Algebra-Geometry Session

Questions 1-16 are worth 1 point each and questions 17-25 are worth 2 points each.

Questions 1-16 multiple choice

Complete instructions are on a separate page, but please:
- Use the answer sheet for your answers.
- Answer only one choice A, B, C, D, or E for each question by circling your answer on the answer sheet.
- Erase clearly any answer you wish to change.
- Do not make stray marks on the answer sheet.

1

What is one-third of 199?

A 33 B 66 C 66.5 D 66 2/3 E none of these

2

Which of these numbers is the largest?

A 1/3 B 3/10 C 333/1000 D 7/20 E 0.33

3

Which of the following is not equal to 0.000 000 125?

A 1.25×10^{-7} B $12\frac{1}{2} \times 10^{-8}$ C 125×10^{-9} D $1/8 \times 10^{-6}$ E $1/8 \times 10^{-7}$

4

If $x + 2y = 5, z + 2x = 9$ and $y + 2z = 10$, find the value of $x + y + z$.

A 2 B 4 C 6 D 8 E more than 8

5

How many axes of symmetry does a rhombus have?

A 0 B 1 C 2 D 3 E 4

6

What is the area of a circle with diameter D?

A πD^2 B $2\pi D^2$ C $\frac{\pi}{2}D^2$ D $0.25\pi D^2$ E none of these

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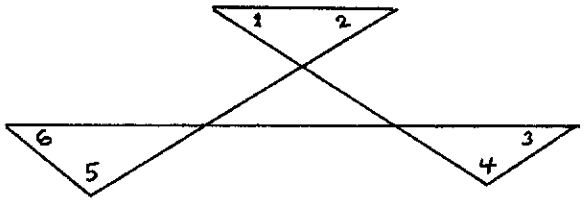
7

In a rectangle we decrease one side by 3 and increase an adjacent side by 2 to form a square of area 25. Find the perimeter of the rectangle.

A 11 B 20 C 22 D 24 E can't be sure

8

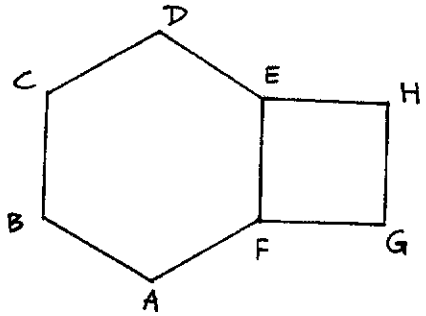
The sum of the marked angles 1, 2, 3, 4, 5, 6 is



A 180° B 270° C 360° D 450° E can't be sure

9

Outside of a regular hexagon $ABCDEF$ we draw a square $EFGH$. How big is the angle AFG?



A 120° B 135° C 145° D 150° E 165°

10

Regular customers in the Magnolia Room buffet at the LSU Union get a 10% discount. But then they pay 9% Louisiana tax and usually leave a 14% tip. The percentages are to be calculated in turn (with each percentage - charge or discount - being based on the previous answer). Which order of these discount/charge computations gives the lowest cost of the lunch?

A tax, tip, discount B tip, tax, discount C discount, tax, tip
D discount, tip, tax E it makes no difference

11

In which quadrants of the coordinate system on the plane does the graph of the function $y = x^4 - 6x^2 + 10$ lie?

A I, II B III, IV C I, III D II, IV E I, II, III

12

Let a, b and c be three different positive numbers, with $a < b$, and $c > b$. Which of the following is always the largest?

A b/a B c/a C c/b D a/c E none

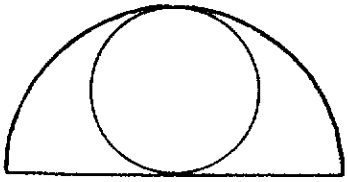
13

Mary has 16 coins that total \$ 3.00. If she has only nickels and quarters, how many quarters does she have?

A not enough info to solve the problem B facts are contradictory - no solution
C 5 D 11 E 4

14

A small circle just fits inside a semicircle. What is the ratio of the area of the small circle to the area of the semicircle containing it?



A 1:1 B 1:2 C 1:3 D 2:3 E 3:4

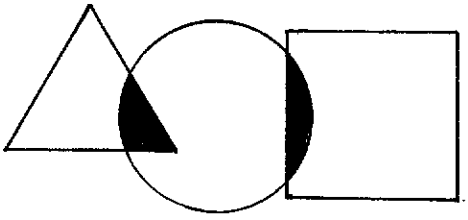
15

A room is 30 feet square and 12 feet high. A spider is located in one of the corners on the floor. An unsuspecting fly rests at the diagonally opposite corner on the ceiling. If the fly does not move, what is the shortest distance the spider must crawl along the walls to catch the fly?

A $\sqrt{1944}$ B $\sqrt{2664}$ C $30+\sqrt{1044}$ D $12+\sqrt{1800}$ E 72

16

In the diagram below the square has sides of length 3, the circle has radius $3/\sqrt{\pi}$ and the equilateral triangle has sides of length 3.



The area of the unshaded region of the square is 8, the area of the unshaded region of the circle is 7. What is the area of the unshaded region in the equilateral triangle?

A $\frac{9\sqrt{3}-1}{4}$ B $\frac{9\sqrt{3}-2}{4}$ C $\frac{9\sqrt{3}-3}{4}$ D $\frac{9\sqrt{3}-4}{4}$ E $\frac{9\sqrt{3}-5}{4}$

Questions 17-25 Exact Answer Questions

These next nine questions are exact numerical or algebraic answers. Hand written exact answers must be written on the answer sheet with fractions reduced, radicals simplified, and denominators rationalized. Do not make an approximation for π or other irrational numbers. Answers must be exact. Large numbers should not be multiplied out, *i.e.*, do not try to multiply out 20! or 6^{40}.

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17. One-third of the people at a party are men, a quarter are boys, one-sixth are women and there are six girls. How many people were at the party?

18. One whole brick weighs 1 kg and half a brick. How much does one brick weigh?

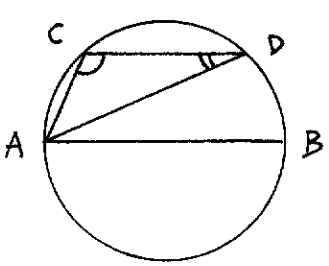
19. If a and b are the roots of the equation $x^2 - px + q = 0$, find the quadratic equation whose roots are $a + 1/b$ and $b + 1/a$.

20. Find the largest number that always divides the difference of squares of any two consecutive odd numbers.

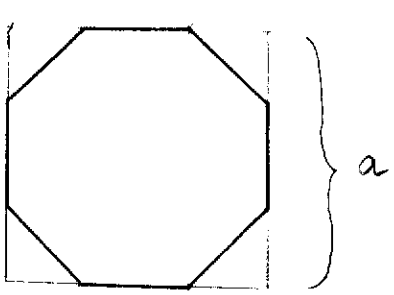
21. A man's salary is reduced by 15%. By what percent would his salary then have to be raised to bring it back to the original amount?

22. If the radius of the base of a cylinder is doubled and its height is tripled, by what number is the volume multiplied?

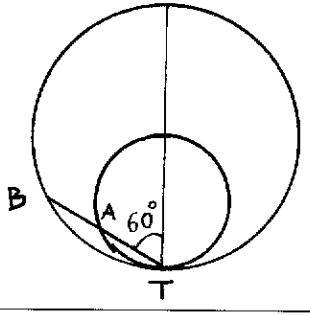
23. AB is a diameter of a circle and CD is a chord parallel to AB. Find the angle $\angle C - \angle D$.



24. The side of a square is a. Find the length of a side of a regular octagon obtained from the square by cutting off its corners.



25. Consider two circles with the second, smaller, internally tangent to the first at a point T and also passing through the center C of the first. Let c be a chord of both circles which has T as an endpoint and which crosses the smaller circle at A and the larger circle at B. The chord forms an angle of $60°$ with the diameter of the circles passing through T. Find $TA : TB$.



Name:_____

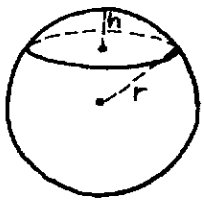
School:_____

Algebra-Geometry Session: Tiebreaker

This last page is the tiebreaker question. This question is graded as an essay question *i.e.*, it is graded for the clarity of explanation and argument as well as correctness. It is graded only to separate first, second, and third place ties. It is the only question graded for partial credit. You may use the back or this page if you need more space.

Question

For the purpose of this problem, treat the earth as a sphere of radius 4000 miles. An observer on the moon is 240,000 miles from the surface of the earth. What fraction of the earth's surface can he see? [The surface area S of a "cap without base" of a sphere of radius r and height $0 \leq h \leq 2r$ is $S = 2\pi rh$.]



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