

### 1. Simple Interest Formulas

- $I = Prt$
- $A = P + Prt$

### 2. Compound Interest Formula

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

### 3. Effective Rate

- $E = \left(1 + \frac{r}{n}\right)^n - 1$

### 4. Annuity Formulas (Future value of payments)

- $A = \frac{R \cdot \left[\left(1 + \frac{r}{n}\right)^{nt} - 1\right]}{\left(\frac{r}{n}\right)}$
- $R = \frac{A \cdot \left(\frac{r}{n}\right)}{\left[\left(1 + \frac{r}{n}\right)^{nt} - 1\right]}$

### 5. Present value of future payments

- $P = \frac{R \cdot \left[1 - \left(1 + \frac{r}{n}\right)^{-nt}\right]}{\left(\frac{r}{n}\right)}$

### 6. Mortgage Formula (Payments for present value)

- $R = \frac{P \cdot \left(\frac{r}{n}\right)}{\left[1 - \left(1 + \frac{r}{n}\right)^{-nt}\right]}$

*Intentionally blank.*

**Math 112 - Final Exam A**  
May 14, 2019

Name \_\_\_\_\_  
Score \_\_\_\_\_

**Show all work to receive full credit.** Supply explanations where necessary.

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1. (5 points) Circle the letter corresponding to each set that **IS NOT** well defined.

- (a) The set of human beings on Mars
- (b) The set of letters of the English alphabet
- (c) The set of all pretty flowers
- (d) The set of all natural numbers that are less than 0
- (e) The set of all smart students

2. (8 points) Let  $L$  be the set letters of the word *abracadabra*.

- (a) Write  $L$  in roster notation.
- (b) What is the cardinality of  $L$ ?
- (c) Give an example of a set that is equivalent to  $L$ , but not equal to  $L$ .
- (d) Give an example of a proper subset of  $L$  that has at least 2 elements.

3. (4 points) Rewrite each of the following statements using mathematical symbols.

- (a) The set  $A$  is a subset of the set of natural numbers.
- (b) The empty set is an element of the set  $B$ .

4. (12 points) Let  $P = \{1, 3, 5\}$  and  $Q = \{1, 2, 3, 5\}$ , and think of  $P$  and  $Q$  as subsets of the universal set  $U = \{1, 2, 3, 4, 5, 6\}$ . Determine each of the following.

(a)  $n(Q)$

(b)  $P'$

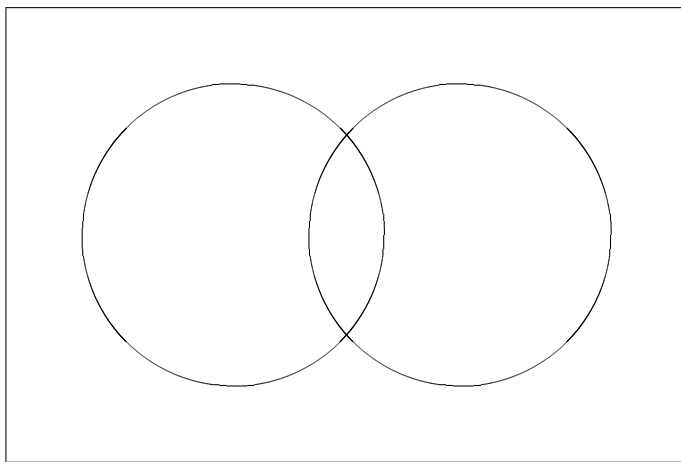
(c)  $P \cup Q$

(d)  $P \cap Q$

(e)  $P - Q$

(f)  $Q \cup \emptyset$

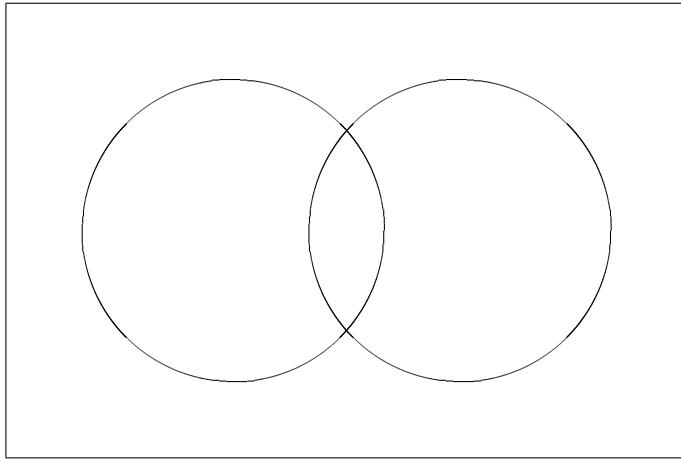
5. (6 points) In the two-set Venn diagram shown below, label the sets  $A$  and  $B$ . Then label the four distinct (disjoint) regions with Roman numerals (or whatever system you prefer to use). Identify and shade the regions that make up  $(A' \cup B)'$ .



6. (10 points) In a survey, 500 randomly selected people were asked whether they have a tattoo and/or a body piercing. Here are the results:

- 79 have only a tattoo
- 31 have only a body piercing
- 151 have a tattoo or a body piercing (or both)

(a) Count and sort these results using a two-set Venn diagram.



(b) How many people have both a tattoo and a body piercing?

(c) How many people have neither a tattoo nor a body piercing?

7. (5 points) Which of these sentences are statements? Circle all that apply.

- (a)  $3 \times 5 = 35$
- (b) Just do it!
- (c) Marie Curie was awarded the 1903 Nobel Prize in Physics.
- (d) Do you watch *Game of Thrones*?
- (e) Some students were late to class.

8. (8 points) Write the negation of each statement in a correct sentence.

(a) He has two dogs.

(b) Some rectangles are not squares.

(c) Nobody will ever run a 3-minute mile.

(d) Someone in this class will get an A.

9. (4 points) Let  $p$  = “She gets paid” and let  $q$  = “She buys groceries.” Write each statement in words.

(a)  $p \wedge q$

(b)  $\sim p \longrightarrow \sim q$

10. (4 points) Refer to the statements  $p$  and  $q$  from the problem directly above. Write each statement in symbolic form.

(a) She gets paid, but she does not buy groceries.

(b) She buys groceries if she gets paid.

11. (5 points) Write the truth table for the conditional statement  $p \longrightarrow q$ .

12. (12 points) Use a truth table to determine whether the statement is a tautology, a self-contradiction, or neither.

$$(p \wedge q) \wedge \sim q$$

13. (6 points) Consider the following conditional statement:

*If Sara learns Python, then she writes programs.*

(a) Write the contrapositive of the statement.

(b) Write the converse of the statement.

(c) Write the inverse of the statement.

14. (5 points) Sofia deposits \$8500 into an account earning simple interest. After 4 years, the account is worth \$10,727. What was Sofia's simple interest rate? Write your final answer in percent form.
15. (10 points) Elaine inherited \$172,000 after the death of a distant relative. She deposited the money, all at once, into an account earning 7.25% compounded quarterly.
- (a) How much money is in the account after 25 years?
- (b) How much money was made in interest?
16. (8 points) Suppose you begin depositing monthly payments into an account earning 4.5% compounded monthly. Your goal is to accumulate \$50,000 in 10 years. What should your monthly payments be?



17. (12 points) A house sells for \$335,000 and an 5% down payment is made. The remaining amount is mortgaged for 30 years at a fixed rate of 4.5% compounded monthly.

(a) How much is the down payment?

(b) What is the loan amount?

(c) Determine the monthly mortgage payment on the loan amount.

(d) When the loan is paid off in 30 years, what will be the total interest paid?

18. (6 points) A letter is selected at random from the word *TENNESSEE*.

(a) What is the sample space?

(b) What is the event of selecting a vowel?

(c) What is the probability of selecting a *T* or *N*?

19. (5 points) The probability of the event  $A$  is  $7/19$ . What are the odds in favor of  $A$ ? What are the odds against  $A$ ? (Indicate which answer is which.)
20. (5 points) A standard 6-sided die is rolled one time. Compute the expected value.
21. (10 points) A jar contains 3 quarters, 1 dime, and 1 nickel. Two coins are selected at random (without replacement).
- (a) Sketch the complete tree diagram for this experiment. **Include the probabilities of each path.**
- (b) What is the probability of selecting 50 cents?
- (c) What is the probability of selecting less than 50 cents?