Surface Plots with MATLAB

We will plot the surface of equation

\[ z = x^2 - y^2 \]

as well as the level curves for \( c = -2, -1, 0, 1, 2 \).

In MATLAB, to get a rectangular domain \(-2 \leq x \leq 2, -2 \leq y \leq 2\) in steps of 0.2, we use the command

\[
\begin{align*}
&>> [x, y] = \text{meshgrid}([-2:0.2:2],[-2:0.2:2]); \\
&\text{We calculate } z = x^2 - y^2 \text{ as follows (note the use of .')}s.
\end{align*}
\]

\[
>> z = x.^2 - y.^2;
\]

To obtain the surface plot, we use either of the following.

\[
\begin{align*}
&>> \text{mesh}(x,y,z) & \quad \%\text{this one has colors} \\
&>> \text{surf}(x,y,z) & \quad \%\text{this one has colors}
\end{align*}
\]

To plot the level curves for \( c = -2, -1, 0, 1, 2 \), we use the following commands.

\[
\begin{align*}
&>> [c,h]=\text{contour}(x,y,z,[-2,-1,0,1,2]); \\
&>> \text{clabel}(c,h) & \quad \%\text{this labels the } c \text{ values on the contour plot}
\end{align*}
\]

The plot of the surface of equation

\[ z = \frac{20}{3 + x^2 + 2y^2} \]

as well as the level curves for \( c = 1, 2, 3, 4, 5 \) are shown below.