Applied Liberal Arts Mathematics  MAT-105-TE

This TECEP® tests a broad-based overview of mathematics intended for non-math majors and emphasizes problem-solving modeled on real-life applications. Topics include: number systems; solution of basic algebraic problems; sets, logic, and probability; interpretation of statistical data; the metric system; and calculations involving geometric objects.  (3 s.h.)

- Test format: 69 multiple choice questions (1 point each)
- Passing score: 70% (48/69 points). Your grade will be reported as CR (credit) or NC (no credit).
- Time limit: 3 hours
- You may use a scientific calculator (non-graphing, non-programmable) during testing.

Topics on the test and their approximate distribution

1. Critical thinking  (5%)
   A. Inductive and deductive reasoning  
   B. Problem-solving

2. Sets and statements  (25%)
   A. Sets and subsets; set-builder notation; roster form  
   B. Subsets; equal sets; equivalent sets  
   C. Venn diagrams; union of sets; intersection of sets  
   D. Venn diagrams with three sets  
   E. Simple and compound statements; qualifiers “and” and “or” and their symbols; conjunction and disjunction; conditional and biconditional statements  
   F. Truth value of a compound statement (no truth tables)

3. Systems of numeration  (5%)
   A. Place value or positional value numeration  
   B. Hindu-Arabic and Roman numerals; base 10 expanded forms; base 2 numbers; conversion between base 10 and base 2

4. Real number systems  (20%)
   A. Prime and composite numbers; divisibility rules; prime factors of composite numbers  
   B. Integers; the real number line and operations with integers  
   C. Fractions and reducing fractions; conversion between decimal numbers and fractions; operations with fractions  
   D. Properties of real numbers such as distributive property  
   E. Rules of exponents (not including scientific notation)

5. Algebra, graphs and functions  (25%)
   A. Order of operations  
   B. Simplifying expressions; equations with one variable; proportion problems  
   C. Evaluation of formulas  
   D. Graphs of linear equations in the rectangular coordinate system  
   E. Functions; vertical line test; domain and range
6. **Metric system, conversions and geometry**  (10%)
   A. Conversions between metric and U.S. customary unit systems
   B. Area of geometric objects and volume of solid objects
   C. Dimensional analysis
   D. Perimeter and area of geometric objects
   E. Surface area and volume of solid objects

7. **Probability and statistics**  (10%)
   A. Empirical probability
   B. Calculations of probability
   C. Counting principle and permutations
   D. Average (mean); mode; median; midrange; range
   E. Interpretation of deviation (not including calculation)

**Study materials**


**Sample questions**

1. Use inductive reasoning to predict the next line in the pattern below.
   
   \[(8 \times 1) \times (2 \times 1) = 16\]
   \[(8 \times 10) \times (2 \times 2) = 320\]
   \[(8 \times 100) \times (2 \times 3) = 4800\]
   
   a. \((8 \times 1000) \times (2 \times 4) = 6400\)
   b. \((8 \times 1000) \times (2 \times 4) = 56,000\)
   c. \((8 \times 1000) \times (2 \times 4) = 64,000\)
   d. \((8 \times 1000) \times (2 \times 4) = 72,000\)

2. An airport parking lot charges $3.50 for the first 2 hours of parking and $1.00 for each additional half hour. How much does it cost to park for 6 hours?
   
   a. $7.50
   b. $8.00
   c. $11.50
   d. $12.00

3. Convert \(10010000_2\) to a numeral in base 10.
   
   a. 4
   b. 144
   c. 288
   d. 20,020,000
4. Find \( n(A) \) for the set: \( A = \{x \mid x \text{ is a second in a minute}\} \)
   a. \( n(A) = 12 \)
   b. \( n(A) = 60 \)
   c. \( n(A) = 120 \)
   d. \( n(A) = \text{infinite} \)

5. How many 6-digit numbers can be formed using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 if repetitions of digits are allowed?
   a. \( 46,656 \)
   b. \( 899,999 \)
   c. \( 900,000 \)
   d. \( 1,000,000 \)

6. The table below gives the total spectator attendance for various U.S. sports in one year. What is the midrange of these attendance numbers?

<table>
<thead>
<tr>
<th>Sport</th>
<th>Attendance (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro Baseball</td>
<td>64.9</td>
</tr>
<tr>
<td>College Basketball (Men’s)</td>
<td>27.7</td>
</tr>
<tr>
<td>College Basketball (Women’s)</td>
<td>6.7</td>
</tr>
<tr>
<td>Pro Basketball (Men’s)</td>
<td>21.7</td>
</tr>
<tr>
<td>College Football</td>
<td>36.9</td>
</tr>
<tr>
<td>Pro Football</td>
<td>14.8</td>
</tr>
<tr>
<td>Pro Hockey</td>
<td>17.1</td>
</tr>
</tbody>
</table>

   a. 21.7 million
   b. 35.8 million
   c. 37 million
   d. 37.9 million

7. 47 liters = ____ quarts.
   a. 21.3
   b. 44.5
   c. 49.5
   d. 56.4

8. Perform the indicated operation and reduce the answer to the lowest terms: \( \frac{6}{7} - \frac{1}{3} \)
   a. \( \frac{1}{105} \)
   b. \( \frac{11}{21} \)
   c. \( \frac{55}{7} \)
   d. \( \frac{21}{11} \)
9. Evaluate the expression: $(-3)^0$
   a. -3
   b. -1
   c. 1
   d. 0

10. Evaluate the expression: $(-1)(7)(-3)$
    a. 21
    b. -21
    c. 11
    d. -11

11. A bank account balance is $5038. Checks for $5779, $1918, and $3224 are written. Deposits of $1192 and $917 are made. How much is in the account? Is it overdrawn?
    a. -$13,850, yes
    b. -$3774, yes
    c. -$550, yes
    d. $13,850, no

12. Evaluate the expression: $(-5)^3$
    a. -125
    b. 125
    c. -1/125
    d. 1/125

13. Solve the equation: $44(x - 176) = 88$
    a. 88
    b. 174
    c. 176
    d. 178

14. Three coins are tossed 80 times and the number of heads is observed below.
    Compute the empirical probability that at most two heads occur.

    | Outcome       | No heads | One head | Two heads | Three heads |
    |---------------|----------|----------|-----------|-------------|
    | Frequency     | 18       | 5        | 7         | 50          |

    a. 2/15
    b. 3/8
    c. 3/4
    d. 23/2
15. The table below shows the number of college students who prefer a given pizza topping. Estimate the indicated probability for: \( P(\text{juniors prefer meat toppings}) \)

<table>
<thead>
<tr>
<th>Toppings</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheese</td>
<td>12</td>
<td>10</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>Meat</td>
<td>27</td>
<td>26</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Veggie</td>
<td>10</td>
<td>12</td>
<td>27</td>
<td>26</td>
</tr>
</tbody>
</table>

a. 0.044  
b. 0.133  
c. 0.156  
d. 0.355  

16. Find the mean of the set of data: 19, 7, 7, 9, 2, 20, 10, 1, 18  
a. 10.2  
b. 10.3  
c. 10.4  
d. 10.8  

17. Express the set in roster form: \( \{x|x \text{ is a natural number multiple of 5}\} \)
   a. \{0, 5, 10, 15,\ldots\}  
b. \{5, 10, 15,\ldots\}  
c. \{10, 15, 20,\ldots\}  
d. \emptyset  

18. Find \( n(A) \) for the set: \( A = \{x|x \text{ is a number on a clock face}\} \)
   a. \( n(A) = 3 \)  
b. \( n(A) = 6 \)  
c. \( n(A) = 12 \)  
d. \( n(A) = 24 \)  

19. Determine whether the sets are equal, equivalent, both, or neither: \{4, 13\} and \{4, 1, 3\}
   a. Equal  
b. Equivalent  
c. Both  
d. Neither
20. Use the Venn diagram to find A.

![Venn diagram]

a. \( \{6, z, q, h\} \)
b. \( \{8, 2, 6, z\} \)
c. \( \{6\} \)
d. \( \{8, 2, 6\} \)

21. Indicate whether the statement at the end is a simple or a compound statement. If it is a compound statement, indicate whether it is a negation, conjunction, disjunction, conditional, or biconditional by choosing both the word and its appropriate symbol. The apartment is rented or it is available.

   a. Simple statement
   b. Compound; conditional; \( \rightarrow \)
   c. Compound; biconditional; \( \leftrightarrow \)
   d. Compound; disjunction; \( \lor \)

22. Write the following compound statement in symbols: If I exercise, then I won’t eat too much.

Let \( r = \) “The food is good.”
Let \( p = \) “I eat too much.”
Let \( q = \) “I’ll exercise.”

   a. \( q \rightarrow \sim p \)
   b. \( \sim(p \rightarrow q) \)
   c. \( r \land p \)
   d. \( p \rightarrow q \)

23. Fill in the missing value: \( 7.99\text{m} = ____ \text{cm} \).

   a. 799
   b. 79.9
   c. 0.799
   d. 0.0799
24. Find the area:

a. $338 \text{ ft}^2$
b. $377 \text{ ft}^2$
c. $422.5 \text{ ft}^2$
d. $845 \text{ ft}^2$

25. Find the missing length in the right triangle. If necessary, round to the nearest tenth.

a. 9.5 cm
b. 14.9 cm
c. 110.5 cm
d. 221 cm

26. Which choice represents the equation for the graph?

a. $f(x) = -\frac{1}{3}x - \frac{5}{3}$
b. $f(x) = -\frac{1}{3}x + \frac{5}{3}$
c. $f(x) = +\frac{1}{3}x - \frac{5}{3}$
d. $f(x) = +\frac{1}{3}x + \frac{5}{3}$

Answers to sample questions

1. c 2. c 3. b 4. b 5. d 6. b 7. c 8. b 9. c
10. a 11. b 12. c 13. d 14. b 15. c 16. b 17. b 18. c