$$

$$i(t) = \frac{V_C(t)}{120} \quad i(t) = \frac{66,666 e^{\frac{-t}{2,666}} + 22,222}{120}$$

$$i(t) = \frac{66,666 \cdot e^{\frac{-0,3}{2,666}} + 22,222}{120} = \frac{59,555 + 22,222}{120} = 0,684 \underline{5 \text{ puan}}$$