The formula shown below will approximate the effective annual yield (interest rate) of an investment/debt where there are periodic receipts/payments of interest and a final lump-sum receipt/payment where the initial amount invested/borrowed isn’t equal to the final lump-sum receipt/payment.

\[
Y = \left[ \frac{I + (P - M)}{N} \right] / \left( \frac{P + M}{2} \right)
\]

Where:  
Y = Effective annual yield (rate)  
N = Number of periods of compounding in total  
M = Amount paid/received at date of purchase/sale  
P = Face/Maturity value (final lump-sum payment)  
I = Amount of income received/paid per compounding period

A good application of this formula would be an investment/sale of a bond where the nominal (stated) interest rate is higher, or lower, than the effective (market) rate on the date of purchase/sale. Required information: (1) periodic interest receipts/payments, (2) initial investment/sales amount, and (3) final lump-sum receipt/payment (maturity value). Knowledge of the nominal (stated) interest rate is not required.

**An example:** A 5-year bond with a maturity value of $100,000.00, a stated annual interest rate of 5.000% with annual interest payments of $5,000.00 (5% x $100,000.00) is sold to yield a 6.000% effective rate. The initial amount of cash changing hands (present value) on the sales date would be $95,787.63 as determined by using present value tables.  
\[
[(100,000.00 \times 0.74725817) + (5,000.00 \times 4.21236379)] = 95,787.63.
\]

The amortization schedule shown below provides proof of the accuracy of the present value.

**Calculation of the effective interest rate using the formula:**

\[
Y = \left[ \frac{5,000 + (100,000.00 - 95,787.63)}{5} \right] / \left( \frac{100,000.00 + 95,787.63}{2} \right)
\]

\[
Y = 5,842.474 / 97,893.815
\]

\[
Y = 5.968172669\% \quad \text{⇒ Close to effective interest rate of 6.000%}
\]

**Amortization Schedule:**

<table>
<thead>
<tr>
<th>Period</th>
<th>Periodic Payment/Receipt</th>
<th>Actual Interest Amount</th>
<th>Amortization Amount</th>
<th>Carrying Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>95,787.63</td>
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<td></td>
<td></td>
</tr>
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<tr>
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<td>890.00</td>
<td>99,056.60</td>
</tr>
<tr>
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<td>5,943.40</td>
<td>943.40</td>
<td>100,000.00</td>
</tr>
</tbody>
</table>