$f(x,y)=48xy - 32x^3 - 24y^2$

I Partial derivatives

$f_x = 48y - 96x^2$ $\quad$ $f_y = 48x - 48y$

$f_{xx} = -192x$ $\quad$ $f_{yy} = -48$

$f_{yx} = (48x - 48y)_x = 48$

II Critical points

$$\begin{cases} 48y - 96x^2 = 0 \\ 48x - 48y = 0 \end{cases}$$

$$\begin{cases} 48y - 96x^2 = 0 \\ x = y \end{cases}$$

$$\begin{cases} 48x - 96x^2 = 0 \\ x = y \end{cases}$$

$$\begin{cases} 48x(1 - 2x) = 0 \\ x = y \end{cases} \longrightarrow \begin{matrix} x = 0 & \vee & x = 0{,}5 \\ y = 0 & \vee & y = 0{,}5 \end{matrix}$$

P_1 (0,0)
P_2 (0.5,0.5)

III Determinants

$$D_f = \begin{vmatrix} -192x & 48 \\ 48 & -48 \end{vmatrix}$$

$$D_f(0,0) = \begin{vmatrix} 0 & 48 \\ 48 & -48 \end{vmatrix} = -2304 \quad < 0$$ **<u>saddle point</u>**

$$D_f(0.5,0.5) = \begin{vmatrix} -96 & 48 \\ 48 & -48 \end{vmatrix} = 4608 - 2304 = 2304 \quad > 0$$

$$(-192x)\Big|_{(0.5,0.5)} = -96 \quad < 0$$ maximum

IV Answer

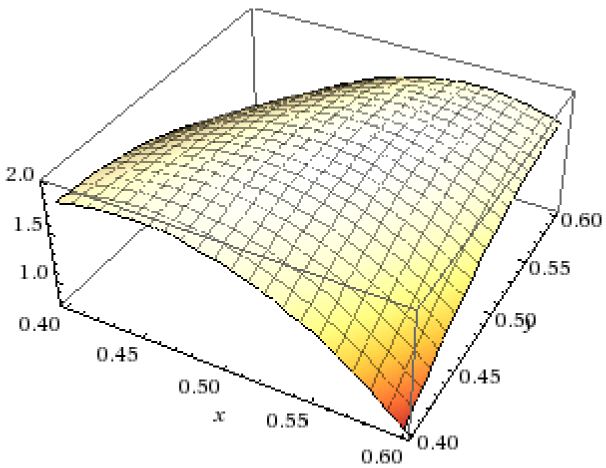
$f(0.5,0.5) = 48*0.5*0.5 - 32*0.125 - 24*0.25 = 12 - 4 - 6 = 2$ is a maximum

Saddle point: $f(0,0) = 0$, P(0,0,0)

Input interpretation:

plot	$48\,x\,y - 32\,x^3 - 24\,y^2$	$x = 0.4$ to 0.6 $y = 0.4$ to 0.6

3D plot:



Contour plot: