

The Gold Mine – Class Handout

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 g/km^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 g/km^3 of gold; 1 horizontal inch = 1 kilometer.)

Go: You want to buy one of three mines that 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 km north	1.2 km north 0.8 km east	3.4 km south 1.7 km east

Challenge: Develop a general formula to estimate the density of gold for a mine located at a point (a, b) .