First I input the equations with which the problem started. Look for comments like this one for items where Mathematica needs a little explanation.

\[ \text{In}[1]:= \quad p_1 = 600 - 0.3 q_1 \]
\[ \text{Out}[1]= \quad 600 - 0.3 q_1 \]

\[ \text{In}[2]:= \quad p_2 = 500 - 0.2 q_2 \]
\[ \text{Out}[2]= \quad 500 - 0.2 q_2 \]

\[ \text{In}[3]:= \quad C = 16 + 1.2 q_1 + 1.5 q_2 + 0.2 q_1 q_2 \]
\[ \text{Set::wrsym: Symbol } C \text{ is Protected. More...} \]
\[ \text{Out}[3]= \quad 16 + 1.2 q_1 + 1.5 q_2 + 0.2 q_1 q_2 \]

Whoops, \( C \) is a protected symbol is Mathematical, so I will rename it cost. Also, note I had to write \( q_1 q_2 \) or \( q_1 q_2 \) (with a space between); \textit{Mathematica} would interpret \( q_1 q_2 \) as a different, single variable with a 4-letter name.

\[ \text{In}[4]:= \quad \text{Cost} = 16 + 1.2 q_1 + 1.5 q_2 + 0.2 q_1 q_2 \]
\[ \text{General::spell: Possible spelling error: new symbol name } \text{Cost} \text{ is similar to existing symbols } \{\text{Cos, Cosh, Cot, Most}\}. \text{ More...} \]
\[ \text{Out}[4]= \quad 16 + 1.2 q_1 + 1.5 q_2 + 0.2 q_1 q_2 \]

A "similar to" warning is not an error; \textit{Mathematica} just wonders if I really meant \( \text{Cos} \) or \( \text{Cosh} \), and is helping me find typos. In this case there was no typo.

\[ \text{In}[5]:= \quad R = p_1 q_1 + p_2 q_2 \]
\[ \text{Out}[5]= \quad (600 - 0.3 q_1) q_1 + (500 - 0.2 q_2) q_2 \]

\[ \text{In}[7]:= \quad \text{Profit} = R - \text{Cost} \]
\[ \text{Out}[7]= \quad -16 - 1.2 q_1 + (600 - 0.3 q_1) q_1 - 1.5 q_2 - 0.2 q_1 q_2 + (500 - 0.2 q_2) q_2 \]

Below, all derivatives and partial derivatives in \textit{Mathematica} are represented by the \( \text{D} \) function. So \( \text{D}[\text{Profit}, q_1] \) means take the partial derivative of \( \text{Profit} \) with respect to \( q_1 \). \( \text{D}[\text{Profit}, \{q_1, q_2\}] \) means take the second partial with respect to \( q_1 \) both times.

\[ \text{In}[8]:= \quad \text{CritEqs} = \{\text{D}[\text{Profit}, q_1] = 0, \text{D}[\text{Profit}, q_2] = 0\} \]
\[ \text{Out}[8]= \quad \{598.8 - 0.6 q_1 - 0.2 q_2 = 0, 498.5 - 0.2 q_1 - 0.4 q_2 = 0\} \]

When you write equations that you want \textit{Mathematica} to solve, you use \( == \). When you write equals in the sense of Let this equal that, you use the regular single =.

\[ \text{In}[9]:= \quad \text{Solve}[	ext{CritEqs}, \{q_1, q_2\}] \]
\[ \text{Out}[9]= \quad \{\{q_1 \rightarrow 699.1, q_2 \rightarrow 896.7\}\} \]
Profit /. % (* special Mathematica command for substituting in
the values from a solve command. "%" refers to the previous output *)

Out[10]= {432797.}

In[11]:= Pxx = D[Profit, {q1, 2}]

Out[11]= -0.6

In[15]:= Dtest = D[Profit, {q1, 2}] * D[Profit, {q2, 2}] - (D[Profit, q1, q2])^2

Out[15]= 0.2

Since Pxx is negative and Dtest is positive, the second-derivative test says we have found a maximum point. (I called it Dtest instead of D because D is a protected symbol for Mathematica.) Had Pxx and Dtest turned out to involve the variables q1 and q2, I would have had to evaluate them at the values found by the Solve function, as follows. I write

In[17]:= {Pxx, Dtest} /. % %9 (*%9 refers to output 9,
which is how that output was numbered while I created the file.*)

Out[17]= {{-0.6, 0.2}}