Student Name:_____

Purdue ID:_____

MA 373 – Spring 2025
Quiz 2

MA 175 11:25 – 11:45 AM
Thursday, February 13th, 2025

INSTRUCTIONS

- Do not open this quiz until you are told to do so.
- There are 20 points possible from 4 problems, 2 worth 4 points and 2 worth 6 points.
- You have 20 minutes to complete this quiz.
- Be sure you have filled in your name and Purdue ID in the slots at the top of the page.
- Show all work to maximize partial credit.
- Be sure all cell phones are silenced and put away out of view. This policy applies to smart watches as well.
- Headphones are not permitted unless prior approval was granted by your instructor.
- Formula sheets are not permitted.
- You are only permitted to use calculator(s) from the following list:
  - BA II Plus
  - BA II Plus Professional
  - BA-35
  - TI–30Xa or TI–30XA (same model just different casing)
  - TI-30X II (IIS solar or IIB battery)
  - TI-30XS MultiView (or XB battery)
- When time expires, put your pencil down and close your exam. Failure to do so will result in automatic disqualification from obtaining University-Earned Credit.

PURDUE HONORS PLEDGE

"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

STUDENT AGREEMENT

By signing below,

- I agree with the Purdue Honors Pledge stated above.
- I will not give or receive any assistance on this exam, and I will report any infractions of the honors pledge.
- I acknowledge that I only used calculator(s) from the above list.
- I am claiming all work in this exam as my own.

X_____

Additional Rubric Details

***Math Errors*: If all setup is correct in any given problem, but numerical answer is incorrect, 4-point problems receive a 0.5-point deduction, 6-point problems receive a 1-point deduction (unless "typo", then max -0.5)**

***Calculation Incomplete*: If all setup correct but did not compute the final answer, 4-point problems receive a 1-point deduction, 6-point problems receive a 1.5-point deduction**

1. (4 points) You are given that $d^{(3)} = 0.06$.

   Calculate the equivalent $i^{(1/2)}$.

   Solution:

$$\left(1+\frac{i^{(1/2)}}{1/2}\right)^{1/2} = \left(1-\frac{d^{(3)}}{3}\right)^{-3} = \left(1-\frac{0.06}{3}\right)^{-3} = (0.98)^{-3}$$

$$\left(1+\frac{i^{(1/2)}}{1/2}\right) = (0.98)^{-6}$$

$$i^{(1/2)} = \left[(0.98)^{-6} - 1\right](1/2) = 6.443450\%$$

Points	
2	Correct equation that uses $d^{(3)} = 0.06$
2	Correct equation that uses $i^{(1/2)}$

2. (4 points) You invest money in a fund that earns a force of interest of $\delta_t = 0.01t$. You deposit 1,000 into the account today and an additional 3,000 into the account at the end of 5 years.

   Calculate the amount you will have in the account at the end of 9 years.

   Solution:

$$a(t) = e^{\int_0^t 0.01t \cdot dt}$$

$$1000a(9) + 3000\left(\frac{a(9)}{a(5)}\right) = 1000e^{\int_0^9 0.01t \cdot dt} + 3000e^{\int_5^9 0.01t \cdot dt} = 1000e^{0.005t^2\big]_0^9} + 3000e^{0.005t^2\big]_5^9}$$

$$= 1000e^{0.405} + 3000e^{0.28} = 5468.69$$

Points	
2	Correct handling of accumulation function with δ
2	Correct accumulation of each investment • 1 point for accumulating the initial 1,000 correctly • 1 point for accumulating 3,000 correctly

3. (6 points) You are receiving an annuity for the next 35 years. The annuity makes quarterly payments of 100 at the end of each quarter.

   Calculate the present value of your annuity using an annual effective interest rate of 8%.

   Solution:

$$\left(1+\frac{i^{(4)}}{4}\right)^4=(1.08)\Rightarrow\frac{i^{(4)}}{4}=0.019426547$$

$$PV=100a_{\overline{35*4}|}=100\left(\frac{1-(1.019426547)^{-140}}{0.019426547}\right)=4,799.44$$

Alternatively, you can use the BA-II:

$$\boxed{I/Y}=1.9426547,\ \boxed{N}=140,\ \boxed{PMT}=100,$$

$$\boxed{CPT}\ \boxed{PV}\rightarrow 4,799.44$$

Points	
2	Correct used quarterly effective interest rate
4	Correct setup for finding PV • 2 points for correct annuity formula • 1 point for coefficient of 100 • 1 point for correct number of payments

4. (6 points) An investment firm pays 3 million today to buy a farm. The farm is expected to produce the following profits:

End of Year	Profits
1	-1 million
2	1.5 million
3	2 million
4	X million

At the end of 4 years, the farm will be obsolete and will be closed.

The Internal Rate of Return on this project is 5%.

Calculate the Net Present Value at an interest rate of 6%.

Solution:

$$-3-1.05^{-1}+1.5(1.05^{-2})+2(1.05^{-3})+X(1.05^{-4})=0$$

$$X=\frac{3+1.05^{-1}-1.5(1.05^{-2})-2(1.05^{-3})}{1.05^{-4}}=1.05039375$$

$$Note: X=1,050,393.75$$

$$CF_0=-3,\ CF_1=-1,\ CF_2=1.5,\ CF_3=2,\ CF_4=1.05039375$$

$$\boxed{NPV}$$

$$\boxed{I}\leftarrow 6$$

$$\boxed{ENTER}\boxed{\downarrow}\boxed{CPT}$$

$$NPV=-0.09715277$$

$$\Rightarrow NPV=-97,152.77$$

Points	
4	Correctly solved for X • 2 points for general equation of value, correct discounting of all given cashflows (if used calculator, correct entry of cashflows into calculator) • 2 points for correctly adjusting X for payment at t=4
2	Correct process for finding NPV at 6%