1 | **Partial Derivatives**

Find all the first, second, and third partial derivatives for the following functions. Also, draw a picture of them!

1.1 | $f(x, y) = 7x + 2x^2y^3 + 10y^2$

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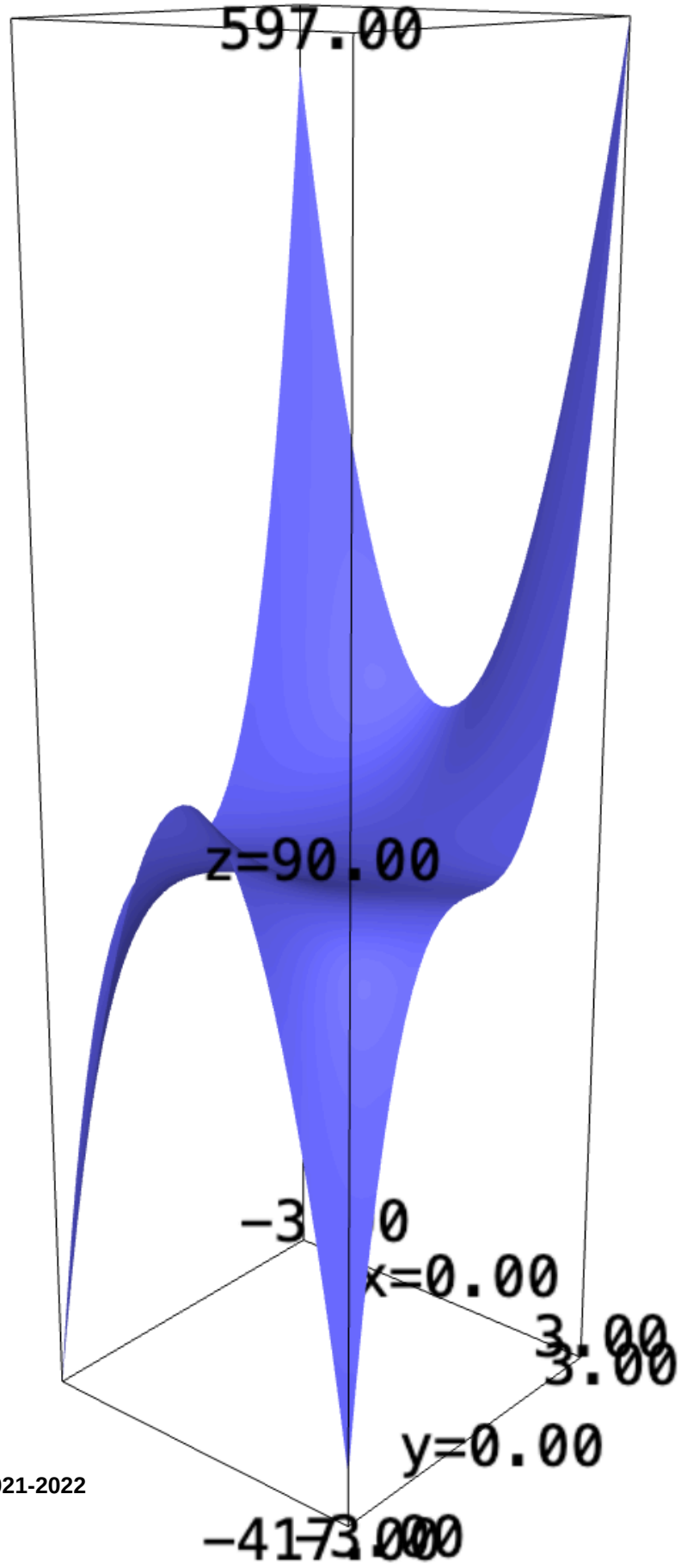
f(x,y) = 7*x+2*x^2*y^3 + 10*y^2
plot3d(f, (x,-3,3), (y,-3,3))
```


597.00
z=90.00
−3
0
x=0.00
3.00
3.00
y=0.00
−41
73.000

- $f_x = 7 + 4xy^3$
- $f_y = 6x^2y^2 + 20y$
- $f_{xy} = 12xy^2$
- $f_{xx} = 4y^3$
- $f_{yy} = 12x^2y + 20$
- $f_{xxx} = 0$
- $f_{yyy} = 12x^2$
- $f_{xxy} = 12y^2$
- $f_{yyx} = 24xy$

1.2 | $f(x, y) = 3xy^3 + 8x^2y^4$

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f(x,y) = 3*x*y^3 + 8*x^2*y^4
plot3d(f, (x,-3,3), (y,-3,3))
```

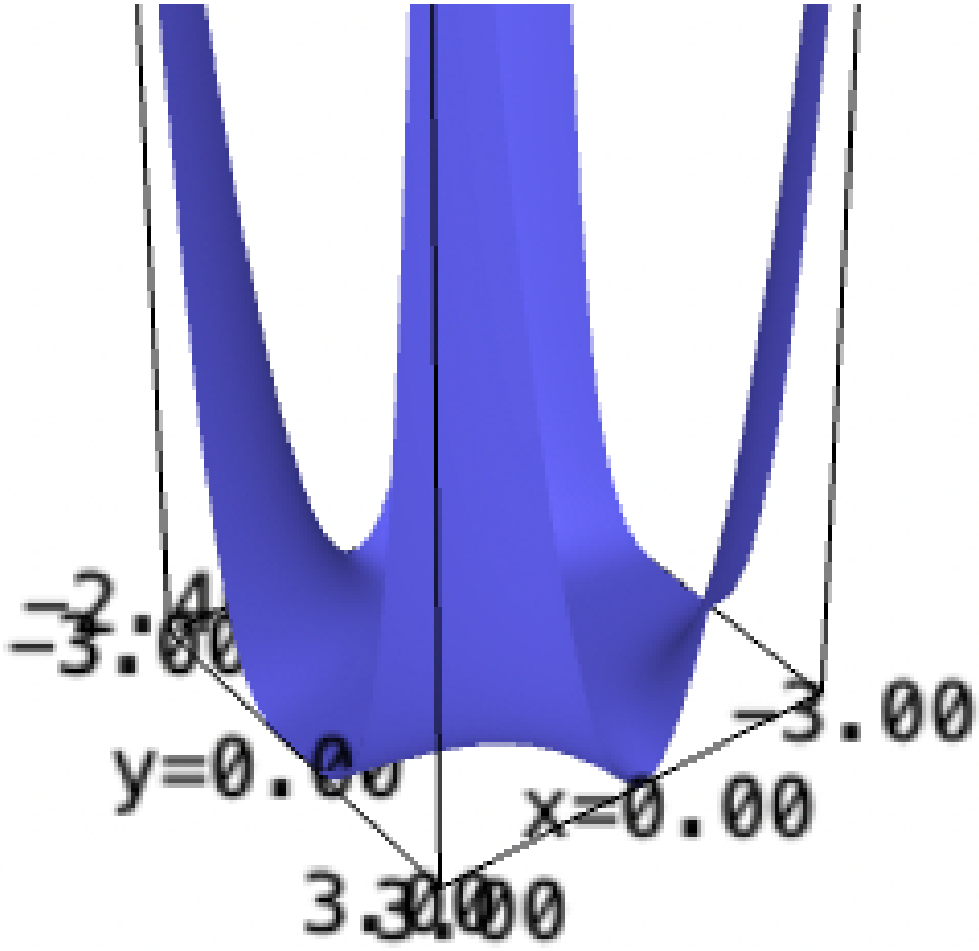

- $f_x = 3y^3 + 16xy^4$
- $f_y = 9xy^2 + 32x^2y^3$
- $f_{xy} = 9y^2 + 64xy^3$
- $f_{xx} = 16y^4$
- $f_{yy} = 18xy + 96x^2y^2$
- $f_{xxx} = 0$
- $f_{yyy} = 18x + 192x^2y$
- $f_{xxy} = 64y^3$
- $f_{yyx} = 18y + 192xy^2$

2 | **Puzzled Classmate**

Suppose that one of your classmates reports that for a particular function $f(x, y)$, the partial derivatives are:

$$\begin{cases} \frac{\partial f}{\partial x} = 2x + 3y \\ \frac{\partial f}{\partial y} = 4x + 6y \end{cases} \tag{1}$$

Do you believe them? Why or why not?

I do not.

If we take the "integrals" along the y and x dimensions, we result the following:

- $\int 2x + 3y \; dx = x^2 + 3xy + c$
- $\int 4x + 6y \; dy = 3y^2 + 4xy + c$

The two resulting functions are not in the same family of functions. Therefore, I do not believe my classmate in this regard.