Negotiating the circularity of equal loan instalments can feel like being lost in a maze. Doug Williamson shows the way through to easy exam marks and practical cash and profit management.

Almost every large business borrows money. The team leader for borrowings is normally the treasurer. The treasurer must safeguard the firm's cash flows at all times, as well as understand and manage the impact of borrowings on the company's interest costs and profits. So treasurers need a deep and joined-up understanding of the effects of different borrowing structures, both on the firm's cash flows and on its profits. For these important reasons, loan repayments are a frequent exam topic.

**Cash is king**

Say we borrow £10m in a lump sum, to be repaid in annual instalments. Obviously, the lender requires full repayment of the £10m principal (capital) borrowed. They will also require interest.

Let's say the rate of interest is 5% per year.

The first year's interest, before any repayments, is simply the original £10m x 5% = £0.5m

The expense charged to the income statement, reducing net profits for the first year, is £0.5m. But the next year can start to seem complicated.

**Business dilemma**

Our instalment will repay some of the principal, as well as paying the interest. This means the second year's interest charge will be less than the first, because of the principal repayment.

But what if we can't afford larger instalments in the earlier years? Can we make our total cash outflows the same in each year? Is there an instalment that will repay just the right amount of principal in each year, to leave the original borrowing repaid, together with all of the reducing annual interest charges, by the end?

**Circle solver**

Help is at hand. There is, indeed, an equal instalment that does just that, sometimes called an **equated instalment**. Equated instalments pay off varying proportions of interest and principal within each period, so that by the end, the loan has been paid off in full.

The equated instalments deal nicely with our cash flow problem, but the interest charges still seem complicated.

**Dynamic balance**

As we've seen, interest is only charged on the reducing balance of the principal. So the interest charge per period starts out relatively large, and then it gets smaller with each annual repayment.

The interest calculation is potentially complicated, even circular, because our principal repayments are changing as well. As the interest element of the instalment goes down each year, the balance available to pay off the principal is going up every time.

How can we figure out the varying annual interest charges? Let's look at a recent exam question, which asked us to do exactly that.

**Earth mover**

Southee Limited, a construction company, is planning to acquire new earth-moving equipment at a cost of £10m. Southee is considering a bank loan for the full cost of the equipment, repayable over four years in equal annual instalments, incorporating interest at a rate of 5% per annum, the first instalment to be paid one year from the date of taking out the loan.
Required:
Calculate the annual instalment that would be payable under the bank loan. Also, calculate how much would represent the principal repayment, and how much would represent interest charges, in each of the four years and in total.

Corporate Finance and Funding (CFF), April 2014, Q5 extracts

**Instalment plan**
Reading the question carefully, we need to work out five things:
1. The annual instalment.
2. Total principal repayments.
3. Total interest charges.
4. Interest charges for each year.
5. Principal repayments in each year.

**Success factor**
The best place to start is with the annual instalment. To work out the annual instalment we need an anuity factor. The anuity factor (AF) is the ratio of our equated annual instalment, to the principal of £10m borrowed at the start.

The annuity factor itself is calculated as:

\[
AF = \frac{1 - (1+r)^{-n}}{r}
\]

Where:
- \(r\) = interest rate per period
- \(n\) = number of periods

Applying the formula:

\[
AF = \frac{1 - (1+0.05)^{-4}}{0.05} = 3.55
\]

Even stevens
Now, the equated annual instalment is given by:

\[
\text{Instalment} = \frac{\text{Principal}}{\text{annuity factor}} = \frac{\£10m}{3.55} = \£2.82m
\]

**Follow the plan**
1. The total of the principal repayments is simply the total principal originally borrowed, ie £10m.
2. The total of the interest charges is the total of all the repayments minus the total principal repaid. We’re only paying principal and interest, so any amount paid that isn’t principal, must be interest.

Time for a table
The allocations are easier to figure out in a nice table. Let’s invest a little time in one, filling in the figures we already know.

(All amounts are in £m.)

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening balance</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Add: 5% interest</td>
<td>0.50</td>
<td>0.38*</td>
<td>0.26</td>
<td>0.13</td>
<td>1.3</td>
</tr>
<tr>
<td>Less: instalments</td>
<td>(2.82)</td>
<td>(2.82)</td>
<td>(2.82)</td>
<td>(2.82)</td>
<td>(11.3)</td>
</tr>
<tr>
<td>Closing balance</td>
<td>7.68</td>
<td>5.24</td>
<td>2.68</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(There is a minor rounding difference of £0.01m in year four that we don’t need to worry about. It would disappear if we used more decimal places.)

Full marks and debt-free
Congratulations! You’ve earned full marks and paid off your debts in full.

A great result from your wise investment in a nice table.

*The interest charge for the second year is less, based on the lower opening balance of £7.68m: 0.05 x £7.68m = £0.38m.
Annual principal: 2.82 + 2.44 + 2.56 + 2.68 = 10

**Even stevens**
Now, the equated annual instalment is given by:

\[
\text{Instalment} = \frac{\text{Principal}}{\text{annuity factor}} = \frac{\£10m}{3.55} = \£2.82m
\]

We’ve answered the first and trickiest part of the question. The rest is quite easy, so long as we follow our steps (2) to (5) above, in order.

Doug Williamson FCT,
is an experienced coach and tutor. As a former chief examiner, he is uniquely qualified to help you to ace your ACT exams, having read and carefully marked a great number of exam scripts.

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