

Math 1108 Mock Final – version 4

1. A couple deposits \$25,000 into an account earning 3% annual interest for 30 years. Calculate the future value of the investment if the interest is compounded weekly. Round your answer to the nearest cent.

**Simple Interest Formula**

$$I = Prt$$

**Compound Interest Formula**

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

**Continuous Compound Interest Formula**

$$A = Pe^{rt}$$

**Annual Percentage Yield (APY)**

$$\text{APY} = \left[ \left( 1 + \frac{r}{n} \right)^n - 1 \right] \cdot 100 \%$$

Answer: \_\_\_\_\_

2. Ashley bought a new car for \$31,000. She paid a 20% down payment and financed the remaining balance for 48 months with an APR of 4.3%. Assuming she made monthly payments, determine the total cost of Ashley's car. Round your answer to the nearest cent, if necessary.

Answer: \_\_\_\_\_

3. Riley starts an IRA (Individual Retirement Account) at the age of 22 to save for retirement. She deposits \$400 each month. The IRA has an average annual interest rate of 7%. How much money will she have saved when she retires at the age of 65? Round your answer to the nearest cent, if necessary.

Answer: \_\_\_\_\_

4. You find \$20000 in a dumpster and you want to invest it, perhaps all of it. You would like to invest at least \$4000 in bonds yielding 3% interest and at most \$2000 in a money market fund earning 4% interest. Use linear programming methods to determine how much money should you put in each kind of investment to maximize the interest earned in one year? Let  $x$  be the money in bonds and  $y$  be the money in the fund. Assume simple interest is applied yearly. Treat this as a linear programming problem and solve it graphically as shown in class. And let's hope that you make a lot of money before whoever owns the dumpster money comes to find you.

Answer: Amount in bonds,  $x =$  \_\_\_\_\_

Amount in fund,  $y =$  \_\_\_\_\_

Maximum annual income is, \_\_\_\_\_

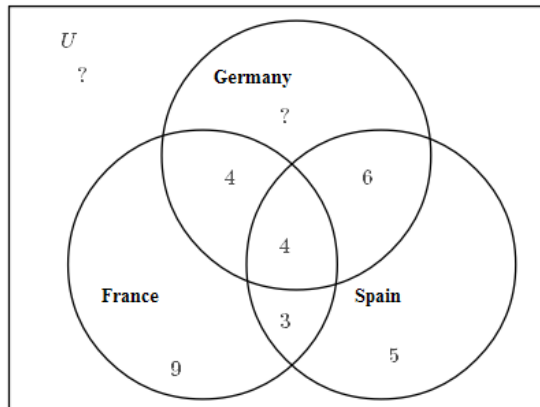
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5. Emilia and Liam are purchasing a home. They wish to save money for 15 years and purchase a house that has a value of \$160,000 with cash. If they deposit money into an account paying 4% interest, how much do they need to deposit each month in order to make the purchase? Round your answer to the nearest cent, if necessary.

Answer: \_\_\_\_\_

6. There are 41 students in the University Travel Club. The following information and Venn diagram show how many students traveled to Germany, France, and Spain. How many students have been to Spain or Germany but not France?

- 16 members have visited Germany
- 18 have been to Spain
- 20 have visited France
- 8 have been to Germany and France
- 5 have only been to Spain
- 9 have only been to France
- 3 have been to only Spain and France
- 4 have been to all three countries
- Some of the members have not been to any of the three



Answer: \_\_\_\_\_

7. A box of jerseys for a pick-up game of basketball contains 9 extra-large jerseys, 7 large jerseys, and 4 medium jerseys. If you are first to the box and grab 3 jerseys, what is the probability that you randomly grab 3 extra-large jerseys? Express your answer as a fraction in lowest terms or a decimal rounded to the nearest millionth.

Answer: \_\_\_\_\_

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8. Suppose that you and a friend are playing cards and decide to make a bet. If your friend draws three non-face cards, where a face card is a Jack, a Queen, or a King, in succession from a standard deck of 52 cards without replacement, you give him \$10. Otherwise, he pays you \$20. Construct a probability distribution for the bet, for  $X$ , your earnings after one play. What is the expected value of your bet? Should your friend play the game? Round your answer to the nearest cent, if necessary.

Answer: \_\_\_\_\_

9. Solve the following system, if possible, using any method of your choice.

$$2x + 2y - 2z = 0$$

$$x + 2y = 5$$

$$x + y - z = 0$$

If there is no solution, enter "inconsistent" for your answer.

If there is a unique solution, enter it as a coordinate of the form  $(x_0, y_0, z_0)$ , where  $x = x_0$ ,  $y = y_0$ , and  $z = z_0$  is the solution.

If there are infinitely many solutions, use each variable as its own parameter where applicable, and enter your answer as a coordinate.

Answer: \_\_\_\_\_

10. Use inverses to solve the system (no credit for any other method!).

$$2x - y = 1$$

$$x - 4y = -3$$

Write your answer as a coordinate of the form  $(x_0, y_0)$ , where  $x = x_0$ , and  $y = y_0$  is the solution.

Answer: \_\_\_\_\_

11. A math 1108 student, worried about their grade, goes to Jhevon and says, "Help me out, professor!".

"Lets play a game," Jhevon says, with his best Jigsaw impression, "pick a table." In Jhevon's office, there are two tables: One table has 5 coins on it, but only 2 of them are fair, the others are double-headed. The other table has 3 dice on it, only 1 is fair, the others only have even numbers.

The student does not know about the unfair pieces. "Pick a table", Jhevon repeats ominously, "if you flip a coin and get tails, or you roll a die and get an odd number, I'll give you an A."

Given only this information, what is the probability that the student will get an A? Enter your answer as a reduced fraction.

Answer: \_\_\_\_\_

12. A multiple choice test has 20 questions and 4 choices per question. All problems are evenly weighted. If a student randomly guesses the answer for every question, what is the probability that the student will get between 70% and 80% inclusive? Enter your answer as a decimal to six decimal places.

Answer: \_\_\_\_\_

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13. A certain math 1108 professor, let's call him J. Smith, tends to have students who mispronounce his first name and have an inexplicable curiosity about where he's from. Being a math teacher, Smith gathered statistics on these phenomena and discovered that only 26% of students pronounce his name correctly. Also, only 7% correctly guess where he is from. Smith also notices that only 31% of students either pronounce his name correctly, or correctly guess where he's from.

Let  $N$  be the event a student pronounces Smith's first name correctly. Let  $F$  be the event a student correctly guesses where Smith is from.

- (a) What is the probability that a random student will both pronounce Smith's first name correctly and correctly guess where Smith is from?

Answer: \_\_\_\_\_

- (b) Are  $N$  and  $F$  independent? Justify.

- (c) Are  $N$  and  $F$  mutually exclusive? Justify.

14. Two cards are drawn at random from a 52-card deck in succession and without replacement. Let  $R$  be the event that the first card drawn is red. Let  $S$  be the event that the second card is red.

- (a) Given that  $R$  has occurred, what is the probability that  $S$  will occur? Enter your answer as a reduced fraction or a decimal to four decimal places.

Answer: \_\_\_\_\_

- (b) Are  $R$  and  $S$  independent? Justify.

15. A manufacturer obtains clock-radios from two different subcontractors: 55% from A, and 45% from B. The defective rates for these subcontractors are 3%, and 2%, respectively. If a customer returns a defective clock-radio, what is the probability that it came from subcontractor B? Write your answer as a decimal to three decimal places.

Answer: \_\_\_\_\_

16. Let  $A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & -1 & 0 \\ 1 & 2 & 1 \end{pmatrix}$

Find  $A^{-1}$ , by hand, using a method of your choice.

17. (a) A neighborhood has two rival cable companies. Company A retains 80% of its customer base each year, but loses 20% of its customers to company B. On the other hand, company B loses 55% of its customers to company A every year. Assuming this trend continues, what will company B's share of the market be in the long run? Write your answer as a percentage with 2 decimal places.

Answer: \_\_\_\_\_%

- (b) Assuming this trend continues, and that company B starts out controlling 35% of the market, what will be company B's market share in 2 years? Write your answer as a percentage with 2 decimal places.

Answer: \_\_\_\_\_%

## Formulas

### Interest:

**Simple:**  $A = P(1 + rt)$

**Compound:**  $A = P \left(1 + \frac{r}{n}\right)^{nt}$

**Compounded Continuously:**  $A = Pe^{rt}$

**Sinking Fund:**  $FV = PMT \frac{\left(1 + \frac{r}{n}\right)^{nt} - 1}{\frac{r}{n}}$       or       $PMT = FV \frac{\frac{r}{n}}{\left(1 + \frac{r}{n}\right)^{nt} - 1}$

**Amortization:**  $PV = PMT \frac{1 - \left(1 + \frac{r}{n}\right)^{-nt}}{\frac{r}{n}}$       or       $PMT = PV \frac{\frac{r}{n}}{1 - \left(1 + \frac{r}{n}\right)^{-nt}}$

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Math 1108 Mock Final – version 4 Answer Key

1. Correct Answer: \$61,474.12
2. Correct Answer: \$33,238.40
3. Correct Answer: \$1,310,451.88
4. Correct Answer: Amount in bonds,  $x = 18000$  Amount in fund,  $y = 2000$  Maximum annual income is, 620
5. Correct Answer: \$650.17
6. Correct Answer: 13
7. Correct Answer:  $\frac{7}{95} \approx 0.073684$
8. Correct Answer:

$X$	-\$10	\$20
$P(X)$	$\frac{38}{85}$	$\frac{47}{85}$

Expected value = \$6.59

No, he should NOT play the game. Not if he likes money!

9. Correct Answer:  $(2z - 5, 5 - z, z)$
10. Correct Answer:  $(1, 1)$
11. Correct Answer:  $\frac{11}{60}$
12. Correct Answer: 0.000029
13. (a). Correct Answer: 0.02  
 (b). Correct Answer: No, because  $P(N \cap F) = 0.02 \neq P(N) \cdot P(F) = 0.0182$   
 (c). Correct Answer: No, because  $P(N \cap F) \neq 0$
14. (a). Correct Answer:  $\frac{25}{51}$   
 (b). Correct Answer: No, because  $P(S|R) = \frac{25}{51} \neq P(S) = \frac{1}{2}$
15. Correct Answer: 0.353
16. Correct Answer:  $A^{-1} = \begin{pmatrix} -1 & 1 & 1 \\ -1 & 0 & 1 \\ 3 & -1 & -2 \end{pmatrix}$
17. **Step 1.** Correct Answer: 26.67%  
**Step 2.** Correct Answer: 27.19%