St John Baptist De La Salle Catholic School, Addis Ababa

Grade 11 Physics Homework 4

3rd Quarter

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March 29, 2024

Information

- The homework is due on **Wednesday**, **April 3**.
- You should Work on it **in groups**.
- For purposes of neatness and simplicity of grading, you should do the homework on an **A-4 paper**. However, use your exercise book as a scrapbook.
- **All answers should be written using a pen. Do not use a pencil. If you make an error, strike a line through it and correct it on the next line.**
- **DO NOT PREPARE A COVER PAGE, JUST WRITE THE NAME OF THE MEMBERS ON THE SAME PAGE AS THE ANSWERS**

Problems on Vector Calculus

For questions 1-5, find the Laplacian of the function $f(x, y, z)$ in Cartesian coordinates.

1. $f(x, y, z) = x + y + z$
2. $f(x, y, z) = x^7$
3. $f(x, y, z) = e^{x^2+y^2+z^2}$
4. $f(x, y, z) = e^{-(x^2+y^2+z^2)}$
5. $f(x, y) = \sin(2x)\cos(6y)$

For questions 6-9 show the following for the position vector $\mathbf{r}(x, y, z) = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$

6. $\nabla(1/r) = -\mathbf{r}/r^3$
7. $\Delta(1/r) = 0$
8. $\nabla(\ln r) = \mathbf{r}/r^3$
9. $\Delta(fg) = f\Delta g + g\Delta f + 2(\nabla f \cdot \nabla g)$