Name: _____   Surface Color: _____

Task Master: _____   Cynic: _____   Recorder: _____

The Gold Mine

Working in small groups (3 or 4 people), solve as many of the problems below as possible. Try to resolve questions within the group before asking for help. Each group member should then write up solutions in their own words; please do not use this sheet for that purpose, but **please turn in this sheet as well.** *Show your work! Explain why your answers work.*

On your Mark: The plastic square represents a plane. Press it against the surface at the Blue Dot. Which quantities below are the same on the surface and on the plane? Which are different?

Surface f at the Blue Dot	$\frac{\partial f}{\partial x}$	$\frac{\partial f}{\partial y}$	$\frac{\partial^2 f}{\partial x^2}$	$\frac{\partial^2 f}{\partial y^2}$	$\frac{\partial^2 f}{\partial x \partial y}$
Plane P at the Blue Dot	$\frac{\partial P}{\partial x}$	$\frac{\partial P}{\partial y}$	$\frac{\partial^2 P}{\partial x^2}$	$\frac{\partial^2 P}{\partial y^2}$	$\frac{\partial^2 P}{\partial x \partial y}$

Get Set: The surface represents the density ρ of gold (in $\frac{g}{mi^3}$) beneath the ground. You own a small mine located at the Blue Dot. Estimate the density of gold at your mine, and measure how the density of gold changes in the north and east directions. Use appropriate notation and include units.

(Note: 1 vertical inch $= 1\frac{g}{mi^3}$ of gold; 1 horizontal inch $= 1$ mile.)

Go: You want to buy one of three mines which are for sale; their locations (relative to your mine) are given below. Estimate the density of gold at each mine using only your previous measurements.

Mine A	Mine B	Mine C
1.2 Miles North	1.2 Miles North	3.4 Miles South
	0.8 Miles East	1.7 Miles East

Challenge: Estimate the density of gold for a mine located at $(x = a, y = b)$.