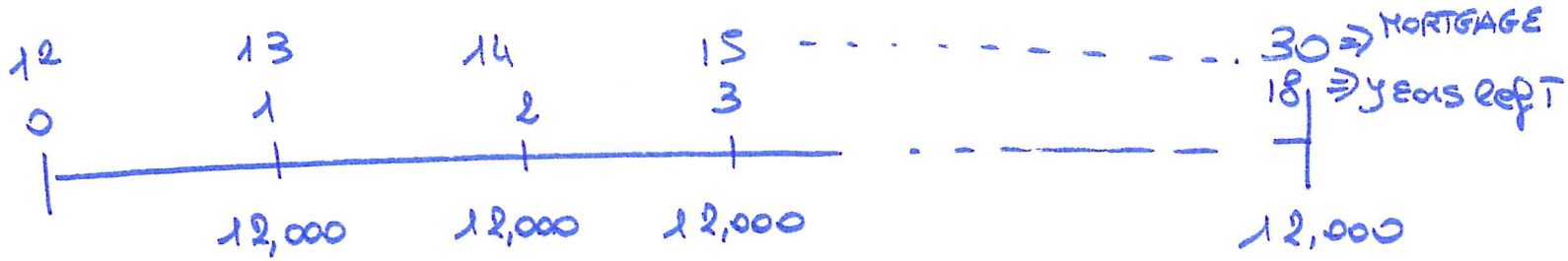
TRAINING SESSION

EX: 1

WHEN YOU PURCHASED YOUR HOUSE, YOU TOOK OUT A 30-YEAR ANNUAL-PAYMENT MORTGAGE WITH AN INTEREST RATE OF 6% PER YEAR. THE ANNUAL PAYMENT ON THE MORTGAGE IS €12,000. YOU HAVE JUST MADE A PAYMENT AND HAVE NOW DECIDED TO PAY THE MORTGAGE OFF BY REPAYING THE OUTSTANDING BALANCE. WHAT IS THE PAYOFF AMOUNT IF:

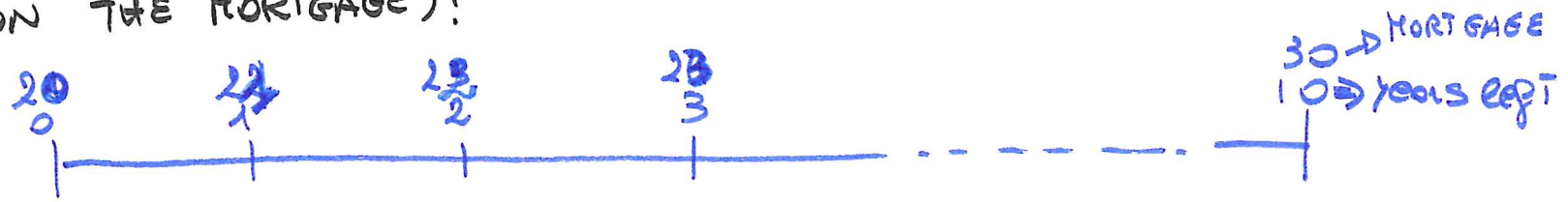
a) YOU HAVE LIVED IN THE HOUSE FOR 12 YEARS (SO THERE ARE 18 YEARS LEFT ON THE MORTGAGE)?




TO PAYOFF THE MORTGAGE YOU MUST REPAY THE REMAINING BALANCE. THE REMAINING BALANCE IS EQUAL TO THE PRESENT VALUE OF THE REMAINING PAYMENTS. THE REMAINING PAYMENTS ARE AN 18-YEAR ANNUITY, SO:

$$PV_{12\ YEAR} = \frac{12{,}000}{0.06} \cdot \left(1 - \frac{1}{1.06^{18}}\right) = €129{,}931.24$$

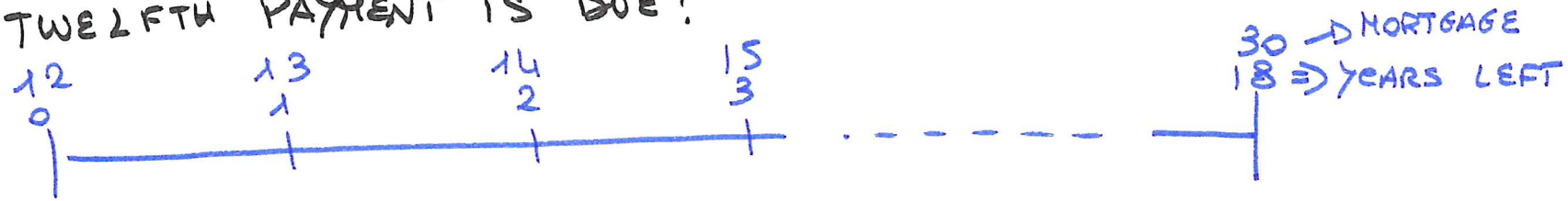
b) YOU HAVE LIVED IN THE HOUSE FOR 20 YEARS (SO THERE ARE 10 YEARS LEFT ON THE MORTGAGE)?




TO PAYOFF THE MORTGAGE YOU MUST REPAY THE REMAINING BALANCE. THE REMAINING BALANCE IS EQUAL TO THE PRESENT VALUE OF THE REMAINING PAYMENTS. THE REMAINING PAYMENTS ARE A 10-YEAR ANNUITY, SO:

$$PV_{21\,YEAR} = \frac{12{,}000}{0.06} \cdot \left(1 - \frac{1}{(1.06)^{10}}\right) = €\,88{,}321.04$$

c) YOU HAVE LIVED IN THE HOUSE FOR 12 YEARS (SO THERE ARE 18 YEARS LEFT ON THE MORTGAGE) AND YOU DECIDE TO PAYOFF THE MORTGAGE <u>BEFORE</u> THE TWELFTH PAYMENT IS DUE?



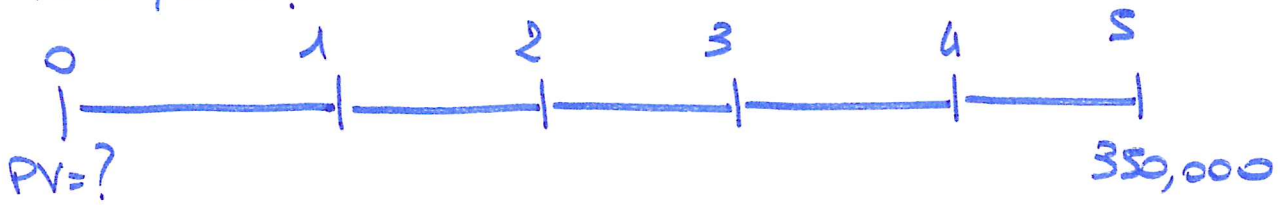

IF YOU DECIDE TO PAY OFF THE MORTGAGE IMMEDIATELY BEFORE THE TWELFTH PAYMENT, YOU WILL HAVE TO PAY EXACTLY WHAT YOU PAID IN POINT (A) AS WELL AS THE TWELFTH PAYMENT ITSELF:

$$129{,}931.24 + 12{,}000 = 141{,}931.24$$

EX: 2

YOU ARE THINKING OF RETIRING. YOUR RETIREMENT PLAN WILL PAY YOU EITHER €250,000 IMMEDIATELY ON RETIREMENT OR € 350,000 FIVE YEARS AFTER THE DATE OF YOUR RETIREMENT. WHICH ALTERNATIVE SHOULD YOU CHOOSE IF THE INTEREST RATE IS:

a) 0% PER YEAR?




$$PV = \frac{350,000}{(1.0)^5} = €350,000$$ ⇒ SO YOU SHOULD TAKE THE €350,000

b) 8% PER YEAR?

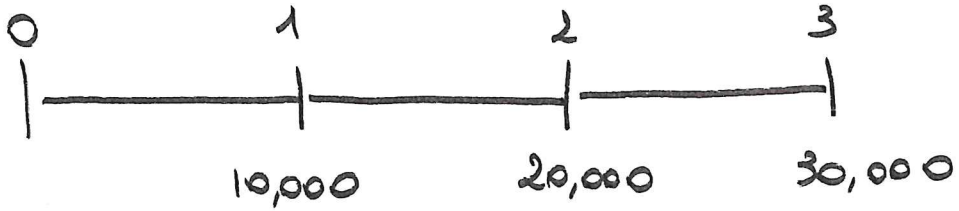
$$PV = \frac{350,000}{(1.08)^5} = € 238,204$$ ⇒ SO YOU SHOULD TAKE THE €250,000

c) 20% PER YEAR?

$$PV = \frac{350,000}{(1.2)^5} = € 140,657$$ ⇒ YOU SHOULD TAKE THE € 250,000

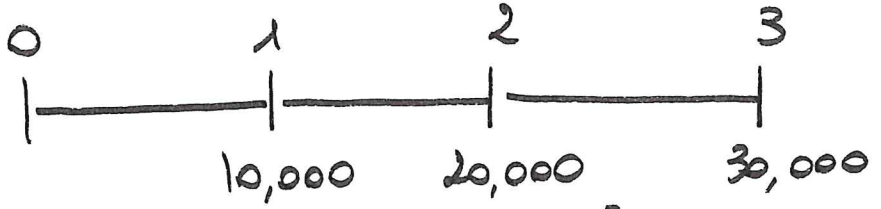
EX3: YOU HAVE JUST RECEIVED A WINDFALL FROM AN INVESTMENT YOU MADE IN A FRIEND'S BUSINESS. HE WILL BE PAYING YOU €10,000 AT THE END OF THIS YEAR, €20,000 AT THE END OF THE FOLLOWING YEAR, AND €30,000 AT THE END OF THE YEAR AFTER THAT (THREE YEARS FROM TODAY). THE INTEREST RATE IS 3.5% PER YEAR.

a) WHAT IS THE PRESENT VALUE OF YOUR WINDFALL?




$$PV = \underbrace{\frac{10,000}{1.035}}_{9,662} + \frac{20,000}{(1.035)^2} + \frac{30,000}{(1.035)^3} = 9,662 + 18,670 + 24,058 = €55,390$$

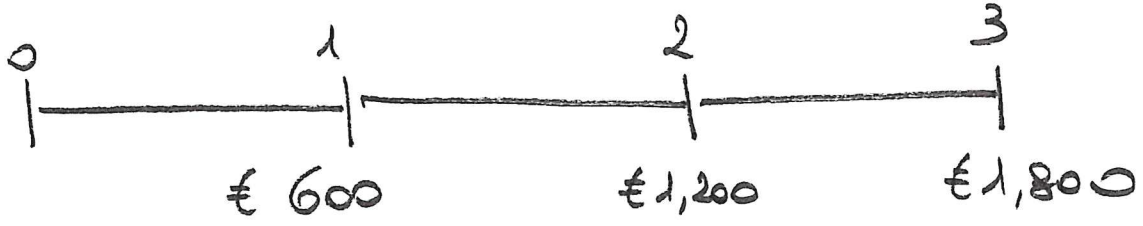
b) WHAT IS THE FUTURE VALUE OF YOUR WINDFALL IN THREE YEARS (ON THE DATE OF THE LAST PAYMENT)?




$$FV = 55,390 \cdot (1.035)^3 = €61,412$$

EX: 4

LET US CONSIDER THE FOLLOWING TIMELINE:




AT AN ANNUAL INTEREST RATE OF 7%, THE FUTURE VALUE OF THE CASH FLOWS IN THIS TIMELINE IN YEAR 2 IS CLOSEST TO:

$$FV_{t=2} = 600(1.07) + 1{,}200 + \left(\frac{1800}{1.07}\right) = € 3{,}524{,}24$$

EX: 5

SUPPOSE THAT YOUR SALARY WILL START AT € 100,000.00 AND WILL GROW AT 10% PER YEAR FOR THE NEXT 3 YEARS.

WHAT IS THE PRESENT VALUE OF YOUR FUTURE SALARY IF THE INTEREST RATE IS 13% PER YEAR?

$$ADF(r, n, g) = \left[ \frac{1 - \frac{(1+g)^n}{(1+r)^n}}{r-g} \right] = \frac{1 - \frac{(1,1)^3}{(1,13)^3}}{0,13-0,1} = 2,585$$

$$PV = 100,000 \cdot 2,585 = 258,500.78$$

## BOND: EX: 1

LET US CONSIDER THE FOLLOWING TABLE WHICH SUMMARIZES PRICES OF VARIOUS DEFAULT-FREE ZERO-COUPON BONDS (EXPRESSED AS A PERCENTAGE OF FACE VALUE):

| MATURITY (YEARS) | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| PRICE (% OF FACE VALUE 100€) | 94.52 | 89.68 | 85.40 | 81.65 | 78.35 |

1.1) THE YIELD TO MATURITY (YTM) FOR THE TWO-YEAR ZERO-COUPON IS CLOSEST TO:

$$YTM\text{-}2\text{-}YEAR = \sqrt{\frac{100}{89.68}} - 1 = 5.6\%.$$

1.2) THE YIELD TO MATURITY (YTM) FOR THE THREE-YEAR ZERO-COUPON BOND IS CLOSEST TO:

$$YTM\text{-}3\text{-}YEAR = \sqrt[3]{\frac{100}{85.40}} - 1 = 5.4\%$$

1.3) BASED UPON THE INFORMATION PROVIDED IN THE TABLE ABOVE, WE CAN CONCLUDE THAT:

A) THE YIELD CURVE IS FLAT;
B) NOTHING ABOUT THE SHAPE OF THE YIELD CURVE;
C) THE YIELD CURVE IS DOWNWARD SLOPING;
D) THE YIELD CURVE IS UPWARD

BOND : EX: 2

THE HILOS COMPANY HAS A BOND OUTSTANDING WITH A FACE VALUE OF € 1,000 THAT REACHES MATURITY IN 15 YEARS. THE BOND CERTIFICATE INDICATES THAT THE STATED COUPON RATE FOR THIS BOND IS 8%. AND THAT THE COUPON PAYMENTS ARE TO BE MADE SEMIANNUALLY.

2.1 HOW MUCH ARE EACH OF THE SEMIANNUAL COUPON PAYMENTS?

$$\text{COUPON} = \left(\frac{0.08 \cdot 1{,}000}{2}\right) = 40$$

.2 ASSUMING THE APPROPRIATE YTM ON THE HILOS COMPANY IS 8.8%, THEN AT WHAT PRICE SHOULD THIS BOND TRADE FOR?

$$P_0 = \frac{40}{0.044} \cdot \left(1 - \frac{1}{(1.044)^{30}}\right) + \frac{1{,}000}{(1.044)^{30}} = 934.07$$

STOCK: EX:1

LET US CONSIDER THE FOLLOWING DIVIDEND FORECASTS:

2022 : 0.7 €
2023 : 0.8 €
2024 : 0.9 €
2025 : 1 €

LET ALSO ASSUME THAT THE DIVIDEND GROWTH RATE WILL BE STEADY BEYOND 2025. THE DIVIDEND PAYOUT RATIO IS 40%. AND THE ROE IS 15%.. THE $\beta = 0.90$, THE RISK-FREE RATE ON LONG-TERM T-BOND IS 3%. AND THE MARKET RETURNS IS 13%.

1) WHAT IS A REASONABLE GUESS FOR THAT STEADY-STATE GROWTH RATE?

$$g = 15\% \cdot (1 - 0.4) = 9\%$$

2) WHAT IS THE INTRINSIC/FUNDAMENTAL VALUE IN 2021?

$$P_{2021} = \frac{D_{2022}}{(1+r)} + \frac{D_{2023}}{(1+r)^2} + \frac{D_{2024}}{(1+r)^3} + \frac{D_{2025} + P_{2025}}{(1+r)^4} =$$

$$P_{2021} = \frac{0.7}{(1+k)} + \frac{0.8}{(1+k)^2} + \frac{0.9}{(1+k)^3} + \frac{1+P_{2025}}{(1+k)^4} =$$

$$P_{2025} = \frac{D_{2026}}{k-g} = \frac{D_{2025}(1+g)}{k-g} = \frac{1\cdot(1.09)}{k-0.09} = \frac{1(1.09)}{0.12-0.09} = 36.33$$

USING THE CAPITAL ASSET PRICING MODEL

$$k = 0.03 + 0.9\,(0.13 - 0.03)$$

$$k = 12\%$$

$$P_{2021} = \frac{0.70}{(1.12)} + \frac{0.8}{(1.12)^2} + \frac{0.9}{(1.12)^3} + \frac{1+36.33}{(1.12)^4} =$$

$$P_{2021} = 0.625 + 0.64 + 0.64 + 23.72 = 25.63$$

STOCK: EX: 2

SUPPOSE THAT THE FUNDAMENTAL / INTRINSIC VALUE OF A STOCK IS €80 AND THAT THE COMPANY HAS JUST PAID €5 ($t=0$) IN DIVIDENDS PER SHARE AND THAT THEY ARE EXPECTED TO GROW CONSTANTLY AND INDEFINITELY. SUPPOSE ALSO THE REQUIRED RATE OF RETURN ON EQUITY IS 16%.

WHAT IS THE GROWTH RATE OF DIVIDENDS?

$$P_0 = \frac{DIV_1}{r-g} = \frac{DIV_0(1+g)}{r-g}$$

$$80 = \frac{5(1+g)}{0.16-g}$$

$$(0.16-g)\cdot 80 = 5(1+g)$$

$$12.8 - 5 = 85g$$

$$g = 9.17$$

STOCK : EX: 3

GROWING REAL FAST COMPANY (GRF) IS EXPECTED TO HAVE A 25% GROWTH RATE FOR THE NEXT FOUR YEARS (AFFECTING D1, D2, D3 AND D4). BEGINNING IN YEAR FIVE, THE GROWTH RATE IS EXPECTED TO DROP TO 7% PER YEAR AND LAST INDEFINITELY. IF GRF JUST PAID A 2€ (t=0) DIVIDEND AND THE APPROPRIATE DISCOUNT RATE IS 15%, THEN WHAT IS THE VALUE OF A SHARE OF GRF?

| TIME PERIOD | DIVIDEND | PRESENT VALUE |
|---|---|---|
| 1 | $2(1.25) = 2.5$ | $2(1.25)/1.15 = 2.17$ |
| 2 | $2(1.25)^2 = 3.125$ | $2(1.25)^2/(1.15)^2 = 2.36$ |
| 3 | $2(1.25)^3 = 3.91$ | $2(1.25)^3/(1.15)^3 = 2.57$ |
| 4 | $2(1.25)^4 = 4.88$ | $2(125)^4/(1.15)^4 = 2.79$ |
| 5 | $2(1.25)^4(1.07) = 5.22$ | $2(1.25)^4(1.07)/(0.15-0.07)(1.15)^4 = 37.34$ |

$PV_0 = 2.17 + 2.36 + 2.57 + 2.79 + 37.34 = 47.24$ €