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First Round: February 25, 2017 at Regional Testing Centers Second Round: April 8, 2017 at The University of North Alabama

## GEOMETRY EXAMINATION

#### Construction of this test directed by Scott H. Brown and Luke A. Smith, Auburn University Montgomery

#### INSTRUCTIONS

This test consists of 50 multiple choice questions. The questions have not been arranged in order of di culty. For each question, choose the best of the ve answer choices labeled A, B, C, D and E.

The test will be scored as follows: 5 points for each correct answer, 1 point for each question left unanswered and 0 points for each wrong answer. (Thus a \perfect paper" with all questions answered correctly earns a score of 250, a blank paper earns a score of 50, and a paper with all questions answered incorrectly earns a score of 0.)

Random guessing will not, on average, either increase or decrease your score. However, if you can eliminate

### Why Major in Mathematics?

What sorts of jobs can I get with a mathematics degree? Examples of occupational opportunities available to math majors:

Market Research Analyst	Cryptanalyst	Mathematician
Air Tra c Controller	Professor	Meteorologist
Climate Analyst	Pollster	Medical Doctor
Estimator	Population Ecologist	Lawyer
Research Scientist	Operations Research	Actuary
Computer Programmer	Data Mining	Statistician

Where can I work? What sorts of companies hire mathematicians? Well just to name a few...

**U.S. Government Agencies** such as the National Center for Computing Sciences, the National Institute of Standards and Technology (NIST), the National Security Agency (NSA), and the U.S. Department of Energy.

**Government labs and research o** ces such as Air Force O ce of Scienti c Research, Los Alamos National Laboratory, and Sandia National Laboratory.

Engineering research organizations such as AT&T Laboratories - Research, Exxon Research and

13.	In the right triangle 4ABC shown, D is on $\overline{AC}$ , $m \setminus BAD = 30$ , $m \setminus BDC = 60$ and $AD = 4$ . Find BC. (A) 2 (B) $2^{D}\overline{2}$ (C) $3^{D}\overline{2}$ (D) $2^{D}\overline{3}$ (E) None of these
14.	The point (2;1) is rejected about the line $y = 2x$ . What are the coordinates of the resulting point?
	(A) (0:5;2) (B) (0:3;2:1) (C) (0:2;2:8) (D) (0:4;2:2) (E) None of these
15.	Which of the following statements is false?
	<ul><li>(A) A parallelogram is a trapezoid.</li><li>(B) A square is a parallelogram.</li></ul>
	(C) A kite is a quadrilateral.(D) A rectangle is a parallelogram.(E) Some rhombi are rectangles.
16.	A circle and a parabola are drawn on a piece of paper. What is the maximum number of regions they divide the paper into?
	(A) 2 (B) 4 (C) 6 (D) 8 (E) None of these=11
17.	Triangle $4ABC$ is shown divided into three isosceles triangles, $4BCD$ , 4CDE and $4DEA$ . Given that $BC = CD$ , $CD = DE$ , $DE = EAand m \setminus A = 20, nd m \setminus B.$
	(A) 20 (B) 40 (C) 60 (D) 80 (E) None of these
18.	A segment has one endpoint of $(3,4)$ and a midpoint of $(2,3)$ . What are the coordinates of other endpoint?

- (A) (7;2) (B)  $\frac{1}{2};\frac{7}{2}$  (C) (4;3) (D)  $2;\frac{11}{2}$  (E) None of these
- 19. In the following diagram, parallel lines ` and *m* are cut by two perpendicular)♠) 20B

**23.** Two circles of radii 2 and 3 are externally tangent. A third circle is circumscribed about the two smaller circles. A pin is dropped inside the largest circle. What

**33.** One rainy afternoon, you decide you want to start a craft project: make the Deathly Hallows (pictured) out of metal wire. The Deathly Hallows consists of a circle inscribed in an equilateral triangle with a single altitude. If you want a side of the triangle to be 2 inches, how much wire will it take to make the Deathly Hallows, in inches?





**34.** A line containing points (2;1) and (8;m) is parallel to the line containing points (7; m + 1) and (11;1). Find the value of m

**41.** Amelia's front yard, which measures 20 feet wide by 10 feet long, is to have two diagonal concrete sidewalks put in, as shown below. If the sidewalks measure 2 feet along the side of the yard, how much of Amelia's yard will not be concrete?



- (A)  $50 \text{ ft}^2$ (B)  $125 \text{ ft}^2$ (C)  $200 8^{2} \overline{29} \text{ ft}^2$ (D)  $200 20^{2} \overline{5} \text{ ft}^2$ (E) None of these
- **42.** A regular square pyramid has height  $\frac{p_{\overline{15}}}{15}$  with the area of a triangular face equal to 10. Find the surface area of the pyramid.
- (A)  $40 + \frac{p_{\overline{15}}}{15}$  (B)  $40 + 2^{\overline{15}}$  (C)  $\overline{60}$  (D) 120 (E) None of these 43. In 4ABC shown, D is the midpoint of  $\overline{AB}$  and E is the midpoint of  $\overline{AC}$ . If  $-\frac{4}{10}$ 
  - 3. In *4ABC* shown, *D* is the midpoint of *AB* and *E* is the midpoint of *AC*. If BC = 7x + 1 and DE = 4x 2, then ind the length *BC*.

- 44. If 5 and 9 are two sides of a right triangle, which of the following could be the third side?
  - (A)  $\frac{\rho_{\overline{24}}}{24}$  (B) 5 (C) 7 (D)  $\frac{\rho_{\overline{56}}}{56}$  (E) None of these
- **45.** In *4ABC* shown,  $\ACB$  and  $\BED$  are right angles,  $m\EAD = 25$  and  $m\BDC = 40$ . If BC = 4, and ED.
  - (A)  $\left| \frac{4\sin 15}{\sin 40} \right|$  (B)  $\frac{4\sin 75}{\sin 50}$  (C)  $\frac{\sin 40}{4\sin 15}$  (D)  $\frac{\sin 50}{4\sin 75}$  (E) 2
- **46.** In *4ABC* with right angle at *C*, altitude  $\overline{CH}$  and median  $\overline{CM}$  trisect the right angle. If the area of *4CHM* is *K*, then the area of *4ABC* is:
  - (A) 6K (B)  $4^{\rho}\overline{3}K$  (C)  $3^{\rho}\overline{3}K$  (D) 3K (E) 4K
- **47.** Points *A*, *B*, *C*, *D* and *E* are drawn on a circle and connected to form a ve pointed star. Find the value of  $m \setminus A + m \setminus B + m \setminus C + m \setminus D + m \setminus E$ .

(A) 120 (B) 180 (C) 240 (D) 360 (E) None of these

**48.** In *4ABC* with right angle at *C*, midpoints *D* and *E* lie along  $\overline{AC}$  and  $\overline{BC}$ , respectively. If AC = 6 and BC = 8, nd the height of trapezoid *ABED*.

(A) 2.4 (B) 3.5 (C) 
$$p_{\overline{5}}$$
 (D)  $p_{\overline{7}}$ 

- **49.** ABCD is a square with side of length 1. Points *E* and *F* are taken respectively on sides  $\overline{AB}$  and  $\overline{AD}$  so that AE = AF and the quadrilateral *CDFE* has maximum area. What is the maximum area of *CDFE*?
  - (A)  $\frac{5}{8}$  (B)  $\frac{23}{32}$  (C)  $\frac{7}{8}$  (D)  $\frac{9}{10}$  (E) None of these
- **50.** The angles of a convex, irregular pentagon form an arithmetic sequence. If all angles have integer measure, what is the largest measure that the smallest angle can have in degrees?
  - (A) 100 (B) 106 (C) 107 (D) 110 (E) None of these=108







(E) None of these