

FIRST EXAM
MAE 301/501, Spring, 2009
March 5, 2007

Name:

Please answer each question in the space provided.

Part I. Answer all questions in this part. Each correct answer will receive 4 credits. No partial credit will be allowed. Record your answers in the spaces provided.

(1) Which letter below has point symmetry but does not have line symmetry?

1. **H** 2. **N** 3. **A** 4. **E**

(1) _____

(2) If the circumference of a circle is doubled, the diameter of the circle

1. remains the same
2. increases by 2
3. is multiplied by 4
4. is doubled

(2) _____

(3) The value of $5!$ is?

1. $\frac{1}{5}$ 2. 20 3. 5 4. 120

(3) _____

(4) A function is defined by the equation $y = \frac{1}{2}x - \frac{3}{2}$. Which equation defines the inverse of this function?

1. $y = 2x + 3$ 2. $y = 2x - 3$ 3. $y = 2x + \frac{3}{2}$ 4. $y = 2x - \frac{3}{2}$

(4) _____

(5) On a standardized test, the distribution of scores is normal, the mean of the scores is 75 and the standard deviation is 5.8. If a student scored 83, the student's score ranks

1. below the 75th percentile
2. between the 75th percentile and the 84th percentile
3. between the 84th percentile and the 97th percentile
4. above the 97th percentile

(5) _____

(6) The expression $\frac{2\cos\theta}{\sin 2\theta}$ is equivalent to

1. $\csc \theta$ 2. $\sec \theta$ 3. $\cot \theta$ 4. $\sin \theta$

(6) _____

(7) If $a + b$ is less than $c + d$, and $d + e$ is less than $a + b$, then e is

1. less than c 2. equal to c 3. less than d 4. greater than d

(7) _____

(8) The sum of the measures of the interior angles of an octagon is

1. 180° 2. 360° 3. 540° 4. $1,080^\circ$

(8) _____

(9) The roots of the equation $2x^2 - x = 4$ are

1. real and irrational
2. real, rational and equal
3. real, rational and unequal
4. imaginary

(9) _____

(10) Two objects are 2.4×10^{20} centimeters apart. A message from one object travels to the other at a rate of 1.2×10^5 centimeters per second. How many seconds does it take the message to travel from one object to the other?

1. 1.2×10^{15} 2. 2.0×10^4 3. 2.0×10^{15} 4. 2.88×10^{25}

(10) _____

Part II. Answer all questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 2 credits.

- (11) A ski lift begins at ground level 0.75 mile from the base of a mountain whose face has a 50° angle of elevation, as shown in the accompanying diagram. The ski lift ascends in a straight line at an angle of 20° . Find the length of the ski lift from the beginning of the ski lift to the top of the mountain, to the *nearest hundredth of a mile*.

- (12) The lengths of the sides of two similar rectangular billboards are in the ratio 5:4. If 250 square feet of material is needed to cover the larger billboard, how much material, in square feet, is needed to cover the smaller billboard?
- (13) In a certain school district, the ages of all new teachers hired during the last 5 years are normally distributed. Within this curve, 95.4% of the ages, centered about the mean, are between 24.6 and 37.4 years. Find the mean age and the standard deviation of the data.

- (14) After studying a couple's family history, a doctor determines that the probability of any child born to this couple having a gene for disease X is 1 out of 4. If the couple has three children, what is the probability that exactly two of the children have the gene for disease X ?
- (15) The equation $W = 120I - 12I^2$ represents the power (W), in watts, of a 120-volt circuit having a resistance of 12 ohms when a current (I) is flowing through the circuit. What is the maximum power, in watts, that can be delivered in this circuit?

Part III. Answer all questions in this part. Each correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 2 credits.

- (16) The senior class at South High School consists of 250 students. Of these students, 130 have brown hair, 160 have brown eyes, and 90 have both brown hair and brown eyes. How many members of the senior class have *neither* brown hair *nor* brown eyes.

- (17) To get from his high school to his home, Jamal travels 5.0 miles east and then 4.0 miles north. When Sheila goes to her home from the same high school, she travels 8.0 miles east and 2.0 miles south. What is the the measure of the shortest distance, to the *nearest tenth of a mile*, between Jamal's home and Sheila's home? (The use of the accompanying grid is optional.)

- (18) On a bookshelf there are five different mystery books and six different biographies. How many different sets of four books can Emilio choose if two of the books must be mystery books and two of the books must be biographies.

(19) Solve for x:

$$\log_4(x^2 + 3x) - \log_4(x + 5) = 1.$$

Part IV. Answer all questions in this part. Each correct answer will receive 8 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 2 credits.

- (20) A surveyor is mapping a triangular plot of land. He measures two of the sides and the angle formed by these two sides and finds that the lengths are 400 yards and 200 yards, and the included angle is 50° .

What is the measure of the third side of the plot of land, to the *nearest yard*?

What is the area of this plot of land, to the *nearest square yard*?

- (21) Determine the distance between point $A(-1, -3)$ and $B(5, 5)$. Write an equation of the perpendicular bisector of \overline{AB} . (The use of the accompanying grid is optional.)

