6.1 A wedge is flying at M=3. If the wedge half angle is 15 degrees determine the total pressure ratio across the oblique shock.

6.2 The conditions upstream of the leading edge of a flying wedge in air are M=3.5, .5 atm. Calculate the maximum pressure on the wedge surface that can be achieved before the oblique becomes detached.

6.3 Air is flowing past a compression corner at M= 4 and .8 atm. Downstream of the corner the pressure is 5 atm. What is the deflection angle of the corner?

6.4 A flow of air has the properties M= 4. and 1 atm. Compare the total pressure loss for two shock structures,

   a) a normal shock
   b) an oblique shock over a 25 degree corner followed by a normal shock.

Which configuration provides the lowest total pressure loss? How does this apply to the inlet to a convention jet engine using subsonic combustion in supersonic flight?

6.5 Plot 4 points of a curve of inlet Mach number versus deflection angle for a corner and parallel wall, similar to Figure 4.18 in the text, that allows just exactly 3 reflections for each combination of Mach number and deflection angle. Sketch the shock polars for the first and last points of your curve.

6.6 For a corner and parallel wall if the Mach number and wave angle of the second reflection are 2.4 and 30 degrees how many regular reflections are there? What is the initial Mach number? If the pressure of the initial flow at the corner is .5 atm what is the pressure after the last regular reflection?
\[\theta - M - \beta \quad @ \quad M_4 = 3, \theta = 15^\circ \Rightarrow \beta = 32.24\]
\[M_{in} = M_1 \sin \beta = 3 \sin 32.24 = 1.600\]
Table A.2 @ \(M_{in} = 1.6\) \(\Rightarrow \frac{p_2}{p_1} = 2.82\)

\[\theta - M - \beta \quad @ \quad M_1 = 3.5, \theta_{max} = 36.8, \Rightarrow \beta = 64.2\]
\[M_{in} = M_1 \sin \beta = 3.5 \sin 64.2 = 3.151\]
Table A.2 @ \(M_{in} = 3.151\), \(\frac{p_2}{p_1} = 11.41\)
\[p_2 = .5 \times 11.41 = 5.71\]
6.3

\[ \frac{p_2}{p_1} = \frac{5}{0.9} = 6.25 \]

Normal shock, Table A.2 if \( \frac{p_2}{p_1} = 6.25 \)

\( M_{1n} = 2.35 \)
\( M_{2n} = 0.5286 \)
\( M_{1n} = M_1 \sin \beta \)
\[ \beta = \sin^{-1} \frac{M_{1n}}{M_1} = \sin^{-1} \frac{2.35}{4} = 35.98 \]

\( M - \beta - \theta \) Chart \( M_1 = 4, \ \beta = 35.98 \)
\( \theta = 22^\circ \)
6.4

Isentropic Table @ $M_1 = 4, \Rightarrow \frac{p_O}{p_1} = 151.8$

normal shock, Table A.2 @ $M_1 = 4 \Rightarrow \frac{p_{O2}}{p_{O1}} = .1388$

$\Delta p_O = p_{O1} \left(1 - \frac{p_{O2}}{p_{O1}}\right) = 151.8(1 - .1338) = 131.49, \ 87\%$

$M - \theta - \beta$ Chart @ $M = 4, \theta = 25 \Rightarrow \beta = 38.45$

$M_{in} = M_1 \sin \beta = 4 \times \sin 38.46 = 2.488$

normal shock, Table A.2, @ $M_{in} = 2.488 \Rightarrow \frac{p_{O2}}{p_{O1}} = .5039$

$\Delta p_O = p_{O1} \left(1 - \frac{p_{O2}}{p_{O1}}\right) = 151.8(1 - .5039) = 75.30, \ 49.6\%$
6.6

Assume values of $M_3$ with $\beta = 30$ until $M_4 = 2.4$

Assume $M_3$

$\beta - M - \theta$ Chart @ $M_3$, $\beta = 30$; $\theta = M_3 \sin \beta$

$M_{3n} = M_3 \sin \beta$

Table A.2 @ $M_{4n}$; $M_{2n} =$

$M_4 = M_{3n} / \sin(\beta - \theta)$

<table>
<thead>
<tr>
<th>$M_3$</th>
<th>$\beta$</th>
<th>$\theta$</th>
<th>$M_{3n}$</th>
<th>$M_{4n}$</th>
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<td>.6866</td>
<td>2.400</td>
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</tbody>
</table>

$\theta = 13.38$