Exercise 7(d)

I introduce the function (be careful, you must use a lot of brackets (paréntesis)).
For it, I write: (2z^(3/2)√(xy))/(sin(2t+xz)+5).

#1: $$\frac{2\cdot z^{3/2}\cdot\sqrt{(x\cdot y)}}{\text{SIN}(2\cdot t + x\cdot z) + 5}$$

I select line #1 and click the simbol ∂, or Cálculo/Derivadas. I indicate that the derivative is with respect x:

#2: $$\frac{d}{dx}\,\frac{2\cdot z^{3/2}\cdot\sqrt{(x\cdot y)}}{\text{SIN}(2\cdot t + x\cdot z) + 5}$$

#3: $$-\,\frac{z^{3/2}\cdot\sqrt{(x\cdot y)}\cdot(2\cdot x\cdot z\cdot\text{COS}(x\cdot z + 2\cdot t) - \text{SIN}(x\cdot z + 2\cdot t) - 5)}{x\cdot(\text{SIN}(x\cdot z + 2\cdot t) + 5)^2}$$

Now I select line #1 again and click the simbol ∂. I indicate that the derivative is now with respect y... Or I can use the function GRAD(), which is for the gradient vector.

For it, we write GRAD([],[]). In the first squared bracket (corchete) we copy the function, and in he second square bracket we write the variables x,y,z,t. So, we write: GRAD([2·z^(3/2)·√(x·y)/(SIN(2·t + x·z) + 5)], [x,y,z,t])

#4: $$\text{GRAD}\left(\left[\frac{2\cdot z^{3/2}\cdot\sqrt{(x\cdot y)}}{\text{SIN}(2\cdot t + x\cdot z) + 5}\right],\ [x,\ y,\ z,\ t]\right)$$

#5:

$$\left[\begin{array}{c} -\dfrac{z^{3/2}\cdot\sqrt{(x\cdot y)}\cdot(2\cdot x\cdot z\cdot COS(x\cdot z + 2\cdot t) - SIN(x\cdot z + 2\cdot t) - 5)}{x\cdot(SIN(x\cdot z + 2\cdot t) + 5)^2} \\ \dfrac{z^{3/2}\cdot\sqrt{(x\cdot y)}}{y\cdot(SIN(x\cdot z + 2\cdot t) + 5)} \\ \dfrac{\sqrt{z}\cdot\sqrt{(x\cdot y)}\cdot(3\cdot(SIN(x\cdot z + 2\cdot t) + 5) - 2\cdot x\cdot z\cdot COS(x\cdot z + 2\cdot t))}{(SIN(x\cdot z + 2\cdot t) + 5)^2} \\ -\dfrac{4\cdot z^{3/2}\cdot\sqrt{(x\cdot y)}\cdot COS(x\cdot z + 2\cdot t)}{(SIN(x\cdot z + 2\cdot t) + 5)^2} \end{array}\right]$$

The vector in line #5 is the gradient vector!

To replace the vector (1,1,0,0), I select line #5 and click "SUB". The results is:

#6:

$$\left[\begin{array}{c} -\dfrac{0^{3/2}\cdot\sqrt{(1\cdot 1)}\cdot(2\cdot 1\cdot 0\cdot COS(1\cdot 0 + 2\cdot 0) - SIN(1\cdot 0 + 2\cdot 0) - 5)}{1\cdot(SIN(1\cdot 0 + 2\cdot 0) + 5)^2} \\ \dfrac{0^{3/2}\cdot\sqrt{(1\cdot 1)}}{1\cdot(SIN(1\cdot 0 + 2\cdot 0) + 5)} \\ \dfrac{\sqrt{0}\cdot\sqrt{(1\cdot 1)}\cdot(3\cdot(SIN(1\cdot 0 + 2\cdot 0) + 5) - 2\cdot 1\cdot 0\cdot COS(1\cdot 0 + 2\cdot 0))}{(SIN(1\cdot 0 + 2\cdot 0) + 5)^2} \\ -\dfrac{4\cdot 0^{3/2}\cdot\sqrt{(1\cdot 1)}\cdot COS(1\cdot 0 + 2\cdot 0)}{(SIN(1\cdot 0 + 2\cdot 0) + 5)^2} \end{array}\right]$$

We click = to get the simplified result. Which is.....

#7:

$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

So, the gradient vector of the function at the point (1,1,0,0) is the null vector (My God, so much work to get the null vector! :-))