6. $f(x,y) = 3x^2 + y$ $\qquad (z = 3x^2 + y)$

a) $\dfrac{f(x+\Delta x, y) - f(x,y)}{\Delta x}$

1ST: $f(\underset{x}{\underline{x+\Delta x}}, \underset{y}{\underline{y}}) = 3(x+\Delta x)^2 + (y)$

$\qquad\qquad = 3(x+\Delta x)(x+\Delta x) + y$

$\qquad\qquad = 3(x^2 + x\Delta x + x\Delta x + (\Delta x)^2) + y$

$\qquad\qquad = 3(x^2 + 2x\Delta x + (\Delta x)^2) + y$

$\qquad\qquad = 3x^2 + 6x\Delta x + 3(\Delta x)^2 + y$

2ND: $\dfrac{f(x+\Delta x, y) - f(x,y)}{\Delta x}$

$= \dfrac{3x^2 + 6x\Delta x + 3(\Delta x)^2 + y - (3x^2 + y)}{\Delta x}$

$= \dfrac{3x^2 + 6x\Delta x + 3(\Delta x)^2 + y - 3x^2 - y}{\Delta x}$

$= \dfrac{6x\Delta x + 3(\Delta x)^2}{\Delta x}$

$= \dfrac{\Delta x(6x + 3\Delta x)}{\Delta x}$

$= \boxed{6x + 3\Delta x}$