ME 423 Test #3

name key

For the following 2-d displacement functions

$u = 2x^2 + 2y^3$

$v = 10xy + 7$

Find the <u>maximum</u> γ at $(x,y)=(2,1)$

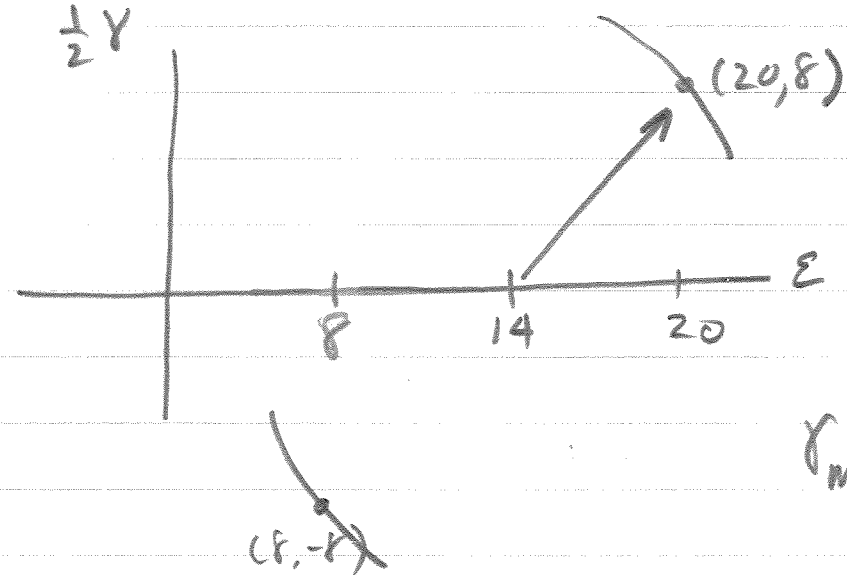
You do not need to give the orientation of the axes associated with this γ

$$\varepsilon_x = \frac{\partial u}{\partial x} = 4x$$

$$\varepsilon_y = \frac{\partial v}{\partial y} = 10x$$

$$\varepsilon_{xy} = \frac{1}{2}\left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x}\right) = \frac{1}{2}(6y^2 + 10y) = 3y^2 + 5y$$

At $(x,y)=(2,1)$ $\quad \underset{\sim}{\varepsilon} = \begin{bmatrix} 8 & 8 \\ 8 & 20 \end{bmatrix}$



$r^2 = 6^2 + 8^2 = 100$

$r = 10 = \varepsilon_{shear\ max}$

$\gamma_{max} = 2\,\varepsilon_{shear\ max} = 20$