10. $f_x(x,y) = x^2 + 2y - 6$

$f_y(x,y) = 2y + 2x - 3$

We set $\begin{cases} x^2 + 2y - 6 = 0 \\ 2y + 2x - 3 = 0 \end{cases}$

We subtract the second equation from the first equation to get

$$x^2 - 2x - 3 = 0$$

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

$$x = 3 \quad x = -1$$

When $x = 3$, $2y + 6 - 3 = 0 \rightarrow 2y = -3 \rightarrow y = -3/2$

so $(x,y) = (3, -3/2)$ is a critical point.

When $x = -1$, $2y - 2 - 3 = 0 \rightarrow 2y = 5 \rightarrow y = 5/2$

so $(x,y) = (-1, 5/2)$ is also a critical point.

Next, $f_{xx}(x,y) = 2x \quad f_{xy}(x,y) = 2$

$f_{yy}(x,y) = 2$

The discriminant is $D = f_{xx}(x,y) f_{yy}(x,y) - [f_{xy}(x,y)]^2$

$= 4x - 4$

For $(x,y) = (3, -3/2)$, $D = 8 > 0$

$f_{xx}(3, -3/2) = 6 > 0$ so this is a local <u>minimum</u>

For $(x,y) = (-1, 5/2)$, $D = -8 < 0$ so this is a <u>saddle point</u>