FIRST EXAM, second try

MAE 301/501, Spring 2009

March 31, 2009

Name:

Please answer each question in the space provided.

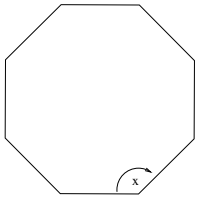
Part I. Answer all questions in this part. Each correct answer will receive 4 credits. No partial credit will be allowed. Record your answers in the spaces provided.

(1) A line segment on the coordinate plane has endpoints $(2,4)$ and $(4,y)$. The midpoint of the segment is point $(3,7)$. What is the value of y?

1. 11 2. 10 3. 5 4. -2.

(1) _____

(2) A stop sign in the shape or a regular octagon is resting on a brick wall, as shown in the accompanying diagram. What is the measure of angle x?



1. 45° 2 60° 3. 120° 4. 135°

(2) _____

(3) The expression $i^0 \cdot i^1 \cdot i^2 \cdot i^3 \cdot i^4$ is equal to

1. 1 2. -1 3. i 4. $-i$

(3) _____

(4) When simplified, the complex fraction

$$\frac{1+\frac{1}{x}}{\frac{1}{x}-x}, \qquad x \neq 0,$$

is equivalent to

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

(4) _____

(5) The mean score on a normally distributed exam is 42 with a standard deviation of 12.1. Which score would be expected to occur *less than* 5% of the time?

1. 25 2. 32 3. 60 4. 67

(5) _____

(6) What is the total number of distinct triangles that can be constructed if $AC = 13$, $BC = 8$, and $m\angle A = 36$?

1. 1 2. 2 3. 3 4. 6

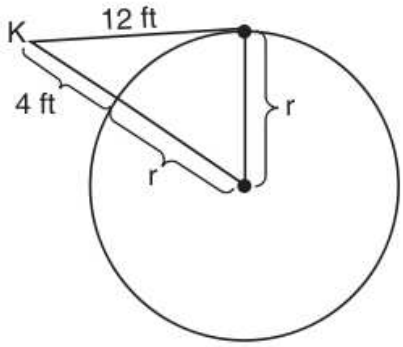
(6) _____

(7) What is the value of x in the equation $81^{x+2} = 27^{5x+4}$?

1. $-\frac{2}{11}$ 2. $-\frac{3}{2}$ 3. $\frac{4}{11}$ 4. $-\frac{4}{11}$

(7) _____

(8) Kimi wants to determine the radius of a circular pool without getting wet. She is located at a point K, wlhich is 4 feet from the pool and 12 feet from the point of tangency, as shown in the accompanying diagram. What is the radius of the pool?



1. 16 ft 2. 20 ft 3. 32 ft 4. $4\sqrt{10}$ ft

(8) _____

(9) If f and g are two functions defined by $f(x) = 3x+5$ and $g(x) = x^2+1$, then $g(f(x))$ is

1. x^2+3x+6 2. $3x^2+8$ 3. $9x^2+30x+26$ 4. $9x^2+26$.

(9) _____

(10) An object orbiting a planet travels in a path represented by the equation

$$3(y+1)^2+5(x+4)^2 = 15.$$

In what type of pattern does the object travel?

1. hyperbola 2. ellipse 3. circle 4. parabola

(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) The profit a coat manufacturer makes each day is modeled by the equation

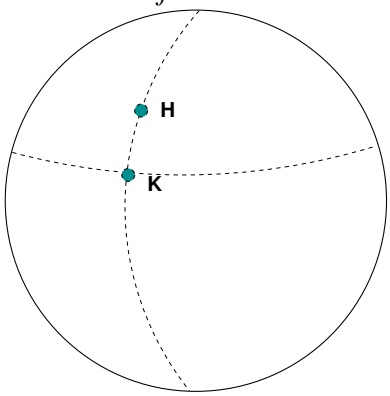
$$P(x) = -x^2 + 120x - 2,000$$

, where P is the profit and x is the price for each coat sold. For what values of x does the company make a profit?

(12) Find all values k such that the equation $3x^2 - 2x + k = 0$ has imaginary roots.

(13) Boyle's law states that the pressure of compressed gas is inversely proportional to its volume. The pressure of a certain sample of a gas is 16 kilopascals when its volume is 1,800 liters. What is the pressure, in kilopascals, when the volume is 900 liters?

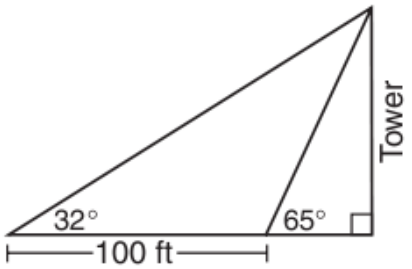
(14) Cities H and K are located on the same line of longitude and the difference in the latitude of these cities is 9°, as shown in the accompanying diagram. If Earth's radius is 3,954 miles, how many miles north of city K is city H along arc HK? Round your answer to the *nearest tenth of a mile*.



(15) The Coolidge family's favorite television channels are 3, 6, 7, 10, 11, and 13. If the Coolidge family selects a favorite channel to view at random each night, what is the probability that they choose *exactly* three even-numbered channels in five nights? Express your answer as a fraction, or as a decimal rounded to *four decimal places*.

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 accompanying diagram shows the plans for a cell-phone tower that is to be built near a busy highway. Find the height of the tower, to the *nearest foot*.



(17) Solve for all values of x:

$$\frac{9}{x}+\frac{9}{x-2}=12$$

(18) A triangular plot of land has sides that measure 5 meters, 7 meters, and 10 meters. What is the area of this plot of land *to the nearest tenth of a square meeter*?

(19) A certain state is considering changing the arrangement of letters and numbers on its license plates. The two options the state is considering are:
Option 1: three letters followed by a four-digit number, with repetitions of both numbers and letters allowed
Option 2: four letters followed by a three-digit number without repetitions of either letters or digits
[Zero may be chosen as the first digit of the number in either option.]
Which option will enable the state to issue more license plates? How many *more* different license plates will that option yield?

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) Mr. Perez owns a sneaker store. He bought 350 pairs of basketball sneakers and 150 pairs of soccer sneakers from the manufacturer for $62,500. He sold all the sneakers and made a 25% profit. If he sold the soccer sneakers for $130 per pair, how much did he charge for one pair of basketball sneakers?

(21) The coordinates of quadrilateral $JKLM$ are $J(1,-2)$, $K(13,4)$, $L(6,8)$, and $M(-2,4)$. Prove that the quadrilateral $JKLM$ is a trapezoid but *not* an isosceles trapezoid.

Formulas

Area of Triangle

$K = \frac{1}{2} ab \sin C$

Functions of the Sum of Two Angles

$\sin (A + B) = \sin A \cos B + \cos A \sin B$
$\cos (A + B) = \cos A \cos B - \sin A \sin B$

Functions of the Difference of Two Angles

$\sin (A - B) = \sin A \cos B - \cos A \sin B$
$\cos (A - B) = \cos A \cos B + \sin A \sin B$

Law of Sines

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Law of Cosines

$a^2 = b^2 + c^2 - 2bc \cos A$

Functions of the Double Angle

$\sin 2A = 2 \sin A \cos A$
$\cos 2A = \cos^2 A - \sin^2 A$
$\cos 2A = 2 \cos^2 A - 1$
$\cos 2A = 1 - 2 \sin^2 A$

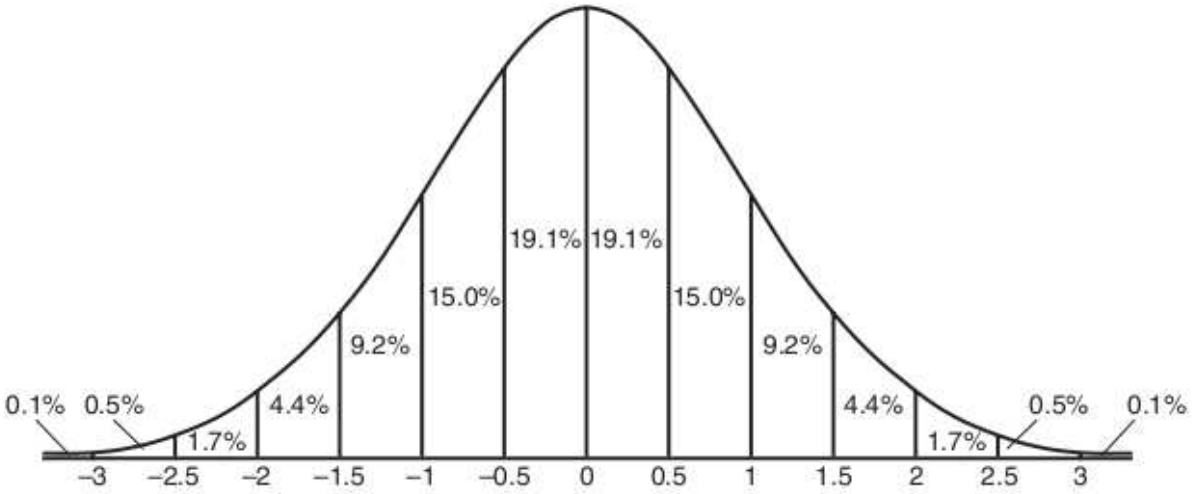
Functions of the Half Angle

$$\sin \tfrac{1}{2} A = \pm \sqrt{\frac{1 - \cos A}{2}}$$

$$\cos \tfrac{1}{2} A = \pm \sqrt{\frac{1 + \cos A}{2}}$$

Normal Curve

Standard Deviation



SCRAP PAGE

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Problem	PartI	11	12	13	14	15	16	17	18	19	20	21	**Total:**
Max	40	4	4	4	4	4	6	6	6	6	8	8	100
Scores													