

① Find local max and min pts, local max and min values, and saddle pts of the function:

$$f(x,y) = 12x^2 - 4x^3 + 6y^2 + 12xy$$

Brianna Patnaude
Section 22
29 10 . pdf

• For critical points $f_x = 0$ and $f_y = 0$:

$$f_x = 24x - 12x^2 + 12y = 0$$

$$f_y = 12y + 12x = 0$$

$$y = -x \text{ — plug into } f_x \text{ equation} \rightarrow 24(x) - 12x^2 - 12x = 0$$

$$-12x^2 + 12x = 0$$

$$-12x(-x+1) = 0$$

$$\hookrightarrow x = 0, +1$$

→ plug $x=0$ and $x=1$ into f_y :

$$f_y(x=0) = 12y = 0 \rightarrow y=0$$

$$f_y(x=1) = 12y + 12 = 0 \rightarrow y=-1$$

critical pts:

$$(0,0)$$

$$(1,-1)$$

• Find values of max/mins:

$$f_{xx} = 24 - 24x$$

$$f_{yy} = 12$$

$$f_{xy} = 12$$

$$D = f_{xx}f_{yy} - (f_{xy})^2 = (24 - 24x)(12) - (12)^2$$

$$= (288 - 288x) - (144)$$

$$= -288x + 144$$

@ (0,0):

$$D = (-288(0) + 144) = 144 > 0$$

max @ (0,0)

$$f(0,0) = 0$$

@ (1,-1)

$$D = -288(1) + 144 = -144 < 0$$

minimum @ (1,-1)

$$f(1,-1) = 12 - 4 + 6 - 12 = 2$$

• Both are saddle points