

**GEORGIA SOUTHERN UNIVERSITY  
INVITATIONAL MATHEMATICS TOURNAMENT  
1999 VARSITY WRITTEN EXAM**

Name\_\_\_\_\_

School\_\_\_\_\_

Directions:

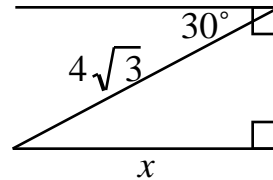
1. Do not open this test booklet until you are told to do so.
2. Use only a #2 lead pencil.
3. No calculators, slide rules, notes or other aids of any kind may be used.
4. Scratch paper is stapled to the back of the test booklet.
5. This is a 40 question multiple-choice exam. You will be allotted 90 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.

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1. Find the approximate value of  $\log_{11} 6$  given  $\log_{11} 3 = 0.4582$  and  $\log_{11} 2 = 0.2891$ .

- A. 0.7473                      B. 0.9164                      C. 0.8673  
D. 0.1325                      E. None of the above

2. In the figure given on the right, find  $x$ .



- A. 6                                  B.  $2\sqrt{3}$                       C. 4  
D. 8                                  E. None of the above

3. Given below is a computer program. What will be the output of the program after it has been executed.

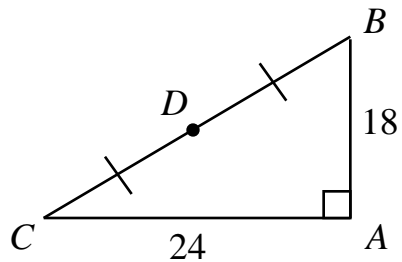
```
10 LET N=-1
20 M=N2+1
30 IF M>25, GOTO 60
40 N=N+1
50 GOTO 20
60 PRINT M
70 END
```

- A. 1                                  B. 25                              C. 26  
D. 0                                  E. None of the above

4. A safety label on a 20-foot extension ladder warns that the ladder is unsafe if the angle it makes with the ground exceeds 75 degrees. If a painter can reach 3 feet above the top of the ladder when it leans against the wall, what is the maximum height this ladder will allow the painter to reach? (Hint:  $\sin 75^\circ \approx 0.97$ ,  $\cos 75^\circ \approx 0.26$ )
- A. 19.4 ft                      B. 22.4 ft                      C. 24.6 ft  
 D. 26 ft                          E. none of the above

5. If  $\frac{4^x}{2^{x+y}} = 8$  and  $\frac{9^{x+y}}{3^{5y}} = 243$ ,  $x$  and  $y$  are real numbers, find  $xy$ .
- A.  $\frac{12}{5}$                               B. 4                              C. 6  
 D. 12                                E. -4

6. In the figure given on the right, find  $|AD|$ .



- A. 30                              B. 18                              C. 15  
 D. 21                              E. None of the above
7. A card is drawn from an ordinary deck of playing cards. What is the probability that it is a black jack?
- A.  $\frac{1}{52}$                               B.  $\frac{1}{13}$                               C.  $\frac{1}{2}$   
 D.  $\frac{1}{26}$                               E. None of the above







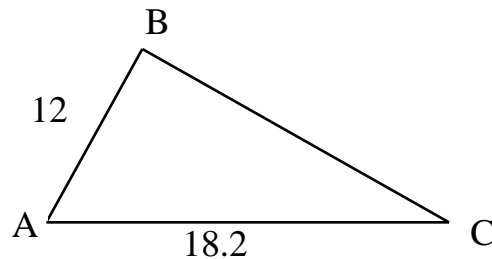
20. A triangle has sides with lengths 7, 13, 15. What is the altitude drawn to the smallest side?

- A.  $\frac{15\sqrt{3}}{26}$                       B.  $\frac{1}{26}$                       C.  $\frac{15\sqrt{3}}{2}$   
D.  $\frac{7\sqrt{3}}{4}$                       E. None of the above

21. The profit for a bicycle store can be represented by the equation  $P(x) = 200x - x^2$  where  $x$  is the number of bikes sold. What is the maximum profit the store can have?

- A. 100                      B. 0                      C. 200  
D. 1,000                      E. None of the above

22. If the area of  $\triangle ABC$  is 91, find the length of the altitude to side  $AC$ .



- A. 1                      B. 10                      C. 54.6  
D. 63.8                      E. None of the above

23. Solve for  $x$  if  $2\sin x = \sqrt{3}$  and  $0 < x < 360^\circ$ .

- A.  $30^\circ, 150^\circ$                       B.  $45^\circ, 135^\circ$   
C.  $60^\circ, 150^\circ$                       D.  $60^\circ, 120^\circ$   
E. None of the above



27. Find  $A$  if  $A = \begin{pmatrix} 2 & 3 & 1 & 0 \\ 4 & 5 & 0 & 1 \end{pmatrix}$ .

A.  $\begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$

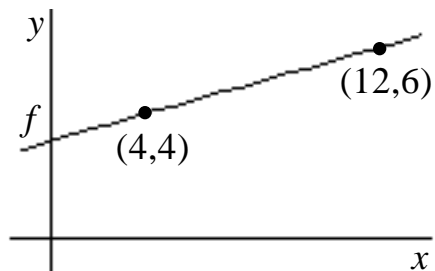
B.  $\begin{pmatrix} 2 & 0 \\ 0 & 5 \end{pmatrix}$

C.  $\begin{pmatrix} 5 & 0 \\ 0 & 9 \end{pmatrix}$

D.  $\begin{pmatrix} 5 & 3 \\ 4 & 2 \end{pmatrix}$

E. None of the above

28. In the figure given on the right, find  $f^{-1}(9)$ .



A. 20

B. 5.5

C. 24

D. 5.25

E. None of the above

29. If the interior angle of a regular polygon is  $135^\circ$ , how many sides does it have?

A. 10

B. 8

C. 16

D. 45

E. None of the above

30. If  $\sin x + \cos x = \frac{1}{5}$  and  $0 < x < \frac{\pi}{2}$ , find  $\tan x$ .

A.  $-\frac{4}{3}$

B.  $-\frac{3}{4}$

C.  $\frac{3}{4}$

D.  $\frac{4}{3}$

E. None of the above

31. Let  $\theta$  be an acute angle of a right triangle and  $\tan \theta = \frac{4}{3}$ .

Find  $\sec \theta$ .

A.  $\frac{4}{5}$

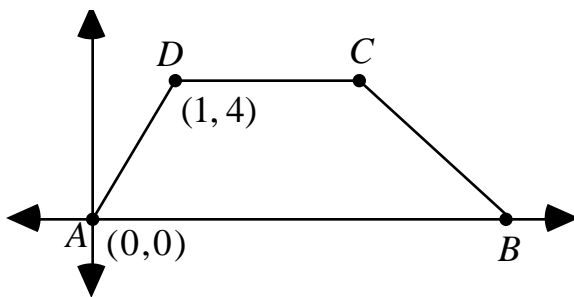
B.  $\frac{5}{3}$

C.  $\frac{5}{4}$

D.  $\frac{3}{5}$

E. None of the above

32. What is the slope of a line perpendicular to  $\overline{AD}$ ?



A. -4

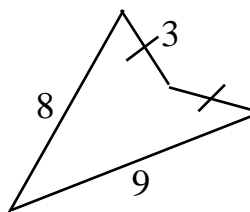
B.  $\frac{1}{4}$

C.  $4x$

D.  $-\frac{1}{4}x$

E. None of the above

33. What is the perimeter of this quadrilateral?



A. 20

B. 23

C. 17

D. 12

E. None of the above





## 1999 VARSITY WRITTEN EXAM ANSWERS

- |                                |                                 |
|--------------------------------|---------------------------------|
| 1. A                           | 2. A                            |
| 3. C                           | 4. B                            |
| 5. B                           | 6. C                            |
| 7. D                           | 8. A                            |
| 9. E (answer: $\frac{32}{3}$ ) | 10. D                           |
| 11. A                          | 12. E (answer: $\frac{3}{4}$ )  |
| 13. D                          | 14. B                           |
| 15. A                          | 16. B                           |
| 17. A                          | 18. D                           |
| 19. C                          | 20. C                           |
| 21. E (answer: 10,000)         | 22. B                           |
| 23. D                          | 24. A                           |
| 25. D                          | 26. C                           |
| 27. A                          | 28. C                           |
| 29. B                          | 30. A                           |
| 31. B                          | 32. E (answer: $-\frac{1}{4}$ ) |
| 33. B                          | 34. A                           |
| 35. D                          | 36. E (answer: 336)             |
| 37. B                          | 38. C                           |
| 39. D                          | 40. B                           |