

**GEORGIA SOUTHERN UNIVERSITY
HIGH SCHOOL MATHEMATICS TOURNAMENT
1995 VARSITY WRITTEN EXAM**

Name _____

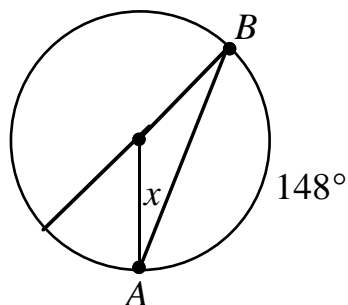
School _____

Directions:

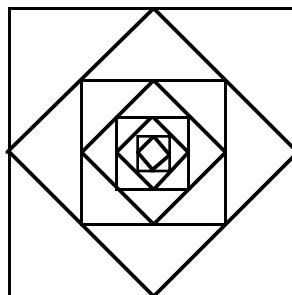
1. Do not open this test booklet until you are told to do so.
2. Use only a #2 lead pencil.
3. No calculators, slide rules, notes or other aids of any kind may be used.
4. Scratch paper is stapled to the back of the test booklet.
5. This is a 40 question multiple-choice exam. You will be allotted 90 minutes to complete the exam.
6. Geometric figures are not necessarily drawn to scale.
7. Your score will be determined by the formula $40 + 4R - W$ where R = number of questions answered correctly and W = number of questions answered wrong. There is no penalty for questions left unanswered.
8. Tie-breakers will be taken from the written exam in order of difficulty. This order will be determined by the number of people that answered each question correctly, with the question(s) correctly answered by the fewest people considered first.

**1995 GEORGIA SOUTHERN UNIVERSITY
MATHEMATICS TOURNAMENT
VARSITY WRITTEN EXAM**

1. Find the degree measure of x if the measure of arc AB is 148° .

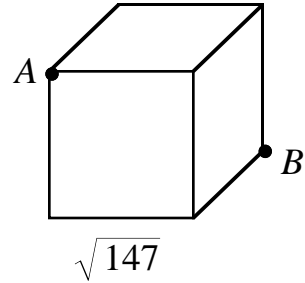


- a. 53
b. 74
c. 16
d. 32
e. none of the above
2. The perimeter of the largest square is 7. Infinitely many other squares are inscribed with vertices at the midpoints of the square that inscribes them. Find the sum of their perimeters.



- a. 14
b. 21
c. $14 + 7\sqrt{2}$
d. $14\sqrt{2}$
e. none of the above
3. If $y = \left(\frac{1}{4}\right)^x$ and $x = -1.5$, find y .
- a. $-\frac{1}{8}$
b. $\sqrt[3]{16}$
c. $\frac{1}{8}$
d. 8
e. none of the above

4. Find $|AB|$ for this cube.



- a. 441
b. 21
c. $7\sqrt{6}$
d. $14\sqrt{6}$
e. none of the above
5. In a box are 12 black socks, 7 red socks and 6 white socks. What is the probability of selecting a black or white sock if one sock is drawn at random?

- a. $\frac{72}{625}$
b. $\frac{2}{3}$
c. $\frac{18}{25}$
d. $\frac{6}{25}$
e. none of the above

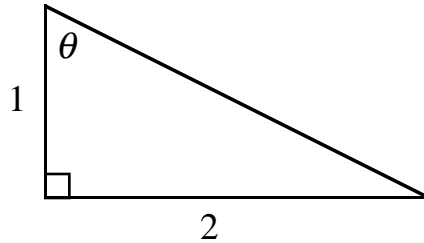
6. Evaluate $5 \tan\left(\cos^{-1} \frac{\sqrt{2}}{2}\right) + 36 \sin 30^\circ$.

- a. $5 + 18\sqrt{3}$
b. $-5 + 18\sqrt{2}$
c. 13
d. 23
e. none of the above

7. At a local pet store, the following signs were posted: "5 dogs and 3 fish for only \$266" and "4 fish and 2 cats for only \$68." The owner stated, "Dogs cost \$50 more than fish." How much would it cost to buy a cat and three fish?

- a. \$24
b. \$32
c. \$40
d. \$42
e. none of the above

25. Determine $\sin \theta$.



a. $\frac{\sqrt{5}}{2}$

b. $\frac{1}{2}$

c. $\sqrt{5}$

d. $\frac{2}{5}$

e. none of the above

26. Evaluate $(5 \sin^2 \theta + 5 \cos^2 \theta)^2$.

a. 5

b. 100

c. 625

d. 25

e. none of the above

27. If $P = 2^{1988} + 2^{-1988}$ and $Q = 2^{1988} - 2^{-1988}$, compute $P^2 - Q^2$.

a. 0

b. 2

c. 4

d. 16

e. none of the above

28. Find all solutions of $|x - 4| + |x - 3| = 2$.

a. 4.5, 2.5

b. \emptyset

c. 4.5

d. -2.5

e. none of the above

29. What is the discriminant of $5x^2 + 8x = -2$?

a. $2\sqrt{6}$

b. $2\sqrt{26}$

c. 104

d. 24

e. none of the above

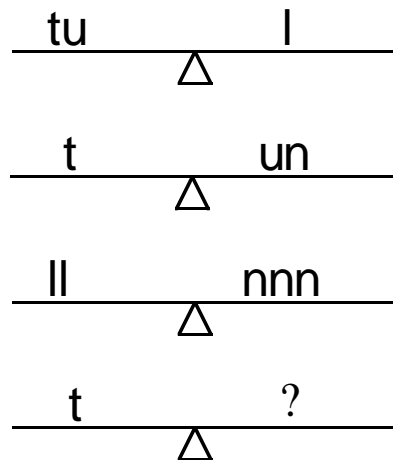
30. If i denotes the imaginary unit, compute the product $i \cdot i^2 \cdot i^3 \cdot i^4 \cdot i^5 \cdot i^6 \cdot \dots \cdot i^{98} \cdot i^{99} \cdot i^{100}$.

- a. 1
- b. -1
- c. i
- d. $-i$
- e. none of the above

31. A sphere and a right circular cylinder have the same volume. If both the height of the cylinder and the diameter of the sphere are $22\sqrt{6}$, what is the radius of the cylinder?

- a. 11
- b. $11\sqrt{6}$
- c. 22
- d. $44\sqrt{2}$
- e. none of the above

32. In the balance-scale pictures shown, how many **U** will replace the question mark?

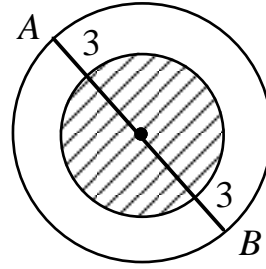


- a. 3
- b. 4
- c. 5
- d. 6
- e. none of the above

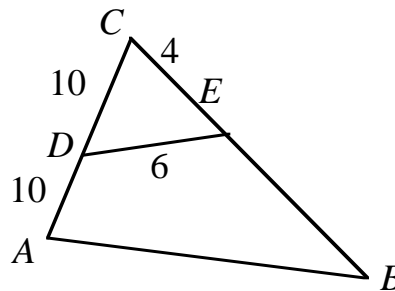
33. Find x if $\frac{55_{\text{ten}}}{101_{\text{two}}} = x_{\text{four}}$.

- a. 23
- b. 11
- c. 32
- d. 13.123
- e. none of the above

34. The two circles are concentric. The larger circle has area 169π . What is the radius of the smaller circle?

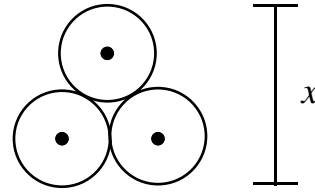


- a. 10
b. 13
c. 16
d. 20
e. none of the above
35. Find θ if $\sin^{-1}(\cos \theta^\circ) = 71^\circ$.
- a. 109
b. 19
c. 71
d. 289
e. none of the above
36. Suppose $3x^2 + 4x - 1 = 0$. If there exist numbers a and b such that $(x + a)^2 = b$, find $9(a - b)$.
- a. $-\frac{1}{9}$
b. -27
c. -1
d. -9
e. none of the above
37. Find $|AB|$ if $\triangle CDE \approx \triangle CBA$.



- a. 30
b. $\frac{40}{3}$
c. 12
d. 15
e. none of the above

38. These are three congruent circular disks of radius $\frac{16}{2 + \sqrt{3}}$. Determine their height, x .



- a. $64(2 - \sqrt{3})$
 c. 16
 e. none of the above

- b. $\frac{16}{7}$
 d. $40(2 - \sqrt{3})$

39. What will be the output of the program?

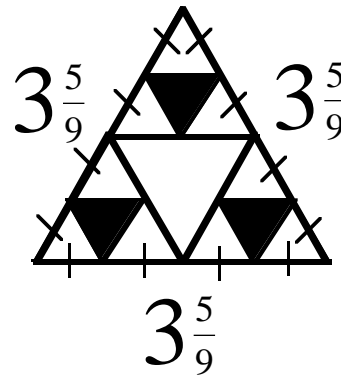
```

10 LET A = 20
20 LET B = A - 1
30 LET A = B
40 IF A < 10, GOTO 60
50 GOTO 20
60 PRINT A
70 END
  
```

- a. 9
 c. 19
 e. none of the above

- b. 10
 d. 20

40. Determine the sum of the perimeters of the shaded triangles.



- a. $\frac{2}{3}$
 c. $\frac{8}{3}$
 e. none of the above

- b. $\frac{8}{9}$
 d. 32

1995 Varsity Written Exam Answers

- | | | | |
|-----|--------------------------|-----|------------------------------------|
| 1. | C | 21. | B |
| 2. | C | 22. | C |
| 3. | D | 23. | B |
| 4. | B | 24. | C |
| 5. | C | 25. | E (correct answer: $2\sqrt{5/5}$) |
| 6. | D | 26. | D |
| 7. | E (correct answer: \$36) | 27. | C |
| 8. | B | 28. | A |
| 9. | C | 29. | D |
| 10. | C | 30. | B |
| 11. | D | 31. | C |
| 12. | B | 32. | C |
| 13. | D | 33. | A |
| 14. | A | 34. | A |
| 15. | E (correct answer: 120) | 35. | B |
| 16. | A | 36. | C |
| 17. | D | 37. | A |
| 18. | B | 38. | C |
| 19. | B | 39. | A |
| 20. | A | 40. | E (correct answer: 8) |