Problem 1. Terminology

a. MPC and the multiplier.
   Multiplier = \( \frac{1}{1.0 - \text{MPC}} \)

b. Actual and planned investment.
   Divergence between the two means the economy is out of equilibrium, since the Keynesian equilibrium condition is \( \text{PAE} = \text{GDP} \) or \( \text{PAE} = \text{Y} \). (\( \text{PAE} = \text{Planned aggregate expenditure} \))
   Divergence is due to unplanned inventory changes (an increase in inventory may be due to failure to make anticipated sales, and will result in lower orders to supplying firms and hence to lower employment and GDP.

c. Aggregate expenditure and Real GDP. If real aggregate expenditure is equal to real GDP, the economy is in Keynesian equilibrium. Note that the following two chapters always use real GDP, and we won't worry about inflation for these chapters.

d. Aggregate output and aggregate income. The circular flow means these are the same thing, looked at from two different perspectives (seller and consumer).

Problem 2. Republic of Yuck.

Real GDP = 200 billion (note that this may not be an equilibrium value)
Planned investment = 75 billion
Consumption function: \( C = 0.75 \text{Y} \)
   (since 25 percent of income is saved, 75 percent is consumed)

Simplest of all Keynesian models:

\[
\begin{align*}
Y &= C + I \\
Y &= 0.75 Y + 75 \\
Y - 0.75 Y &= 75 \\
(1 - 0.75)Y &= 75 \\
0.25 Y &= 75 \\
Y &= 4 * 75 = 300 \text{ billion}
\end{align*}
\]

Since the equilibrium GDP of 300 billion is higher than the actual GDP of 200 billion, we can forecast an increase in actual GDP (as long as the economy is not operating at capacity). The planned investment means an increase in investment, which must have previously been 50 billion if 200 billion was initially a Keynesian equilibrium value (remember the multiplier of 4 to see this).

The new investment will require new hires to make capital goods or build factories or homes, and they will spend 75 percent of their income. As a result inventories will be run down, and there will be new hires in the consumer goods industry. The process will end when GDP is at 300 billion.
Problem 2. Table of GDP and Planned investment.

Just a few lines are included:

<table>
<thead>
<tr>
<th>GDP</th>
<th>CONSUMPTION</th>
<th>SAVING</th>
<th>PLANNED INVESTMENT</th>
<th>ΔC / ΔGDP</th>
<th>MPC</th>
<th>Unplanned ΔInventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,000</td>
<td>2,900</td>
<td>100</td>
<td>300</td>
<td>----------</td>
<td>0.8</td>
<td>-200</td>
</tr>
<tr>
<td>3,500</td>
<td>3,300</td>
<td>200</td>
<td>300</td>
<td>400 / 500 = 0.8</td>
<td>0.8</td>
<td>-100</td>
</tr>
<tr>
<td>4,000</td>
<td>3,700</td>
<td>300</td>
<td>300</td>
<td>400 / 500 = 0.8</td>
<td>0.8</td>
<td>0</td>
</tr>
<tr>
<td>4,500</td>
<td>4,100</td>
<td>400</td>
<td>300</td>
<td>400 / 500 = 0.8</td>
<td>0.8</td>
<td>+100</td>
</tr>
<tr>
<td>5,000</td>
<td>4,500</td>
<td>500</td>
<td>300</td>
<td>400 / 500 = 0.8</td>
<td>0.8</td>
<td>+200</td>
</tr>
</tbody>
</table>

Note that equilibrium output will be GDP = 4,000. Only at that level is there zero unplanned inventory change. If planned investment increases by 200 to 500, equilibrium output will be 5,000.

MPC = ΔC / Δ GDP where for example between GDP = 3000 and GDP = 3500,

ΔC = 3,300 – 2,900 = 400 and Δ GDP = 3,500 – 3,000 = 500

The full consumption function will be C = 500 + 0.8 Y, since at Y = 3,000,

induced consumption is 0.8 * Y = 2,400

and we must add autonomous consumption of 500 to reproduce the values in the table.
Problem 6. Ruritania, not Freedonia.

The text problem on Freedonia does not show up quite so well on the graph, so I shall create the country of Ruritania with the more modest consumption function of \( C = 200 + 0.4Y \); that is, the Ruritanians spend 40 cents out of every dollar and save 60. The savings function will be \( S = -200 + 0.6Y \), with dissaving of 200 and a marginal propensity to save of 0.6. (Note that dissaving = negative of autonomous consumption, and MPS = 1 – MPC.)

If investment is initially 100, we have and then rises to 160, we have:

\[
\begin{align*}
Y &= 200 + 0.4Y + 100 \\
0.6Y &= 300 \\
Y &= 500 \\
\end{align*}
\]

\[
\begin{align*}
Y &= 200 + 0.4Y + 160 \\
0.6Y &= 360 \\
Y &= 600 \\
\end{align*}
\]

Which can be shown in a Keynesian cross diagram as:

Or we can present it as the savings-investment graph (see p. 150) as:
Problem 7. Consumption and Wealth.

Consumption depends not only on income, but also on wealth (Bill Gates is not starving now that he has retired). A common rule of financial advisers is that retirees can safely spend 4 percent of their wealth and still expect some growth in their wealth from stock market appreciation or interest on bonds, and this rule went into the text example. A consumer who wants to spend $10,000 a year plus 75 percent of income, plus 4 percent of wealth, will have the consumption function (note that the $ 10,000 is entered as 10 for convenience; we drop the last three zeros of any other numbers in the equation, and must remember to say “thousands” in interpreting the results):

\[ C = 10 + 0.75Y + 0.04W \]

If wealth is $1,000,000, this means that the final term is 0.04 * 1,000 = 40 or $40,000. Hence we can rewrite the consumption function as:

\[ C = 50 + 0.75Y \]

If we have a country of millionaires with this consumption function, and if planned investment is $100,000 per millionaire, the standard Keynesian math will give:

\[ Y = C + I \]
\[ Y = 50 + 0.75Y + 100 \]
\[ 0.25Y = 150 \]
\[ Y = 600 \]

and if wealth increases to $1,500,000 (for example due to a run-up in house prices or stock values, as happened in the 2003-8 period, we must rewrite the consumption function as:

\[ C = 10 + 0.75Y + 0.4 * (1,500) \]
\[ C = 70 + .75Y \]

\[ Y = 70 + .75Y + 100 \]
\[ 0.25Y = 170 \]
\[ Y = 680 \]

and the increase in wealth will indirectly have an impact on GDP. If the country is already operating close to full employment, this may be inflationary.

Of course, if the stock market loses half its value, wealth will contract sharply, and this will lead to falling GDP. You should find that if \( W \) falls to 750, GDP will be down to 520.

Problem 10. Paradox of thrift: There is a potential bit of confusion in the problem statement, since the model on p. 154 will NOT predict falling savings from an increase in autonomous savings – it predicts constant savings and falling GDP. If investment remains the same, the only problem is that the required amount of savings will be reached at a lower level of GDP.