Concordia UNIVERSITY

COURSE	NUMBER	SECTION	
PHYSICS	205/1	51	
EXAMINATION	DATE	DURATION	# OF PAGES
MID-TERM EXAM	July 19, 2017	60 minutes	1

(1) ***Chapter 23***.

Given two point charges q_1 whose coordinates $(x, y, z) = (a, 0, 0)$ and q_2 whose coordinates $(x, y, z) = (0, b, 0)$, find the electric field at the location $(x, y, z) = (0, 0, z)$. Express the field components in each of $\hat{i}, \hat{j}, \hat{k}$ direction.

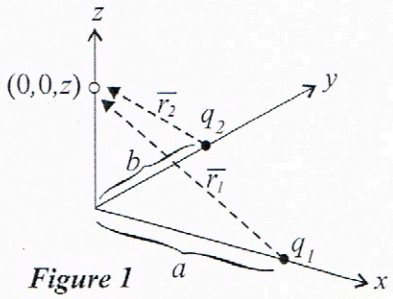

Figure 1

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(2) ***Chapter 24***.

Consider a wedge shaped triangular box with the vertical surface lying on the y-z plane. The dimensions and orientation is given in ***Figure 2*** at right.

There exists a non-uiform electric field given by $\vec{E}(x, y, z) = \hat{k}\, C\, x$, where C is a constant. (a) Calculate the total electric flux leaving the top face.

Since the field is a function of x but not y, it makes sense to take dA as a narrow strip along the y-axis and some appropriate width on the top face.

Then sum the $\vec{E} \bullet d\vec{A}$ over the top face. Draw a 2-D diagram to indicate the angles relating the field and area.

(b) Can you tell if there is any charge enclosed by the box?

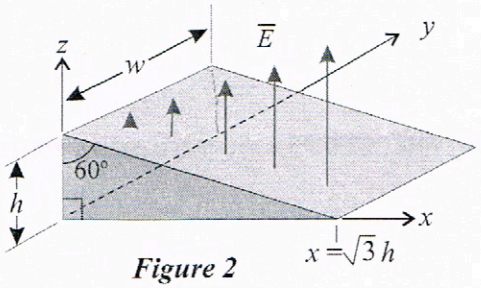

Figure 2

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(3) ***Chapter 25***

Given point charges and their location as shown in the diagram. Here Q is a positive number.

(a) Label the charges in a new diagram and determine the exact electric potential $V(y)$ at any point along the y axis in terms of Q, d, and y.

(b) If $y >> d$, show that the ***approximate*** potential is given by

$$V(y) \approx \frac{-Qd^2}{4\pi\varepsilon_o y^3}.$$

[If you have an expression involving y and d, factor out y, then use the relationship $(1+\delta)^n \approx 1 + n\delta$ provided $\delta << 1$]