

FIRST MIDTERM

Average: 20.6

Name (print): Grader, Hao Hu Name (signed): _____

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Discussion Section # _____

SHOW ALL WORK!!!!

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!

Use the conversion constants and data given on the front page.

Three electric charges are placed as shown. Take

$$a = 3.20 \times 10^{-8} \text{ m.}$$

(a) Calculate the force, in \hat{i}, \hat{j} notation, on a charge of

+9.00 μC placed at P.

(b) Determine the electric field at P, in \hat{i}, \hat{j} notation.

$$k = 9 \times 10^9$$

$$F = \frac{kq_1q_2}{r^2}$$

$$(a) F_1 = k \cdot \frac{-2 \times 9 \times (10^{-9})^2}{a^2} = -1.58 \times 10^{-4} \text{ N } \hat{i}$$

$$F_2 = k \cdot \frac{-3 \times 9 \times (10^{-6})^2}{(\sqrt{2}a)^2} (\cos 45^\circ \hat{i} + \sin 45^\circ \hat{j})$$

$$= -1.12 \times 10^{-4} \text{ N } \hat{i} - 1.12 \times 10^{-4} \text{ N } \hat{j}$$

$$F_3 = k \cdot \frac{4 \times 9 \times (10^{-6})^2}{(\sqrt{2}a)^2} (\cos 45^\circ \hat{i} - \sin 45^\circ \hat{j})$$

$$= 8.39 \times 10^{-3} \text{ N } \hat{i} - 8.39 \times 10^{-3} \text{ N } \hat{j}$$

$$\text{So: } \Sigma F = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 = +3.0 \times 10^{-4} \hat{i} - 1.96 \times 10^{-4} \hat{j} \text{ (N)}$$

$$(b) E = \frac{\Sigma F}{q} = \frac{\Sigma F}{9 \times 10^{-6}} = -1.44 \times 10^9 \text{ N/C } \hat{i} - 2.17 \times 10^9 \text{ N/C } \hat{j}$$

