Math 254, Fly in the Lab Lab

This lab is designed to be done as a group project with each group having 3 to 4 students. Please use a separate sheet of paper to record the groups work and answers.

An OSU scientist has constructed an enclosed study room that is 10 meters by 10 meters by 10 meters. One corner of the lab is at location $(0,0,0)$ while the opposite corner is at $(10,10,10)$. A special genetically engineered fly is at the location $(5,5,5)$. Using equipment that was salvaged from the Roswell crash the scientist determines that the temperature at each point in the room is given by the equation:

$$T(x,y,z) = 25.67 + 1.63\sin(0.01x^2yz) + 3.11\cos(0.02xy) \text{ degrees Celsius.}$$

Use 2 decimal place accuracy for your answers.

1. The fly that is at the point $(5,5,5)$ starts to fly toward the origin $.(0,0,0)$ Find the rate of change of the temperature at the beginning of its flight.

2. If this fly was engineered so that it will start its flight in the direction of greatest positive temperature change in what direction (give your answer as a unit vector) will the fly fly? Find the rate of change of the temperature at the beginning of its flight.

3. If this fly was engineered so that it will start its flight in the direction of greatest negative temperature change in what direction (give your answer as a unit vector) will the fly fly? Find the rate of change of the temperature at the beginning of its flight.

4. Once this special fly starts flying it will fly in a straight line until it hits an obstacle. Which wall will the fly from problem 2 hit and where will it hit this wall?

Mth 254 Partial Derivative Practice

Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ for each of the following (by hand).

1. $z = 6y - 4y^3 - x^2 + 1$
2. $z = \ln\left(\frac{x}{x^2 + y^2}\right)$
3. $z = xe^{x^2 y}$
4. $z = \frac{4xy}{\sqrt{x^2 + y^2}}$
5. $z = \arctan(y / x)$
6. $z = \tan(2x - y)$
7. $z = e^y \sin(xy)$
8. $z = \frac{\cos(x^2 + y^2)}{1 + x^2 + y^2}$
9. $z = (\cos x)(\cos y)e^{-(x^2+y^2)}$