

Excel Sheet

Problem 2

Interest Rate		10%
Periods		10
Payment	\$	100

Calculated with 'Brute Force method' in Excel

Period	Payment	Discount Factor	PV of Payment	Total PV
1	\$ 100	0,90909	\$ 90,90909	\$ 614,457
2	\$ 100	0,82645	\$ 82,64463	
3	\$ 100	0,75131	\$ 75,13148	
4	\$ 100	0,68301	\$ 68,30135	
5	\$ 100	0,62092	\$ 62,09213	
6	\$ 100	0,56447	\$ 56,44739	
7	\$ 100	0,51316	\$ 51,31581	
8	\$ 100	0,46651	\$ 46,65074	
9	\$ 100	0,42410	\$ 42,40976	
10	\$ 100	0,38554	\$ 38,55433	

Calculated with 'Present Value' formula in Excel

Total PV \$ -614,457 <← **negative as this is the cash-outflow we are willing to have for this payment stream**

Problem 3

	(i)	(ii)	(iii)	(iv)
Payment	\$0	\$0	\$80.000	\$175.000
Periods	0	4	Infinite	10
Future Value	\$1.200.000	\$1.600.000	-	\$0

Value with 5% interest rate

Interest rate 5%

(i)	(ii)	(iii)	(iv)
\$ 1.200.000,00	\$ 1.316.323,96	\$ 1.600.000,00	\$ 1.351.303,61

Value with 9% interest rate

Interest rate 9%

(i)	(ii)	(iii)	(iv)
\$ 1.200.000,00	\$ 1.133.480,34	\$ 888.888,89	\$ 1.123.090,10

Problem 4*Calculate the value of a \$1,000 bond with 5% coupon rate*

Face value	\$1.000
Coupon rate	5%
Payment pr year	2
Periods	10

Period	Spot rate	Discount Factor	Payment	Present Value	Price
1	2%	0,99010	\$25	\$24,75248	\$968,073
2	3%	0,97066	\$25	\$24,26654	
3	3,67%	0,94691	\$25	\$23,67276	
4	4,17%	0,92077	\$25	\$23,01931	
5	4,57%	0,89318	\$25	\$22,32956	
6	4,90%	0,86482	\$25	\$21,62062	
7	5,19%	0,83583	\$25	\$20,89569	
8	5,44%	0,80679	\$25	\$20,16972	
9	5,66%	0,77790	\$25	\$19,44740	
10	5,86%	0,74917	\$1.025	\$767,89906	

Calculate the YTM

Brute force with GoalSeek

YTM 5,74%

Period	Spot rate	Discount Factor	Payment	Present Value	Difference
1	5,74%	0,97208	\$25	\$24,30208	\$0,000
2	5,74%	0,94495	\$25	\$23,62365	
3	5,74%	0,91857	\$25	\$22,96416	
4	5,74%	0,89292	\$25	\$22,32308	
5	5,74%	0,86800	\$25	\$21,69989	
6	5,74%	0,84376	\$25	\$21,09410	
7	5,74%	0,82021	\$25	\$20,50523	
8	5,74%	0,79731	\$25	\$19,93279	
9	5,74%	0,77505	\$25	\$19,37633	
10	5,74%	0,75342	\$1.025	\$772,25193	

Using =RATE(period;payment;price;future value)*periods

YTM **5,74%**

Calculate the Macualay Duration

m	2
R	5,74%
P	\$968,073

t	CF	Value of Sum	Multiplier	D	
1	\$ 25	0,025	0,500	4,475	
2	\$ 25	0,049			
3	\$ 25	0,071			
4	\$ 25	0,092			
5	\$ 25	0,112			
6	\$ 25	0,131			
7	\$ 25	0,148			
8	\$ 25	0,165			
9	\$ 25	0,180			
10	\$ 1.025	7,977			

Calculate the Duration

D* with formula	4,350
D* with MDURAT	4,350

Calculate the Convexity

t	CF	Value of Sum	Multiplier	C	
1	\$ 25	0,050	0,236	22,383	
2	\$ 25	0,146			
3	\$ 25	0,285			
4	\$ 25	0,461			
5	\$ 25	0,672			
6	\$ 25	0,915			
7	\$ 25	1,186			
8	\$ 25	1,482			
9	\$ 25	1,801			
10	\$ 1.025	87,749			

Recalculate the Price 100 basis points higher

Delta-% in spot 1%

Period	Spot rate	Discount Factor	Payment	Present Value	Price
1	3%	0,98522	\$25	\$24,63054	\$927,140
2	4%	0,96117	\$25	\$24,02922	
3	4,67%	0,93310	\$25	\$23,32746	
4	5,17%	0,90295	\$25	\$22,57379	
5	5,57%	0,87167	\$25	\$21,79171	
6	5,90%	0,83993	\$25	\$20,99819	
7	6,19%	0,80786	\$25	\$20,19653	
8	6,44%	0,77605	\$25	\$19,40123	
9	6,66%	0,74467	\$25	\$18,61668	
10	6,86%	0,71373	\$1.025	\$731,57460	

Recalculate the Price 100 basis points lower

Delta-% in spot -1%

Period	Spot rate	Discount Factor	Payment	Present Value	Price
1	1%	0,99502	\$25	\$24,87562	\$1.011,164
2	2%	0,98030	\$25	\$24,50740	
3	2,67%	0,96100	\$25	\$24,02490	
4	3,17%	0,93903	\$25	\$23,47587	
5	3,57%	0,91534	\$25	\$22,88343	
6	3,90%	0,89059	\$25	\$22,26469	
7	4,19%	0,86491	\$25	\$21,62264	
8	4,44%	0,83891	\$25	\$20,97263	
9	4,66%	0,81278	\$25	\$20,31951	
10	4,86%	0,78655	\$1.025	\$806,21735	

Calculate the Effective Duration

D_eff 4,340

Calculate prices using the modified duration

		Delta price
Delta r = 1%	\$ 925,959	\$ -1,181
Delta r = -1%	\$ 1.010,187	\$ -0,977

Calculate prices using the modified duration and convexity-based approximation

		Delta price
Delta r = 1%	\$ 927,043	\$ -0,097
Delta r = -1%	\$ 1.011,271	\$ 0,107

Recalculate the Price 25 basis points higher

Delta-% in spot 0,25%

Period	Spot rate	Discount Factor	Payment	Present Value	Price
1	2%	0,98888	\$25	\$24,72188	\$957,642
2	3%	0,96828	\$25	\$24,20688	
3	3,92%	0,94343	\$25	\$23,58580	
4	4,42%	0,91628	\$25	\$22,90691	
5	4,82%	0,88774	\$25	\$22,19362	
6	5,15%	0,85852	\$25	\$21,46302	
7	5,44%	0,82873	\$25	\$20,71834	
8	5,69%	0,79898	\$25	\$19,97444	
9	5,91%	0,76944	\$25	\$19,23592	
10	6,11%	0,74013	\$1.025	\$758,63555	

Recalculate the Price 25 basis points lower

Delta-% in spot -0,25%

Period	Spot rate	Discount Factor	Payment	Present Value	Price
1	2%	0,99133	\$25	\$24,78315	\$978,639
2	3%	0,97306	\$25	\$24,32642	
3	3,42%	0,95041	\$25	\$23,76014	
4	3,92%	0,92530	\$25	\$23,13240	
5	4,32%	0,89866	\$25	\$22,46651	
6	4,65%	0,87118	\$25	\$21,77958	
7	4,94%	0,84299	\$25	\$21,07477	
8	5,19%	0,81469	\$25	\$20,36716	
9	5,41%	0,78646	\$25	\$19,66146	
10	5,61%	0,75833	\$1.025	\$777,28716	

Calculate the Effective Duration

D_eff	4,338	\$20,996
		\$4,840

Calculate prices using the modified duration

		Delta price
Delta r = 0,25%	\$ 957,545	\$ -0,098
Delta r = -0,25%	\$ 978,602	\$ -0,037

Calculate prices using the modified duration and convexity-based approximation

		Delta price
Delta r = 0,25%	\$ 957,612	\$ -0,030
Delta r = -0,25%	\$ 978,669	\$ 0,031