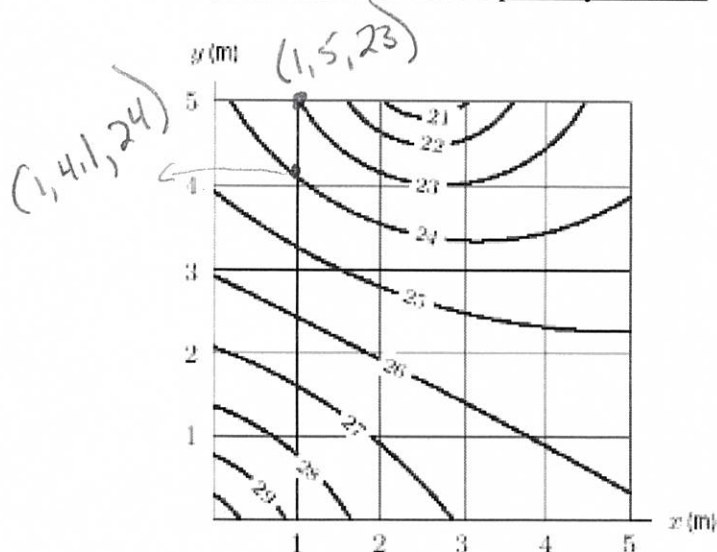


1. The diagram below is a contour diagram of a function  $T(x,y)$  which gives the temperature in degrees Celsius of a metal plate at location  $x$  meters and  $y$  meters from a heater located at the origin. Use the diagram to find the value of  $T_y(1,5)$ . Show the 3D coordinates of the points you used. Include units on your answer.



$$T_y(1,5) \approx \frac{\Delta T}{\Delta y} = \frac{24 - 23}{4.1 - 5} = \frac{1}{-0.9}$$

$$= -1.11 \frac{^\circ\text{C}}{\text{meter}}$$

2. The annual salary  $S$  for a teacher depends on both her years of experience teaching  $E$  and the number of hours of professional development course hours  $P$  she has attended. Therefore we can say  $S$  is a function of both  $E$  and  $P$ , or,  $S(E,P)$

A) What are the units on  $S_p(5,85)$ ?

$$S_p(5,85) \approx \frac{\Delta S}{\Delta P} \Rightarrow \frac{\$/\text{yr}}{\text{hr}} \text{ or } \frac{\$}{\text{hr}}$$

B) Interpret the meaning of the number  $S_p(5,85) = 20$  in the context of the problem.

For a teacher with 5 yrs of experience and 85 hrs of PD courses, she can expect her annual salary to go up by 20 per hr of additional PD courses.

3. Given the function  $f(x,y) = 3\ln(xy) + 2$ , find the equation of the tangent plane at the point  $(3, 1/3)$ .

$$f_x = \frac{3}{xy} = \frac{3}{x} \quad f_x(3, 1/3) = 1 \quad f(3, 1/3) = 3\ln(3 \cdot 1/3) + 2 = 2$$

$$f_y = \frac{3}{xy} = \frac{3}{y} \quad f_y(3, 1/3) = \frac{3}{1/3} = 9$$

$$z = (x-3) + 9(y - 1/3) + 2$$