MA341 HOMEWORK #3
Some Corrections and Comments

1. A correction. The three points in Problem #6 of Section 3.3 should be: $(1, 0, 0)$, $(\cos 120°, \sin 120°, 0)$, $(\cos 240°, \sin 240°, 0)$.

2. A clarification: In Problem #3(a) of Section 3.3, the coordinates of the three points mentioned are (x, y, z) (Cartesian) coordinates, not spherical coordinates.

3. Some partial solutions:

   (a) In Problem #1 of Section 3.3, the conversion from cylindrical to (x, y, z) (Cartesian) coordinates is:
   $$\begin{aligned} x &= r\cos\theta \\ y &= r\sin\theta \\ z &= z \end{aligned}$$
   You can see from these formulas that if r is changed to $r' = -r$, θ is changed to $\theta' = \theta + 180°$, and z is left unchanged, then (x, y, z) is unchanged; i.e., precisely the same point is described. Can you also see geometrically why this is the case?

   Another possibility of two sets of cylindrical coordinates describing precisely the same point occurs when $r = 0$. In this case, leaving r and z unchanged, but changing θ arbitrarily, still results in cylindrical coordinates for precisely the same point.

   Finally, possibly in combination with the changes above, any integer multiple of $360°$ can be added to θ without changing the point.

   (b) In Problem #2 of Section 3.3, the conversion from spherical to Cartesian coordinates is:
   $$\begin{aligned} x &= \rho\sin\phi\cos\theta \\ y &= \rho\sin\phi\sin\theta \\ z &= \rho\cos\phi \end{aligned}$$
   You should make sure you know how to derive these formulas.

   You can see from these formulas that if ρ is changed to $\rho' = -\rho$, ϕ is changed to $\phi' = \phi + 180°$, and θ is left unchanged, then (x, y, z) is unchanged; i.e., precisely the same point is described. Can you see geometrically what is going on? Can you use these conversion formulas to find all the other cases when changing ρ, θ, and/or ϕ results in the same point as before? Let's allow ρ, θ, and ϕ to assume any values whatsoever. Try breaking down the problem into cases, in which various combinations of ρ, $\sin\phi$, $\cos\phi$, $\sin\theta$, and $\cos\theta$ are zero or nonzero.