Paper LBO Modeling Test (NO EXCEL OR CALCULATORS) – 30 Minute – SOLUTIONS

Valen Capital is considering a leveraged buyout of Ravello Refineries, a leading producer of oil and industrial chemicals.

The company is planning to increase its CapEx significantly over the next several years to support higher growth, even if its margins fall.

Valen plans to purchase the company for 10x LTM EBITDA, and it will use a Term Loan for 4x EBITDA and Senior Notes for 2x EBITDA, with Investor Equity funding the remainder.

The Term Loan interest rate is 5%, and 2% of the initial principal must be repaid each year. Additionally, 100% of the company's Free Cash Flow will be used to make optional repayments of the Term Loan.

The Senior Note interest rate is 10%, and no principal repayments are allowed.

Ravello's LTM EBITDA is $250 million, and it spends 60% of its Revenue on COGS and 15% on SG&A. D&A is **not** included in these COGS and SG&A figures and is a separate expense.

The company expects to grow its Revenue at 5.0%, 7.5%, 10.0%, 10.0%, and 10.0% over the next 5 years, and SG&A as a % of Revenue will increase by 1% per year.

Ravello also plans to spend 8% of its Revenue on Capital Expenditures (CapEx) and 4% on the Purchases of Intangible Assets. The Change in Working Capital will be a source of funds at 2% of Revenue per year.

The company expects Depreciation & Amortization to represent 5% of its annual Revenue, and its effective tax rate is 20%.

Valen Capital expects that it will be able to sell Ravello for 12x EBITDA at the end of the 5-year holding period because of the higher growth rate.

If Valen Capital is targeting a 20% IRR over 5 years, would you recommend this deal? Estimate the money-on-money multiple and IRR and show the FCF and Debt paydown calculations to support your answer.

You MAY not use Excel or a calculator for this exercise. Complete all the calculations using pencil and paper and round the numbers to simplify the calculations.

SOLUTIONS:

STEP 1 – Determine the End Goal

With a "paper LBO" test, **start with the end in mind**.

You know from the previous lessons that a 20% IRR over 5 years means a **2.5x multiple** (since a ~15% IRR is a 2x multiple and a ~25% IRR is a 3x multiple).

We are not given the company's LTM Revenue here, but we do have its LTM EBITDA: $250 million. Since it spends 60% of Revenue on COGS and 15% on SG&A, its EBITDA Margin is therefore, 1 – 60% – 15% = 25%. So, the company's LTM Revenue is $250 / 25% = $1,000.

A 10x purchase multiple means a Purchase Enterprise Value of $2,500, and we know the deal is funded with 6x Debt and 4x Equity, so the Investor Equity here is $2,500 * 40% = $1,000.

Therefore, this deal must generate $1,000 * 2.5x = $2,500 in Equity Proceeds to be viable.

We need to determine the Year 5 EBITDA and the Year 5 Debt balance to see if that's possible.

STEP 2 – Project Revenue and EBITDA

You should project Revenue and EBITDA **FIRST** because these two numbers drive everything else. Even if you cannot *finish* the FCF projections, you can always use EBITDA to make a rough estimate of the Year 5 Debt balance (e.g., by making FCF a simple percentage of EBITDA).

Here are the numbers they gave us:

	LTM	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue:	$1,000					
Growth:		5%	7.5%	10%	10%	10%
Margin:	25%	24%	23%	22%	21%	20%
EBITDA:	$250					

We know the EBITDA Margin falls by 1% per year because SG&A as a % of Revenue increases by 1% per year.

Some of these numbers are messy, so you can **round extensively** to get numbers that end in 5 or 10, making the math much easier. Here are some examples:

- $1,000 * 5% → This is easy; an increase of $50.
- $1,050 * 7.5% → Halfway between $52.5 and $105; round this to $80.

- $1,130 * 10% → This is $113, which you can round down to $110.
- $1,240 * 10% → This is $124, which you can round down to $120.
- $1,360 * 10% → This is $136, which you can round up to $140.

	LTM	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue:	$1,000	$1,050	$1,130	$1,240	$1,360	$1,500
Growth:		5%	7.5%	10%	10%	10%
Margin:	25%	24%	23%	22%	21%	20%
EBITDA:	$250					

Revenue is $1,502 in Year 5 if you calculate it in Excel. We're off by **0.2%**, but who cares? It's close enough!

Using round numbers like the ones above will make your life **10x easier**, so you **need** to do this if you want to finish in anything close to 30 minutes.

To project EBITDA, notice how the margins are always in between the "easy numbers" of 25% and 20%. You can, therefore, take 10% * Revenue * 2 to get to 20% each year and then add 1%, 2%, 3%, etc., based on the exact percentage, and round up or down.

Here's the math:

- **Year 1:** $1,050 * 24% → $1,050 is a bit higher than $1,000, and 24% is a bit lower than 25%, so we can estimate $250 once again.
  - o **Round To:** $250.
- **Year 2:** $1,130 * 23% → $1,130 * 10% = $113, so 20% of $1,130 is about $225. 1% of $1,130 is $11, so we can add $33 to $225 to get $258.
  - o **Round To:** $260.
- **Year 3:** $1,240 * 22% → $1,240 * 10% = $124, so $1,240 * 20% = $248. $1,240 * 2% = $24, so this is $272.
  - o **Round To:** $270.
- **Year 4:** $1,360 * 21% → $1,360 * 10% = $136, so $1,360 * 20% = $272. And 1% of $1,360 is $14, so this equals $286.
  - o **Round To:** $290.
- **Year 5:** $1,500 * 20% → $300 because 20% of $15 is $3. Easy.
  - o **Round To:** $300.

Here's what our pencil-and-paper sketch now looks like:

	LTM	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue:	$1,000	$1,050	$1,130	$1,240	$1,360	$1,500
Growth:		5%	7.5%	10%	10%	10%
Margin:	25%	24%	23%	22%	21%	20%
EBITDA:	$250	$250	$260	$270	$290	$300

It's fine to use something like $260, $270, $280, $290, and $300 in this progression if you want to simplify it even further and skip some of the math. You could even start with the Year 5 number and then fill in the rest based on the LTM figure and $10 increments.

STEP 3 – Calculate Annual FCF

Free Cash Flow = EBITDA – Interest – Taxes +/– Change in WC – CapEx – Purchases of Intangibles.

If you don't understand this formula, think about how FCF is defined: **Cash Flow from Operations (CFO) – CapEx.**

CFO starts with Net Income, and Net Income = Pre-Tax Income – Taxes.

Pre-Tax Income = EBITDA – Interest – D&A.

So, we can say that Net Income = EBITDA – Interest – D&A – Taxes.

Within CFO, we start with Net Income, add back non-cash expenses (only D&A here), and reflect the Change in Working Capital (which is positive here, per the instructions):

CFO = Net Income + D&A + Change in WC.

CFO = EBITDA – Interest – D&A – Taxes + D&A + Change in WC.

The two D&A terms cancel out, leaving us with:

CFO = EBITDA – Interest – Taxes + Change in WC.

Since FCF = CFO – CapEx, FCF = EBITDA – Interest – Taxes + Change in WC – CapEx.

"Purchases of Intangibles" is an additional item that's just like CapEx: the company purchases intangible assets and amortizes them over time.

Remember that CapEx, Purchases of Intangibles, and the Change in WC are all simple percentages of Revenue.

Therefore, it makes no sense to calculate them separately.

Group them to save time:

FCF = EBITDA – Interest – Taxes + Change in WC – CapEx – Purchases of Intangibles.

FCF = EBITDA – Interest – Taxes – "Other Items."

CapEx = 8% of Revenue, Intangible Purchases = 4%, and Change in WC = 2%, and the first two are negative, while the Change in WC is positive, **so "Other Items" represents negative 10% of Revenue.**

Once again, we'll round the numbers to units of 5 or 10, so $1,130 * 10% = $113 becomes $115:

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue:	$1,050	$1,130	$1,240	$1,360	$1,500
EBITDA:	$250	$260	$270	$290	$300
Interest:					
Taxes:					
Other Items:	($105)	($115)	($125)	($135)	($150)
FCF:					

To calculate the company's **Taxes**, we need to determine its Taxable Income. EBITDA – D&A = EBIT, and EBIT – Interest = Taxable Income; we can then multiply that by 20%.

D&A is 5% of Revenue, so that part is easy. To get these numbers, we can take 50% of the "Other Items" above and round it to units of 5 or 10:

	Year 1	Year 2	Year 3	Year 4	Year 5
EBITDA:	$250	$260	$270	$290	$300
D&A:	($50)	($55)	($60)	($65)	($75)
Interest:					
Taxable Income:					
Taxes:					

The Interest Expense will be DIFFERENT each year because the company repays the Term Loan over time. Many of the other numbers are interdependent as well:

- **Interest:** Depends on the Debt balance, but the Debt balance depends on FCF.
- **FCF:** Depends on the Interest and Taxes.
- **Taxes:** Depends on the Interest.

You have to do this **iteratively** and go year-by-year, starting with the Interest in Year 1.

The initial Term Loan is $1,000, or $250 * 4, and the initial Senior Notes are $500, or $250 * 2, so the Interest Expense is $1,000 * 5% + $500 * 10% = $100:

	Year 1	Year 2	Year 3	Year 4	Year 5
EBITDA:	$250	$260	$270	$290	$300
D&A:	($50)	($55)	($60)	($65)	($75)
Interest:	($100)				
Taxable Income:	$100				
Taxes:	$20				
EBITDA:	$250	$260	$270	$290	$300
Interest:	($100)				
Taxes:	($20)				
Other Items:	($105)	($115)	($125)	($135)	($150)
FCF:	$25				
Beginning Debt:	$1,500				
Ending Debt:	$1,475				

You do **not** need to separate the 2% annual principal repayments because 2% of $1,000 is $20, which is less than the $25 of FCF, and 100% of FCF is used to repay the Term Loan principal.

In Year 1, for example, the company's FCF is $25. That covers the $20 in mandatory repayments, and there's $5 of FCF left to repay more of the Term Loan.

Instead of splitting these payments, use all the FCF to repay the Debt balance.

The Senior Notes remain the same at $500 each year, so only the Term Loan balance changes.

Once you have the Year 1 numbers, you can continue to Year 2, where Interest = 5% * $975 + 10% * $500.

If you do not round all the Interest numbers to $95 or $100, the math will start to get messy, so round away.

As you'll see, the company's FCF never changes by a huge amount, so it's perfectly acceptable to round each annual FCF figure to $25, $30, or $35 as well.

Technically, 5% * $975 + 10% * $500 is ~$99, but you should round it to $100 to simplify:

	Year 1	Year 2	Year 3	Year 4	Year 5
EBITDA:	$250	$260	$270	$290	$300
D&A:	($50)	($55)	($60)	($65)	($75)
Interest:	($100)	($100)			
Taxable Income:	$100	$105			
Taxes:	$20	$20			
EBITDA:	$250	$260	$270	$290	$300
Interest:	($100)	($100)			
Taxes:	($20)	($20)			
Other Items:	($105)	($115)	($125)	($135)	($150)
FCF:	$25	$25			
Beginning Debt:	$1,500	$1,475			
Ending Debt:	$1,475	$1,450			

We're also **rounding the Taxes** here. Yes, $105 * 20% = $21, and you can easily calculate it ($100 * 20% + $5 * 20%) but rounding it to $20 will make the rest easier.

You can then repeat the same process for Year 3. Interest = 5% * $950 + 10% *$500 = $95 / 2 + $50 = $47.5 + $50, but let's round it to $95:

	Year 1	Year 2	Year 3	Year 4	Year 5
EBITDA:	$250	$260	$270	$290	$300
D&A:	($50)	($55)	($60)	($65)	($75)
Interest:	($100)	($100)	($95)		
Taxable Income:	$100	$105	$115		
Taxes:	$20	$20	$25		
EBITDA:	$250	$260	$270	$290	$300
Interest:	($100)	($100)	($95)		
Taxes:	($20)	($20)	($25)		
Other Items:	($105)	($115)	($125)	($135)	($150)
FCF:	$25	$25	$25		
Beginning Debt:	$1,500	$1,475	$1,450		
Ending Debt:	$1,475	$1,450	$1,425		

As with the Interest, it's easiest to round the Taxes to $20, $25, $30, etc. each year. For example, $120 * 20% = $100 * 20% + $20 * 20% = $20 + $4 = $24 in Taxes.

https://breakingintowallstreet.com

$115 is a bit less than $120, so the Taxes should be more like $23, but it's much easier to round this up to $25.

In Year 4, Interest = $925 * 5% + $500 * 10% = $92.5 / 2 + $50. Since $92.5 / 2 is closer to $45 than $50, let's round this down to $45 + $50 = $95:

	Year 1	Year 2	Year 3	Year 4	Year 5
EBITDA:	$250	$260	$270	$290	$300
D&A:	($50)	($55)	($60)	($65)	($75)
Interest:	($100)	($100)	($95)	($95)	
Taxable Income:	$100	$105	$115	$130	
Taxes:	$20	$20	$25	$25	
EBITDA:	$250	$260	$270	$290	$300
Interest:	($100)	($100)	($95)	($95)	
Taxes:	($20)	($20)	($25)	($25)	
Other Items:	($105)	($115)	($125)	($135)	($150)
FCF:	$25	$25	$25	$35	
Beginning Debt:	$1,500	$1,475	$1,450	$1,425	
Ending Debt:	$1,475	$1,450	$1,425	$1,390	

Yes, $130 * 20% is greater than $25, but we're simplifying and rounding the Taxes again.

In Year 5, Interest = 5% * $890 + 10% * $500, and $89 / 2 is close to $45, so we'll round the total Interest to $95 once again:

	Year 1	Year 2	Year 3	Year 4	Year 5
EBITDA:	$250	$260	$270	$290	$300
D&A:	($50)	($55)	($60)	($65)	($75)
Interest:	($100)	($100)	($95)	($95)	($95)
Taxable Income:	$100	$105	$115	$130	$130
Taxes:	$20	$20	$25	$25	$25
EBITDA:	$250	$260	$270	$290	$300
Interest:	($100)	($100)	($95)	($95)	($95)
Taxes:	($20)	($20)	($25)	($25)	($25)
Other Items:	($105)	($115)	($125)	($135)	($150)
FCF:	$25	$25	$25	$35	$30
Beginning Debt:	$1,500	$1,475	$1,450	$1,425	$1,390
Ending Debt:	$1,475	$1,450	$1,425	$1,390	$1,360

STEP 4 – Calculate the Exit Proceeds

We're *almost* done now. To finish, we need to calculate the Exit Enterprise Value, Exit Equity Value, money-on-money multiple, and IRR.

We know the Year 5 EBITDA and the Year 5 Exit Multiple of 12x:

$300 * 12 = $300 * 10 + $300 * 2 = $3,600 for the Exit Enterprise Value (AKA $3.6 billion).

We have no information on the Cash balance, but we know it has NOT changed because all the FCF was used to repay the Term Loan.

Since the total remaining Debt at the end is $1,360, the Exit Equity Value = $3,600 – $1,360 = $2,240 (you could round this to $2,200 or $2,300).

To get a 20% IRR over 5 years, we need a 2.5x multiple on the $1,000 of Investor Equity.

Therefore, this deal is **not viable** because the multiple will be in the 2.2x – 2.3x range.

It's not *terrible* – the IRR is probably between 15% and 20% – but it's also clearly not what the PE firm was targeting. So, we recommend **against** the deal.

There's another problem as well: because of the minimal Debt Paydown and very modest EBITDA growth, a huge percentage of these returns must come from the Multiple Expansion (10x → 12x).

And it's not a wise idea to bet on a deal that's overly dependent on Multiple Expansion.

STEP 5 – Verify These Calculations

This last step is **NOT** a part of the case study, but we wanted to use it to illustrate the accuracy of the estimates above.

Take a look at the accompanying Excel file, and you'll see what the "real" numbers look like in a simple Excel model.

Even though we rounded and heavily simplified the numbers, **the results are remarkably close: a 2.2x multiple and a 17.6% IRR.**

You'll see bigger divergences in more complex models, but the point of this exercise is simple: **always do a quick check of the numbers first.**

If the deal doesn't work with a simple model, it will *never* work with a complex model.