**Example:** Calculate the undiscounted and discounted loss ratio at year-end 2016

| | |
|---|---|
| date of claim: | 30-Jun-16 |
| undiscounted reserve: | 1,000 |
| discount rate: | 5% |
| earned premium: | 1,000 |

| payment pattern | |
|---|---|
| 12 | 25% |
| 24 | 25% |
| 36 | 25% |
| 48 | 25% |

We'll make some **simplifying assumptions** so we can see more clearly what's going on with the discounting and interest payments:

- the insurer has only 1 policy and 1 claim
- policy premium is $1,000
- effective date of policy is July 1, 2015 *(so claim is on last date of policy term)*
- all PfADs = 0 *(So PV and APV are the same for this problem)*
- all payments are made on June 30 of the given CY *(in other words, mid-year)*

This means (earned premium) = $1,000 and therefore (unearned premium) = 0
*(So we don't need to worry about investment income on the unearned premium)*

Now, you can calculate the paid and unpaid triangles, but to save time I've provided them below:

| **paid** | CY 2016 | CY 2017 | CY 2018 | CY 2019 |
|---|---|---|---|---|
| AY 2016 | 250 | 250 | 250 | 250 |

** incremental paid values*

| **APV UCAE** | CY 2016 | CY 2017 | CY 2018 | CY 2019 |
|---|---|---|---|---|
| AY 2016 | 697 | 476 | 243 | 0 |

** year-end values*

You could also calculate the investment income due to the year-end unpaid loss that accrues over each CY but I'll provide that too.

| investment income | CY 2016 | CY 2017 | CY 2018 | CY 2019 |
|---|---|---|---|---|
| AY 2016 | -- | 29 | 18 | 6 |

**Example:** Example- **[ANSWER SHEET]**

**Source:** CIA.MfAD & CCIR.ARinstr

**undiscounted loss ratio**
= (undiscounted reserve) / (earned premium)
= 1,000 / 1,000
**= 100%**

**discounted loss ratio** *(according to the formula from CCIR.ARinstr, page VI-9, Line 31)*
= [(paid during year) - InvInc(UCAE) + (APV of unpaid claims)] / (EP + InvInc(EP))
= [250 - (29 + 18 + 6) + 697] / (1000 + 0)
= 894 / 1000
**= 89.4%**

**Back to your question:**
Why is (sum of investment income subtracted) ?

**Answer:**
This is just how the discounted loss ratio is defined. It could have been defined <u>without</u> subtracting the investment income, but it wasn't. I realize this answer is not very satisfying.

**Here is how I thought through the process:**
The way I think about it is that at the end of 2016, the insurer has already paid 250, but also has to keep 697 in the bank to be able to pay out the 250 in each of the next 3 years.
- the key is the 697
- that's the actual amount of money they have to set aside for reserves
- it's less than what they will have to pay out, which is 750 in total over 3 years
- but they will also earn invesment income over the 3 years and it will make up the difference of 750 - 697 = 53 *(Note that 29 + 18 + 6 = 53)*

So they have 697 in discounted reserves and have already paid 250. That sums to 947. I think it would have been perfectly reasonable to define the **discounted loss ratio** is:
= (250 + 697) / 1000
= 947 / 1000
**= 94.7%** *(Don't do this on the exam! Do it the way shown above that resulted in 89.4%)*

**The details of how the payouts and investment income interact are as follows:**
Between year-end 2016 and the next payment of 250 in **mid-2017**, the insurer will earn investment income of (697 x 1.05^0.5) - 697 = 17.2, so they will have 714.2 in reserves. If they then pay 250, they will have 464.2 and that amount will continue accruing interest until the end of 2017, at which point they will have 464.2 x (1.05)^0.5 = 476. They will earn (476 x 1.05^0.5) - 476 = 12 more in interest by **mid-2018** when they will pay another 250. This process continues, making payments and earning investment income, until the middle of 2019 when the final payment of 250 is made and the reserves go to zero.