16. Solve the following simple derivatives:
    (a) $\vec{\nabla}|\vec{r}|$
    (b) $\vec{\nabla} \cdot \vec{r}$
    (c) $\vec{\nabla} \times \vec{r}$

17. (a) Show explicitly that the expression

$$\Phi(x, y, z) = q \sum_{n=-\infty}^{+\infty} \frac{(-1)^n}{\{(x - x')^2 + (y - y')^2 + [z - (-1)^n z' + nd]^2\}^{\frac{1}{2}}}$$

for the potential between parallel grounded conducting plates with a point charge between, obtained in class by the method of images, has the property $\Phi(x, y, \frac{d}{2}) = 0 = \Phi(x, y, -\frac{d}{2})$. (Hint: Break the sum into even-n and odd-n sums.)

(b) Obtain an expression for the charge density on each of the conducting planes. At what value of (x, y) is the charge density a maximum? When $z' = 0$ (charge q equidistant from the two planes), obtain an approximate value for this maximum surface charge density. (You will need to perform a sum: by hand, or calculator, or computer – your choice!) Compare this result with the maximum charge density for a point charge q placed a distance $\frac{d}{2}$ from a **single** grounded conducting plane.

(c) **Attempt** to obtain the total charge induced on each of the conducting planes for a general location of the point charge z' between the planes by integrating the infinite series obtained in the first part of (b) for the two charge densities term by term. Comment on the result.