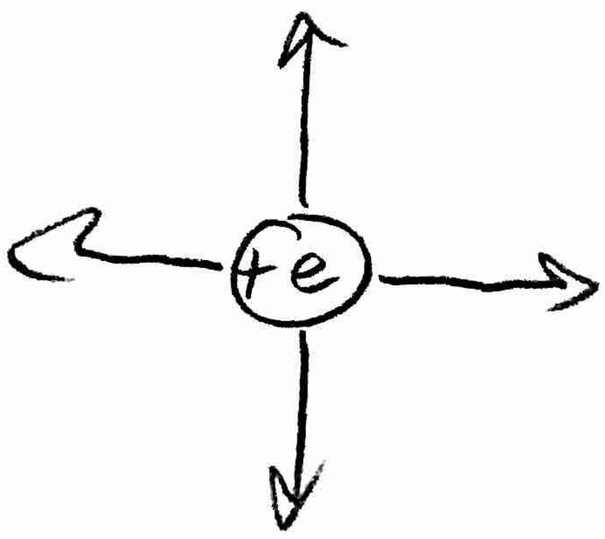
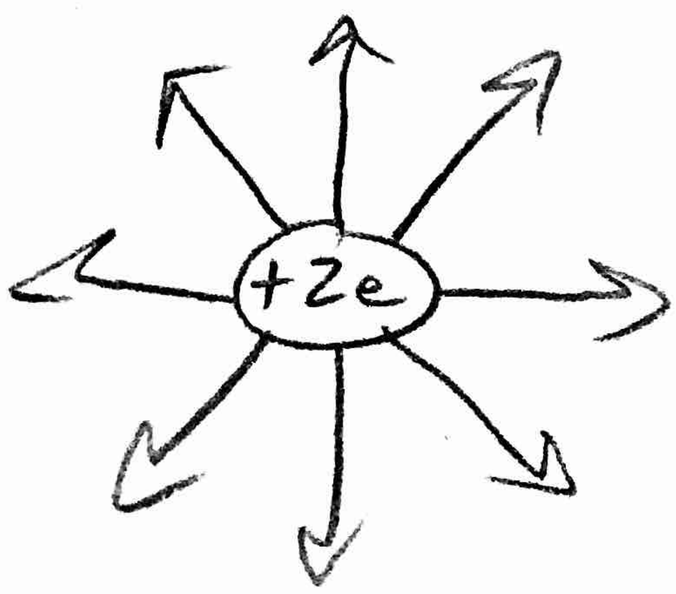
Notes - 18.5 Electric Field Lines: Multiple Charges

1. Drawings using lines to represent electric fields around charged objects are very useful in visualizing field strength and direction. Since the electric field has both magnitude and direction, it is a vector. Like all vectors, the electric field can be represented by an arrow that has length proportional to its magnitude and that points in the correct direction. **However, electric fields are often represented with lines whose magnitude is represented by their proximity rather than length.**

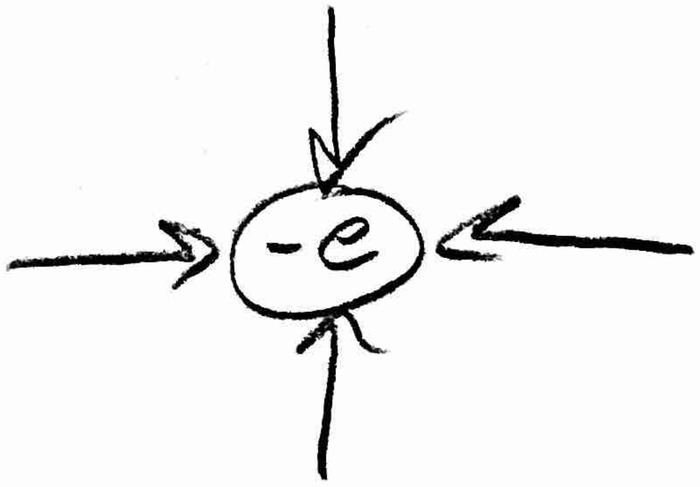
2. Electric field lines point in the direction of electric force acting on **positive** charge. Therefore, properties of electric field lines for any charge distribution can be summarized as follows:
   1. Field lines must begin on positive charges and terminate on negative charges (or at infinity in the hypothetical case of isolated charges).
   2. The number of field lines leaving a positive charge or entering a negative charge is proportional to the magnitude of the charge.
   3. The strength of the field is proportional to the closeness of the field lines.
   4. The direction of the electric field is tangent (parallel) to the field line at any point in space.
   5. Field lines can never cross. This last property means that the field is unique at any point. The field line represents the direction of the field; so if they crossed, the field would have two directions at that location (an impossibility if the field is unique).

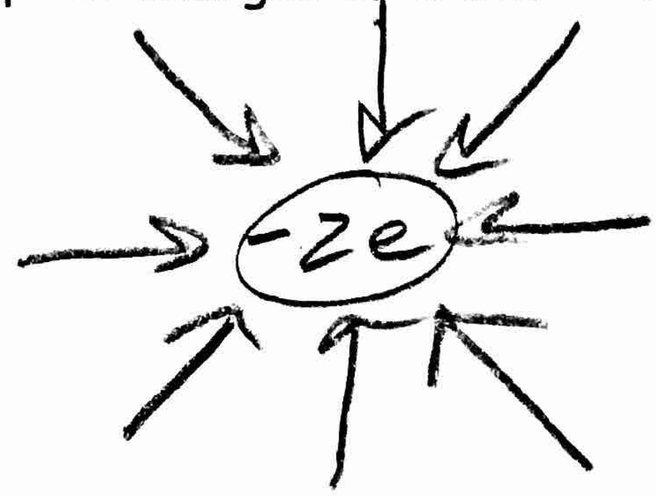
3. Draw the electric field lines for positive point charges of +e and +2e.



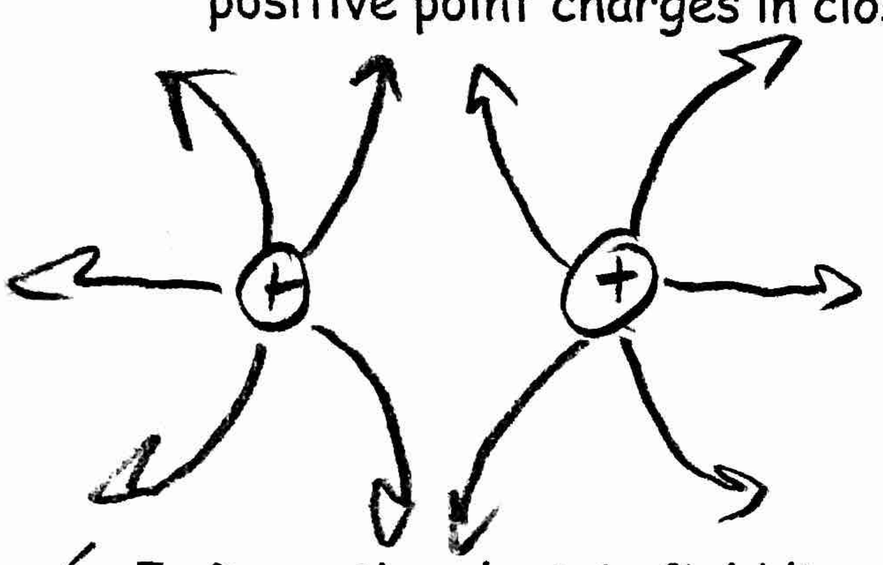


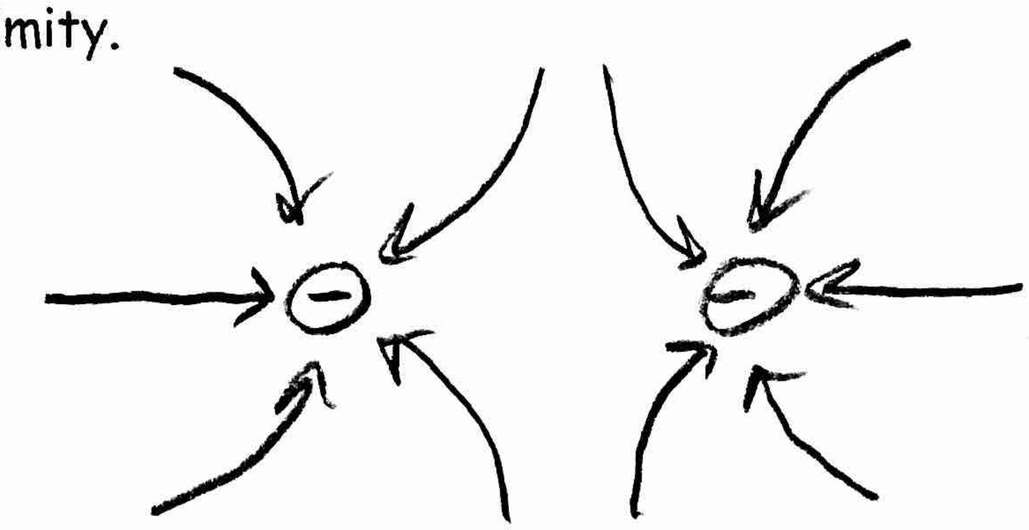
4. Draw the electric field lines for negative point charges of -e and -2e.





5. Draw the electric field lines for 2 negative point charges in close proximity and 2 positive point charges in close proximity.





6. Draw the electric field lines for a negative and a positive point charge in close proximity.