

1. Show that the following functions do not have limits as  $(x, y) \rightarrow (0, 0)$ :

$$\text{a) } \frac{x^2 - y^2}{x^2 + y^2} \qquad \text{b) } \frac{x^4 - y^2}{x^4 + y^2}$$

2. Show that the function  $\frac{x^2(x^2 - y^2)}{x^2 + y^2}$  does have a limit as  $(x, y) \rightarrow (0, 0)$ .
3. Solve Sec. 19.1 problems 11, 13, 14, 15, 16 what is its graph?, 17 what is its graph?
4. Related to 19.2 problem 30: show that any function of the form  $f(x, t) = g(x + at) + h(x - at)$  satisfies the wave equation  $f_{tt} = a^2 f_{xx}$  if  $g, h$  are functions twice differentiable of one variable.
5. Solve problem 31 in 19.2.