MA 16020 Quiz 10 (Lessons 21-23)

Write your name, section number (054 for 11:30, 039 for 12:30), and quiz number on the top of your quiz, **front and back.**

You may use a one-line calculator.

1. Using differentials, compute approximately the quantity

$$\frac{7.1}{\sqrt{2}}\sin\left(\frac{\pi}{4}-0.2\right)-\frac{7}{\sqrt{2}}\sin\left(\frac{\pi}{4}\right) .$$

2. Find all the critical points of the function

$$f(x,y)=y^3-x^3+3yx-16 .$$

1. $f(x,y)=\frac{x}{\sqrt{2}}\sin(y) \rightsquigarrow \Delta z = f(7.1, \frac{\pi}{4}-0.2) - f(7,\frac{\pi}{4})$,

so $\Delta x = 0.1$, $\Delta y = -0.2$

$\frac{\partial f}{\partial x}=\frac{1}{\sqrt{2}}\sin(y)$, $\frac{\partial f}{\partial y}=\frac{x}{\sqrt{2}}\cos(y)$

$$\Delta z \approx \frac{\partial f}{\partial x}(7,\tfrac{\pi}{4})\cdot(0.1)+\frac{\partial f}{\partial y}(7,\tfrac{\pi}{4})\cdot(-0.2)=\frac{1}{\sqrt{2}}\cdot\left(\frac{\sqrt{2}}{2}\right)(0.1)+\frac{7}{\sqrt{2}}\cdot\left(\frac{\sqrt{2}}{2}\right)(-0.2)$$

$$=\frac{1}{2}\cdot(0.1)+\frac{7}{2}\cdot(-0.2)=0.05-0.7=\underline{-0.65}$$

2. $\frac{\partial f}{\partial x}=-3x^2+3y$ $\frac{\partial f}{\partial y}=3y^2+3x$

$\rightsquigarrow$ $-3x^2+3y=0$ & $3y^2+3x=0$

$-x^2+y=0$

$y=x^2$ plug in $3x^4+3x=0$

$3x(x^3+1)=0$

$x=0$ or $x^3+1=0$

$y=0^2=0$ $x=\sqrt[3]{-1}=-1$

$y=(-1)^2=1$

$\Rightarrow$ critical points are $(0,0)$ and $(-1,1)$