

## Pre-exam on Time Value of Money Concepts Practice Exam Solutions

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Note: The TVM practice problem set contains at least one example of each calculation required in this exam.

### Multiple-Choice / True-False Questions – 2 points each

- \_\_\_\_\_ 1. Suppose you deposit \$3,000 today into an account that will earn 5 percent interest, compounded annually. How much will your account be worth at the end of 30 years?
- A. \$90,000.00
  - B. \$12,965.83**
  - C. \$199,316.54
  - D. \$4,500.00
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$PV = 3,000, P/Y = 1, N = 30, I = 5, PMT = 0 \Rightarrow FV = -12,965.83.$$

- \_\_\_\_\_ 2. Suppose instead that the account in the previous question earns 5 percent interest, compounded quarterly. How much will the account be worth at the end of 30 years in this case?
- A. \$21,000.00
  - B. \$4,354.84
  - C. \$825,651.17
  - D. \$13,320.64**
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$\text{Change } P/Y = 4 \text{ and } N = 30 \times 4 = 120 \Rightarrow FV = -13,320.64.$$

- \_\_\_\_\_ 3. Assuming the same positive discount rate and the same number of years over which they will be received, which of the following has the larger present value? (MC/TF Question 5)
- A. A \$2,400 annuity with annual payments.
  - B. A \$200 ANNUITY WITH MONTHLY PAYMENTS.**
  - C. Both have the same present value.
  - D. There is not enough information to answer this question.

The reason is “sooner is better than later.” The total payments you receive is the same under both annuities (\$2,400 per year), but you get some of your money sooner with the monthly annuity. You could put this in an account and earn interest on it, making it worth more to you than \$2,400 at the end of each year.

- \_\_\_\_\_ 4. What is the present value of an investment that is expected to pay \$8,000 at the end of three years if the appropriate discount rate is 16 percent?
- A. \$8,000.00
  - B. \$5,125.26**
  - C. \$12,487.17
  - D. \$17,967.12
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$N = 3, P/Y = 1, FV = 8,000, I = 16, PMT = 0 \Rightarrow PV = -5,125.26.$$

- \_\_\_\_\_ 5. What is the monthly payment on a \$1.5 million, 20-year mortgage at 7.75 percent interest?
- A. \$2,626.73
  - B. \$12,314.23**
  - C. \$12,495.59
  - D. \$6,250.00
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$P/Y = 12, PV = 1,500,000, N = 20 \times 12 = 240, I = 7.75, FV = 0 \Rightarrow PMT = -12,314.23.$$

- \_\_\_\_\_ 6. If the first payment on this loan is on May 1 of this year, how much total interest will the borrower pay on this loan this year?
- A. \$116,250.00
  - B. \$77,500.00
  - C. \$38,647.78
  - D. \$77,018.81**
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$P1 = 1, P2 = 8 \Rightarrow INT = 77,018.81.$$

\_\_\_\_\_ 7. How much total interest will the borrower pay on this loan NEXT year?

- A. \$116,250.00
- B. \$114,253.85
- C. \$113,379.57**
- D. \$122,706.14
- E. None of the above; the correct answer is \_\_\_\_\_.

$$P1 = 9, P2 = 20 \Rightarrow INT = 113,379.57.$$

\_\_\_\_\_ 8. The Dronkeys want to save \$500 to buy a new video game system. If they deposit \$25 at the end of each month into an account paying 8 percent interest (compounded monthly), how long will it take them to save the \$500? (This is like practice problem 10)

- A. 21.54 months
- B. 22.54 months
- C. 18.84 MONTHS**
- D. They will never be able to save \$500 at this rate of saving.
- E. None of the above; the correct answer is \_\_\_\_\_.

$$P/Y = 12, PMT = 25, PV = 0, FV = -500, I = 8 \Rightarrow N = 18.84.$$

\_\_\_\_\_ 9. If the Dronkey's want to buy their game system in one year, how large will their monthly deposits need to be?

- A. \$40.16**
- B. \$43.49
- C. \$461.68
- D. They will not be able to save \$500 in one year.
- E. None of the above; the correct answer is \_\_\_\_\_.

$$\text{Change } N = 12 \Rightarrow PMT = 40.16.$$

\_\_\_\_\_ 10. Puss in Boots is considering an investment that is expected to pay \$750 per month for the next 10 years. If his required rate of return is 9.5 percent, how much is this investment worth to him today?

- A. \$7,183.52
- B. \$57,960.91**
- C. \$58,252.05
- D. \$1,932.04
- E. None of the above; the correct answer is \_\_\_\_\_.

$$P/Y = 12, N = 10 \times 12 = 120, I = 9.5, PMT = 750, FV = 0 \Rightarrow PV = -57,960.91.$$

- \_\_\_\_\_ 11. King Harold has borrowed \$1.2 million over 25 years with monthly payments at 12 percent interest. What is the required monthly payment on this loan?
- A. **\$12,638.69**
  - B. \$4,000.00
  - C. \$12,749.99
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$PV = 1,200,000, P/Y = 12, N = 25 \times 12 = 300, I = 12, FV = 0 \Rightarrow PMT = -12,638.69.$$

- \_\_\_\_\_ 12. Suppose that Harold makes payments of \$15,000 per month. How long will it take him to fully repay the loan from the previous question?
- A. 80 months
  - B. **162 MONTHS**
  - C. 59 months
  - D. Harold will never repay the loan.
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$\text{Change } PMT = -15,000 \Rightarrow N = 161.75.$$

- \_\_\_\_\_ 13. Artie owns an investment that will pay \$6,500 per year forever into the future. If his discount rate is 21 percent, how much is this investment worth to him today?
- A. \$309.52
  - B. \$26,351.51
  - C. **\$30,952.38**
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$\text{This is a perpetuity, so you solve for } PV = PMT / I = 6,500 / 0.21 = 30,952.38.$$

- \_\_\_\_\_ 14. How much will this investment be worth next year?
- A. \$309.52
  - B. **\$30,952.38**
  - C. \$25,385.32
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$\text{The PV of a perpetuity never changes, so the answer is once again } \$30,952.38.$$

- \_\_\_\_\_ 15. What is the internal rate of return on an investment that costs \$2,000 and returns \$32 per month for the next 15 years?
- A. The IRR cannot be calculated for this investment
  - B. 1.48%
  - C. 17.86%**
  - D. 14.13%
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$PV = -2,000, P/Y = 12, N = 15 \times 12 = 180, PMT = 32, FV = 0 \Rightarrow I = 17.86.$$

- \_\_\_\_\_ 16. Lord Farquaad has invested \$80,000 in an annuity that will pay him \$835 per month for the next 15 years. At the end of that time he will receive an additional \$45,000. What is the internal rate of return on this investment?
- A. 11.41%**
  - B. 9.49%
  - C. 22.84%
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$\text{TVM Keys: } PV = -80,000, P/Y = 12, N = 15 \times 12 = 180, PMT = 835, FV = 45,000 \Rightarrow \text{IRR} = 11.41\%.$$

$$\text{CF Worksheet: } CF_0 = -80,000, C_01 = 835, F_01 = 179, C_02 = 45,835, F_02 = 1 \Rightarrow \text{IRR} = 0.95 \times 12 = 11.41\%.$$

- \_\_\_\_\_ 17. What is the NPV of the investment in the previous question if Lord Farquaad's required rate of return is 10 percent?
- A. (\$12,400.50)
  - B. \$7,806.42**
  - C. (\$7,806.42)
  - D. (\$87,806.42)
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$\text{TVM Keys: } I = 10 \Rightarrow PV = 87,806.42 \text{ so } NPV = PV - CF_0 = 87,806.42 - 80,000 = 7,806.42.$$

$$\text{CF Worksheet: Set } I = 10/12 = 0.8333 \Rightarrow NPV = 7,086.42.$$

- \_\_\_\_\_ 18. Consider an investment that will generate \$25,000 next year. This cash flow is expected to grow by 5 percent per year forever into the future. If you purchase this investment for \$312,500, what will be your internal rate of return?
- A. 8.00%
  - B. 13.00%**
  - C. 5.00%
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

Recall that  $PV_{\text{growing perpetuity}} = CF_1 / (r - g)$ , so  $312,500 = 25,000 / (r - 0.05)$ . Solving this for  $r$  gives you  $r = 0.13$  or 13%.

- \_\_\_\_\_ 19. What is the most you should be willing to pay for an investment that pays \$1,500 per year for the next three years and then \$2,000 per year for the following two years? Assume a discount rate of 13 percent per year?
- A. \$5,853.89**
  - B. \$6,361.37
  - C. \$5,688.34
  - D. \$8,500.00
  - E. None of the above; the correct answer is \_\_\_\_\_.

BAn Plus:  $CF_0 = 0, C_01 = 1,500, F_01 = 3, C_02 = 2,000, F_02 = 2, I = 13 \Rightarrow NPV = PV = 5,853.89$ .

TI83:  $L1 = 1,500, 2,000; L2 = 3, 2 \Rightarrow NPV(13, 0, L1, L2) = 5,853.89$ .

Use the following information to answer the next three questions.

Consider an investment that will cost \$25,000 and generate the following stream of cash flows in the future:

n	\$
1	6,500
2	6,500
3	10,000
4	12,000
5	12,000

- \_\_\_\_\_ 20. What is the net present value of this investment using an 18 percent discount rate?
- A. \$27,697.76
  - B. \$22,000.00
  - C. (\$5,006.11)
  - D. \$2,697.76**
  - E. None of the above; the correct answer is \_\_\_\_\_.

BAII Plus:  $CF_0 = -25,000$ ,  $C_01 = 6,500$ ,  $F_01 = 2$ ,  $C_02 = 10,000$ ,  $F_02 = 1$ ,  
 $C_03 = 12,000$ ,  $F_03 = 2$ ,  $I = 18 \Rightarrow NPV = 2,697.76$ .

TI83:  $L1 = 6,500$ ,  $10,000$ ,  $12,000$ ;  $L2 = 2$ ,  $1$ ,  $2 \Rightarrow NPV(18, -25,000, L1, L2) = 2,679.76$ .

- \_\_\_\_\_ 21. What is the IRR of the investment?
- A. 6.21%
  - B. 22.09%**
  - C. 18.00%
  - D. The IRR cannot be calculated for this investment.
  - E. None of the above; the correct answer is \_\_\_\_\_.

BAII Plus:  $IRR = 22.09\%$ .

TI83:  $IRR(-25,000, L1, L2) = 22.09\%$ .

- \_\_\_\_\_ 22. What is the most you should be willing to pay for this investment?
- A. \$22,000.00
  - B. \$2,697.76
  - C. \$27,697.76**
  - D. (5,006.11)
  - E. None of the above; the correct answer is \_\_\_\_\_.

The “most you would be willing to pay” is the PV of the investment, which is the NPV with  $CF_0 = 0$ . Change  $CF_0 = 0$ , and solve for  $NPV = 27,697.76$ . You can also solve it by taking the answer from 21 above and adding the \$25,000 required investment.

- \_\_\_\_\_ 23. Gingy is considering investing in a project that will generate a cash flow of \$35,000 next year. This figure is expected to grow by 4 percent each year forever into the future. If Gingy’s require rate of return on investments like this is 14 percent, how much should he be willing to pay for this project?
- A. \$875,000
  - B. \$250,000
  - C. \$350,000**
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

This investment is a growing perpetuity. The most he should be willing to pay is the PV of the future cash flows.  $PV_{\text{growing perp}} = CF_1 / (r - g) = 35,000 / (0.14 - 0.04) = 350,000$ .

Use the following information to answer the next two questions.

Four years ago you borrowed \$25,000 at 9 percent interest with monthly payments of \$450.64.

- \_\_\_\_\_ 24. What was the original term of this loan (that is, how long were you scheduled to make the payments before the loan would be paid in full)?
- A. 55 months
  - B. 47 months
  - C. **72 MONTHS**
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$PV = 25,000, P/Y = 12, I = 9, PMT = -450.64, FV = 0 \Rightarrow N = 72.00.$$

- \_\_\_\_\_ 25. How much do you currently owe on this loan?
- A. **\$9,864.00**
  - B. \$3,369.28
  - C. \$25,000.00
  - D. \$0.00
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$\text{Change } N = 4 \times 12 = 48 \Rightarrow FV = -9,864.00.$$

- \_\_\_\_\_ 26. Artie Pendragon is trying to save for retirement. He would like to have enough saved to provide him with \$80,000 in income per year for 25 years (a 25-year ordinary annuity). If his investments during retirement will earn 7 percent annually, how much must he have in his retirement account to accomplish his goal? (Hint: Assume he will spend all of the principal balance over the 25 years of retirement and that payments happen at the end of each year, so that the retirement fund is an ordinary annuity.)
- A. **\$932,287**
  - B. \$5,059,923
  - C. \$434,195
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$P/Y = 1, N = 25, PMT = 80,000, FV = 0, I = 7 \Rightarrow PV = -932,287.$$

- \_\_\_\_\_ 27. Artie has 15 years until he retires. If he makes annual contributions into his retirement account (once again earning 7 percent), how large must these contributions be to grow to the sum you calculated in the last question?
- A. \$102,360
  - B. \$37,100
  - C. \$337,904
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$P/Y = 1, N = 15, FV = 932,287, PV = 0, I = 7 \Rightarrow PMT = -37,100.$$

- \_\_\_\_\_ 28. Consider an investment that is expected to pay \$5,000 per year in each of the next five years. After that it will pay \$10,000 forever into the future. If your required rate of return on this investment is 22 percent, how much is it worth to you today?
- A. **\$31,136.35**
  - B. \$17,350.98
  - C. \$28,103.57
  - D. There is not enough information to answer this question.
  - E. None of the above; the correct answer is \_\_\_\_\_.

This is a two-part problem. First, solve for the investment's value at the end of five years:  $FV = V_5 = 10,000 / 0.22 = 45,454.55$ . Next use the TVM keys to solve for the present value:  $P/Y = 1, N = 5, PMT = 5,000, FV = 45,454.55, I = 22 \Rightarrow PV = -31,136.35$ .

- \_\_\_\_\_ 29. Queen Lillian has the opportunity to invest in a project that will pay \$30,000 in each of the next four years. After that, the cash flows are expected to grow by 4 percent per year (so that the year 5 cash flow is \$31,200, etc.). If her required rate of return on this investment is 17 percent, how much is it worth to her today?
- A. \$205,447.06
  - B. \$176,470.59
  - C. \$180,237.53
  - D. **\$210,373.06**
  - E. None of the above; the correct answer is \_\_\_\_\_.

This solved the same was as the last problem, except that the value at the end of four years =  $V_4 = 31,200 / (0.17 - 0.04) = 240,000$ :  $P/Y = 1, N = 4, PMT = 30,000, FV = 240,000, I = 17 \Rightarrow PV = -210,373.06$ .

- \_\_\_\_\_ 30. Merlin has borrowed \$75,000 using a loan that requires annual payments of \$10,100 over the next 10 years. If his loan is fully repaid over that time, what is the implied interest rate on the loan?
- A. **5.81%**
  - B. 13.47%
  - C. 6.82%
  - D. 10.00%
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$PV = 75,000, N = 10, P/Y = 1, PMT = -10,100, FV = 0 \Rightarrow I = 5.81\%.$$

- \_\_\_\_\_ 31. What will Merlin's annual payments be if the interest rate on this loan is 12 percent?
- A. \$4,273.81
  - B. \$9,000.00
  - C. \$12,912.39
  - D. **\$13,273.81**
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$\text{Change } I = 12 \Rightarrow PMT = -13,273.81.$$

- \_\_\_\_\_ 32. What is the present value of an investment that pays \$45,000 at the end of four years if the appropriate discount rate is 6.5 percent, compounded annually?
- A. \$154,160.94
  - B. **\$34,979.54**
  - C. \$45,000.00
  - D. \$57,890.99
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$P/Y = 1, PMT = 0, N = 4, FV = 45,000, I = 6.5 \Rightarrow PV = 34,979.54.$$

- \_\_\_\_\_ 33. Which of the following is NOT a potential problem with the IRR?
- A. The IRR may not be unique if the cash flows change sign more than once.
  - B. The IRR does not take into account the size of the initial investment when comparing mutually exclusive projects.
  - C. The IRR calculation assumes that all cash flows are reinvested at the IRR.
  - D. **ALL OF THE ABOVE ARE POTENTIAL PROBLEMS WITH THE IRR.**
  - E. None of the above are potential problems with the IRR.

- \_\_\_\_\_ 34. The Big Bad Wolf is considering an investment that is expected to pay \$45,000 per year for the next five years and will be worth \$500,000 at the end of the fifth year. If his discount rate is 13 percent, what is the most he should be willing to pay for this investment?
- A. \$725,000.00
  - B. \$658,275.41
  - C. \$429,655.37**
  - D. \$398,434.67
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$P/Y = 1, N = 5, PMT = 45,000, FV = 500,000, I = 13 \Rightarrow PV = 429,655.37.$$

- \_\_\_\_\_ 35. Fairy Godmother has an investment that is expected to generate a 14 percent internal rate of return. The NPV of this project is  $-\$25,000$ . Based on this information, which of the following is true? More than one answer may be correct; write down the letters for all correct answers.
- A. Fairy Godmother's discount rate is less than 14 percent.
  - B. FAIRY GODMOTHER'S DISCOUNT RATE IS GREATER THAN 14 PERCENT.**
  - C. Fairy Godmother should accept this project.
  - D. FAIRY GODMOTHER SHOULD REJECT THIS PROJECT.**
  - E. All of the above are true.

Recall that the IRR rule says accept a project if and only if  $IRR \geq$  discount rate and NPV rule says accept a project if and only if  $NPV \geq 0$ . For projects with normal cash flows, these two rules will always agree. From these facts you get the answer to this question.

- \_\_\_\_\_ 36. How long will it take for \$5,000 to grow to \$10,000 if it is invested in an account that pays 15 percent interest, compounded annually?
- A. 1.88 years
  - B. 4.96 YEARS**
  - C. 2 years
  - D. 6.67 years
  - E. None of the above; the correct answer is \_\_\_\_\_.

$$P/Y = 1, PV = 5,000, FV = 10,000, PMT = 0, I = 15 \Rightarrow N = 4.96.$$

\_\_\_\_\_ 37. What is the internal rate of return of an investment with the following cash flows?

<b>n</b>	<b>\$</b>
0	(2,000)
1	400
2	400
3	400
4	500
5	500

- A. -39.01%
- B. 10.00%
- C. **3.12%**
- D. The IRR cannot be calculated for this investment
- E. None of the above; the correct answer is \_\_\_\_\_.

BAlI Plus:  $CF_0 = -2,000, C_01 = 400, F_01 = 3, C_02 = 500, F_02 = 2 \Rightarrow IRR = 3.12\%$ .

TI83:  $L1 = 400, 500; L2 = 3, 2 \Rightarrow IRR(-2,000, L1, L2) = 3.12\%$ .

\_\_\_\_\_ 38. If your discount rate is 12 percent, what is the NPV of the investment from the last question?

- A. **(437.80)**
- B. (1,244.26)
- C. 1,562.20
- D. \$200.00
- E. None of the above; the correct answer is \_\_\_\_\_.

BAlI Plus:  $I = 12 \Rightarrow NPV = -437.80$ .

TI83:  $NPV(12, -2,000, L1, L2) = -437.80$ .

\_\_\_\_\_ 39. Fiona wants to save for the Ogre babies' college fund. She is planning on investing \$150 at the end of each month in an investment that pays 6.5 percent interest, compounded monthly. How much will her investment be worth in 18 years?

- A. **\$61,250.84**
- B. \$58,338.12
- C. \$4,861.51
- D. \$2,827.98
- E. None of the above; the correct answer is \_\_\_\_\_.

$P/Y = 12, N = 18 \times 12 = 216, PMT = -150, PV = 0, I = 6.5 \Rightarrow FV = 61,250.84$ .

- \_\_\_\_\_ 40. You are considering the choice between two mutually exclusive projects. Project A requires an initial investment of \$1 million. It has an NPV of \$200,000 and an IRR of 21 percent. Project B requires an initial investment of \$100,000, with an NPV of \$50,000 and an IRR of 45 percent. Based on this information, which of the following is most correct?
- A. **YOU SHOULD CHOOSE PROJECT A BECAUSE IT HAS THE HIGHER NPV.**
  - B. You should choose Project B because it has the higher IRR.
  - C. Both projects are equally desirable.
  - D. Neither project is acceptable; reject both.
  - E. There is not enough information to decide which project should be chosen.

When choosing between two mutually exclusive projects, the NPV rule will never lead you astray; the IRR rule might.

- \_\_\_\_\_ 41. (Freebe) What do all of the names used in this exam have in common?
- A. They are all names of faculty in the Barton School.
  - B. They are all the nicknames of Barton School faculty members.
  - C. They prove that you are not only cruel for giving an exam the second week of class, but you are also demented.
  - D. **THEY ARE ALL NAMES OF CHARACTERS FROM THE SHREK MOVIES.**
  - E. None of the above; the correct answer is \_\_\_\_\_.