

**GEORGIA SOUTHERN UNIVERSITY
INVITATIONAL MATHEMATICS TOURNAMENT
2003 JUNIOR 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. The 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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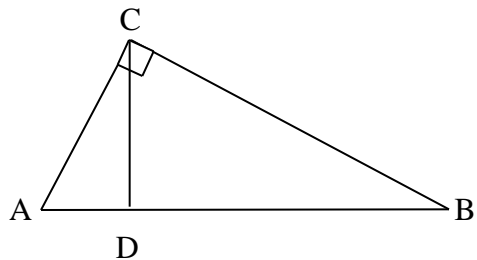
1. Old McDonald had some chickens and cows. If the 27 animals had a total of 70 legs, how many cows were on the farm?
 - (a) 8
 - (b) 9
 - (c) 12
 - (d) 14
 - (e) none of these

2. Find the equation of the parabola in the form $y = a(x - h)^2 + k$ with vertex (3, 2) and that passes through the point (2, 4).
 - (a) $y = -2(x + 2)^2 + 4$
 - (b) $y = -2(x - 2)^2 + 4$
 - (c) $y = 2(x + 3)^2 + 2$
 - (d) $y = 2(x - 3)^2 + 2$
 - (e) none of these

3. Rick is now three-fourths of his brother Ryan's age. In 14 years, he'll be five-sixths of his brother's age. Seven years ago, he was two-thirds of his brother's age. What is Rick's age now?
 - (a) 21
 - (b) 18
 - (c) 24
 - (d) 28
 - (e) none of these

4. What is the sum of all the divisors of 36, including 1 and itself?
 - (a) 37
 - (b) 91
 - (c) 55
 - (d) 73
 - (e) none of these

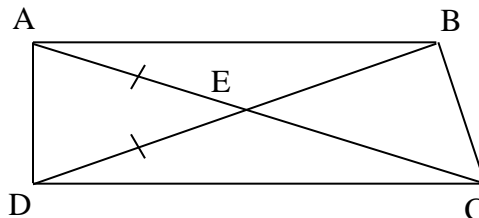
5. Shown is a right triangle ABC with altitude \overline{CD} .
If $AC = 13$ ft and $CD = 12$ ft find BD .



- (a) 31.2 ft
 (b) 28.8 ft
 (c) 17.7 ft
 (d) 25 ft
 (e) none of these
6. If $f(x) = \sqrt{x}$ and $g(x) = x^2 - 4$, find the domain of $f(g(x))$.

- (a) all real numbers
 (b) $x \geq -2$ or $x \geq 2$
 (c) $-2 \leq x \leq 2$
 (d) $x \geq 0$
 (e) none of these

7. $ABCD$ is a trapezoid with parallel sides \overline{AB} and \overline{DC} . Triangle AED is isosceles. \overline{AD} is perpendicular to \overline{AB} .
 $\angle ABC = 130^\circ$ and $\angle ADB = 75^\circ$. Find the degree measure of angle ACB .

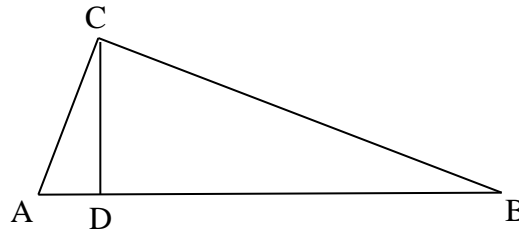


- (a) 20
 (b) 30
 (c) 35
 (d) 40
 (e) none of these
8. Solve for all values of x : $\sqrt{x-3} + 5 = x$.

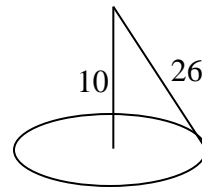
- (a) no solution
 (b) 4
 (c) 4 and 7
 (d) 7
 (e) none of these

9. The GSU Math Club is selling tee shirts for a fundraiser. The Tee Shirt Shack is charging a \$50 set-up fee and \$6.25 per shirt. The Math Club plans to sell their shirts for \$12 each. What is the least whole number of shirts that the club needs to sell in order to make a profit?
- (a) 5
 (b) 6
 (c) 7
 (d) 8
 (e) none of these

10. $\triangle ABC$ is shown with altitudes \overline{CD} and \overline{AC} . If $BC = 12$ cm, $AC = 9$ cm and $AB = 15$ cm, find CD .



- (a) 7.2 cm
 (b) 11.25 cm
 (c) 20 cm
 (d) 8 cm
 (e) none of these
11. A 26-foot string is attached to the top of a 10-foot, vertical flagpole. When the other end of the string is held taut to the ground, what is the area of the largest circle that can be drawn with the end of the string?



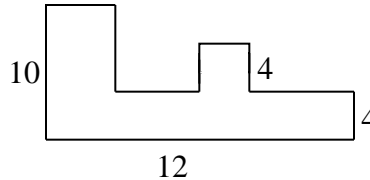
- (a) 676 square feet
 (b) 100 square feet
 (c) 576 square feet
 (d) 256 square feet
 (e) none of these
12. Margie has test grades of 82, 95, 84, and 80. Assuming that all tests are worth 100 points, what does she need to score on the next test so that her average will be 86%?
- (a) 85
 (b) 92
 (c) 86
 (d) 89
 (e) none of these

13. A certain stock is currently worth $35\frac{1}{8}$ dollars per share. Carmen has 16 shares and is planning to trade this stock to buy some that is worth $29\frac{3}{8}$ dollars per share.

What is the greatest number of whole shares she can buy?

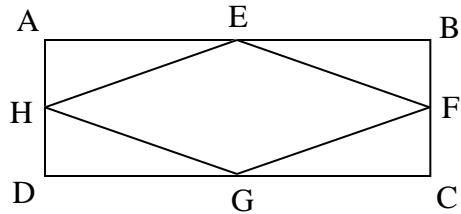
- (a) 16
(b) 19
(c) 20
(d) 18
(e) none of these
14. A baseball diamond is a square with sides of 90 feet with a base located at each corner. A sports announcer recently speculated that a baseball player could run around the four bases of a baseball diamond in 10 seconds. How fast is the player running? Give your answer in feet per second.
- (a) 9
(b) 36
(c) 18
(d) 27
(e) none of these

15. Determine the perimeter of the figure shown. All lengths are given in feet. Assume all lines are either parallel or perpendicular.



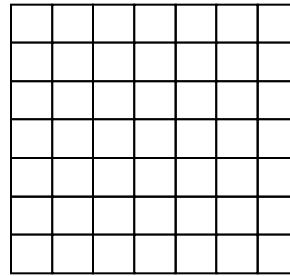
- (a) 44
(b) 48
(c) 50
(d) 52
(e) none of these
16. How many liters of a 70% alcohol solution should be mixed with 8 liters of a 40% alcohol solution to get a 50% alcohol solution?
- (a) 16
(b) 6
(c) 2
(d) 4
(e) none of these

17. ABCD is a rectangle with dimensions 10 inches by 4 inches. E, F, G, and H are the midpoints on each side of the rectangle. EFGH is a rhombus. Determine the area of EFGH.



- (a) 10 square inches
(b) 30 square inches
(c) 20 square inches
(d) 4 square inches
(e) none of these
18. A florist has corsage orders for a very large wedding party. Each of his assistants can make 3 corsages in 45 minutes. How many of his assistants are needed to make up 16 corsages in 2 hours?
- (a) 3
(b) 6
(c) 2
(d) 4
(e) none of these
19. If $f(x) = -x^2 + 2x$, find $f(x+h)$.
- (a) $-x^3 + 2xh - x^2h + 2xh$
(b) $-x^2 - 2xh - h^2 + 2x + 2h$
(c) $-x^2 - h^2 + 2x + 2h$
(d) $-x^2 + 2x + h$
(e) none of these
20. Find the distance on a number line between the two solutions of $x^2 + 3x - 4 = 0$.
- (a) 3
(b) 4
(c) 1
(d) $\sqrt{17}$
(e) none of these

21. Find the total number of squares in the figure shown at the right.



- (a) 49
(b) 70
(c) 140
(d) 280
(e) none of these
22. Biologists have found that the number of chirps crickets of a certain species make per minute is related to the temperature. The relationship is very close to being linear. At 68° F those crickets chirp about 124 times per minute. At 80° F they chirp about 172 times per minute. Find the linear equation relating Fahrenheit temperature (x) and the number of chirps (y).
- (a) $y = 4x - 148$
(b) $y = -4x + 148$
(c) $y = -4x + 252$
(d) $y = 4x - 252$
(e) none of these
23. Which number is different from the others?
- (a) $3^2 \cdot 2^3 \cdot 5 \cdot 15$
(b) $3^3 \cdot 2^2 \cdot 5 \cdot 10$
(c) $3^3 \cdot 2^3 \cdot 25$
(d) $3^2 \cdot 2^2 \cdot 10 \cdot 15$
(e) These are all equal
24. Mr. James buys 12 bales of hay. He sells each bale of hay for \$1.75 more than his purchase price. If his total revenue from selling all the bales of hay is \$102, find the total amount he originally paid for the hay.
- (a) \$60
(b) \$81
(c) \$21
(d) \$51
(e) none of these

25. The salary for the President of the United States is \$400,000 per year. Suppose a sales person makes \$13,000. How many years would the sales person have to work to make as much money as the President earns in one year?

- (a) about 31
- (b) less than 4
- (c) more than 35
- (d) between 29 and 30
- (e) about 34

26. How many multiples of 7 are between 100 and 500?

- (a) 71
- (b) 67
- (c) 57
- (d) 61
- (e) none of these

27. Simplify the given complex fraction. Express the answer as a common fraction.

$$\frac{\frac{3}{3}}{1 + \frac{\frac{3}{3}}{1 + \frac{3}{1+3}}}$$

- (a) $\frac{21}{19}$
- (b) $\frac{3}{2}$
- (c) $\frac{19}{24}$
- (d) $\frac{18}{17}$
- (e) none of these

28. At a local high school, 45 students are on the football roster and 28 students are on the baseball roster. When both teams assembled for a sports photo, there were 67 students altogether with everyone in attendance from both teams. How many students play both football and baseball?

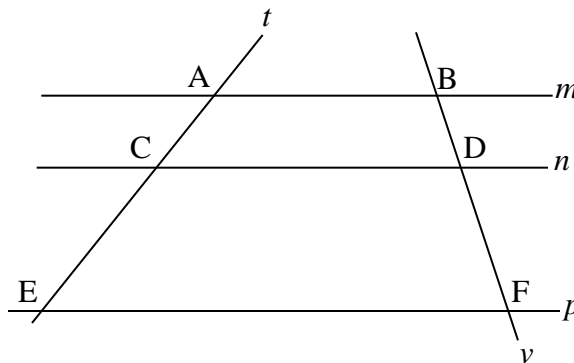
- (a) 12
- (b) 4
- (c) 17
- (d) 5
- (e) none of these

29. Jack runs up the hill to fetch a pail of water at 3 miles per hour. Coming down, even burdened with the pail of water, he runs at 6 miles per hour. The hill is 3 miles long from the bottom of the hill to the well. What is Jack's average speed in miles per hour?
- (a) 3.75
 - (b) 5
 - (c) 4
 - (d) 4.5
 - (e) none of these
30. Mary's sink with a leaky faucet will fill with the drain closed in 7 hours. The sink has a capacity of 3 gallons. Mary had 1 gallon of water in the sink with the drain closed when she left the sink unattended. How long will it be until the water in the sink runs over?
- (a) $2\frac{1}{3}$ hours
 - (b) $3\frac{1}{2}$ hours
 - (c) $2\frac{1}{10}$ hours
 - (d) $4\frac{2}{3}$ hours
 - (e) none of these
31. A certain number is divided by one-half and then 23 is added to that quotient. If the result is 38, what is the original number?
- (a) 15
 - (b) 10.5
 - (c) 7.5
 - (d) 30
 - (e) none of these
32. Find two points on the line $y = x + 1$ whose distance is $\sqrt{5}$ units from the point $(0, 4)$.
- (a) $(1, 2)$ and $(2, 3)$
 - (b) $(-4, -3)$ and $(-3, -2)$
 - (c) $(4, 5)$ and $(-1, 0)$
 - (d) $(-1, 2)$ and $(2, 5)$
 - (e) none of these

33. A diagonal in a convex polygon is any line segment that connects two non-adjacent vertices. How many different diagonals can be found in a convex hexagon?
- (a) 18
 - (b) 6
 - (c) 12
 - (d) 9
 - (e) none of these

34. Find the sum $3 + 5 + 7 + \dots + 97 + 99$.
- (a) 2499
 - (b) 4896
 - (c) 4692
 - (d) 2448
 - (e) none of these

35. Lines m , n and p are parallel lines with transversals t and v . If $BD = 2$, $BF = 7$, and $CE = 10$, find the measure of AC .



- (a) $\frac{20}{7}$
 - (b) 4
 - (c) 3.5
 - (d) 3
 - (e) none of these
36. A dozen peaches in a decorator basket sell for \$7.95. The peaches without the basket cost \$4.65 more than the basket, how much do the peaches cost?
- (a) \$1.65
 - (b) \$6.30
 - (c) \$3.30
 - (d) \$6.60
 - (e) none of these

37. Find k such that $3x^2 - 20x + k = 0$ has a solution of $x = 5$.
- (a) 25
 - (b) 125
 - (c) 50
 - (d) 15
 - (e) none of these
38. A right rectangular prism with dimensions 3 cm by 15 cm by 20 cm is full of water. If the water is poured into a right cylindrical can with radius 10 cm, how high will the water level be?
- (a) $\frac{9}{2}$ cm
 - (b) $\frac{9}{4}$ cm
 - (c) 9 cm
 - (d) $\frac{18}{5}$ cm
 - (e) none of these
39. In triangle MNP, $MN = MP$. The measure of angle P is 10 more than 3 times a number and the measure of angle N is 8 less than 5 times the same number. Find the measure of angle M. Assume all angle measures are in degrees.
- (a) 48°
 - (b) 106°
 - (c) 37°
 - (d) 116°
 - (e) none of these
40. The height S (in feet) of an object thrown vertically upward is given by $S(t) = -16t^2 + 80t$, where t is the number of seconds after the object is thrown. After how many seconds does the object reach its maximum height?
- (a) 2.5
 - (b) 5
 - (c) 7.5
 - (d) 10
 - (e) none of these

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SOLUTIONS

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