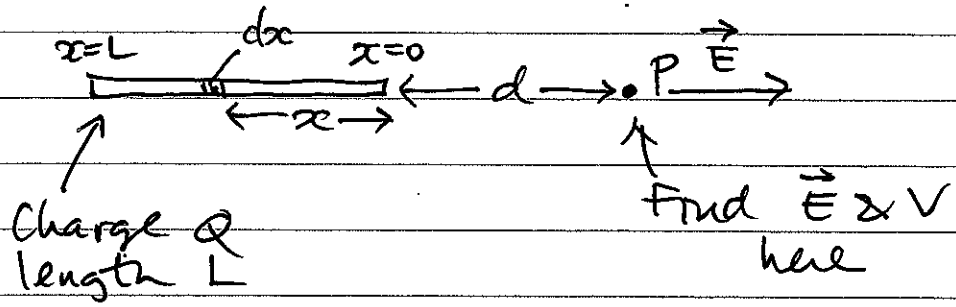
		Questions	Problems	
$\boxed{\text{TEST 3}}$	Ch. 34	✓	✓	waves in general
	35	✓		
	36	✓	✓	mirror
	37	✓	✓	interference & diffractions
	38			
	(39)			
	(40)			

$\boxed{\text{FINAL EXAM}}$	T1	23	1-2 questions	1 problem
		24		
		25		
		26		
	T2	27	1-2 questions	2 problems
		28		
		29	1-2 questions	2 problems
		30		
		31		
		~~32~~		
		~~33~~		
		34		
		35		
		36		
		37		
		38		
		39 — questions only		
		40 — questions only		

Chapters 23, 24, 25

Problem on electric field & potential produced by an extended charge distrib.



The small element of length dx produces $d\vec{E}$ which points away from the charge

$$dE = \underset{\frac{1}{4\pi\epsilon_0}}{k}\,\frac{dq}{r^2} = k\,\frac{\overset{Q/L}{\lambda}\,dx}{(d+x)^2}$$

and

$$dV = k\,\frac{dq}{r} = k\,\frac{\lambda\,dx}{d+x}$$

So the full electric field and potential are

$$E = k\int_0^L \frac{\lambda\,dx}{(d+x)^2} = k\lambda\left[-\frac{1}{d+x}\right]_0^L = k\lambda\left(\frac{1}{d}-\frac{1}{d+L}\right)$$

$$V = k\int_0^L \frac{\lambda\,dx}{d+x} = k\lambda\left[\ln(d+x)\right]_0^L = k\lambda\ln\frac{d+L}{d}$$

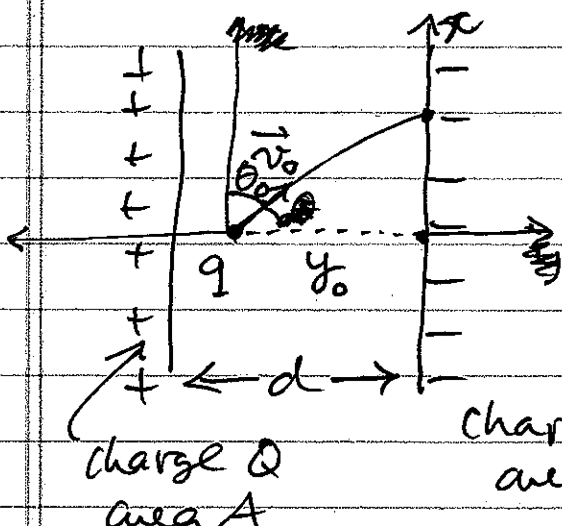
Or calculate V as above, and then use the fact that the electric field is the ~~E/x~~ negative of the derivative of V.

$$\text{horizontal component of } E = -\frac{\partial V}{\partial d} = -\frac{\partial}{\partial d}\left(k\lambda\,\overset{\ln(d+L)-\ln d}{\ln\frac{d+L}{d}}\right)$$

$$= -k\lambda\left(\frac{1}{d+L}-\frac{1}{d}\right)$$

~~Problems~~ Chapters 23, 24, 25

Problem on motion of a charged particle in a (constant) electric field



✓ Where does it hit the plate?

✓ How long does it take?

✓ With what velocity?

charge $-Q$ area A, $\sigma = \frac{Q}{A}$ mass m

The force on q is $\vec{F} = q\vec{E}$, where $\vec{E}$ points toward the $-$ plate and $E = \sigma/\varepsilon_0$

So the force is in the y direction, and $F = q\sigma/\varepsilon_0$.

The particle starts at $y = y_0$, $x_0 = 0$

$v_{0y} = v_0 \sin\theta_0 \quad v_{0x} = v_0 \cos\theta_0$

Start by calculating the time

$\Delta y = v_{0y} t + \frac{1}{2} a_y t^2 \rightarrow$ find t (need $a_y = \frac{F}{m} = \frac{q\sigma}{m\varepsilon_0}$)

With t, calculate where the particle goes using $x = x_0 + v_{0x} t$

To find the velocity, use $v_x = v_{0x}$

$v_y = v_{0y} + a_y t$

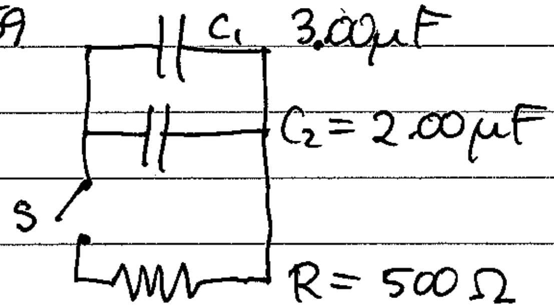
Or, to find the final speed, you can use conservation of energy: $E_i = E_f$

$K_i + U_i = K_f + U_f, \quad K_f = K_i - \Delta U \qquad \Delta V = E y_0$

$\frac{1}{2} m v_f^2 = \frac{1}{2} m v_0^2 - q\Delta V$

Chapters 26-27-28 : Capacitance
Resistance
DC-circuits

Problem 59



} Charged by a 12-V battery

1.00 ms after the switch is closed,

(a) How much charge is on C_1?

General idea: This is an RC-circuit where the voltage goes like

$V = \mathcal{E} e^{-t/\tau}$

$\tau = RC$

$RC = 500 \times 5 \times 10^{-6}$
$= 2.50 \times 10^{-3}$

$C = C_{eq} = C_1 + C_2$
$= 5.00\,\mu F$

$V = \mathcal{E} e^{-t/\tau}$
$= 12.0\, e^{-1.00\times10^{-3}/2.50\times10^{-3}}$
$= 12.0\, e^{-0.400}$
$= 8.04\ V$

Then $Q_1 = C_1 V = (3.00\times10^{-6})(8.04) = 2.41\times10^{-5}\ C$

(b) Charge on C_2? (same procedure)

(c) What is I in the resistor at this time?

$I = \frac{V}{R} = \frac{8.04\ V}{500\ \Omega} = 0.0161\ A$