

# A

First Round: February 27, 2016 at Regional Testing Centers  
Second Round: April 9, 2016 at The University of North Alabama

## COMPREHENSIVE EXAM

Construction of this test directed  
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### INSTRUCTIONS

This test consists of 50 multiple choice questions. The questions have not been arranged in order of difficulty.

## 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 Traffic 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 offices** such as Air Force Office of Scientific Research, Los Alamos National Laboratory, and Sandia National Laboratory.

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



12. Two tangents to the same circle form a  $50^\circ$  angle. The radius of the circle is 10. Find the length of the smaller of the intercepted arcs.

(A)  $\frac{65}{9}$

(B)  $\frac{40}{9}$

(C)  $\frac{25}{9}$

(D)  $\frac{10}{9}$

(E) None of these

13.



31. In the figure shown, the line  $y = x + 1$  intersects the parabola  $y = x^2 - 3x + 4$  at points  $P$  and  $Q$ . What are the coordinates of point  $Q$ ?

- (A)  $(-1; 0)$  (B)  $(4; 0)$  (C)  $(4; 5)$  (D)  $(5; 6)$  (E) None of these



32. Find the number of distinct solutions to the equation  $\sqrt[3]{5x} = \sqrt{2x}$ :

- (A) 0 (B) 1 (C) 2 (D) 3 (E) None of these

33. A box contains four fair coins and six biased coins. Whenever a fair coin is flipped, it lands with heads facing up with a probability of 0.5. Whenever a biased coin is flipped it lands with heads facing up with a probability of 0.9. A coin is randomly chosen from the box and flipped. What is the probability that it will land with heads facing up?

- (A) 0.74 (B) 0.70 (C) 0.50 (D) 0.45 (E) None of these

34. The smallest angle of a rhombus is one-half the measure of the larger angle. The shorter diagonal is 20 m. Find the perimeter of the rhombus.

- (A) 40 m (B) 60 m (C) 80 m (D) 100 m (E) None of these

35. Find the sum of all solutions to the equation  $e^{2x} - 5e^x = 6$ .

- (A) 5 (B)  $\ln 5$  (C) 6 (D)  $\ln 6$  (E) None of these

36. How many solutions are there to the equation  $\cos(4x) = 2$  for  $x$  in  $[0; 2\pi]$ ?

- (A) 1 (B) 2 (C) 4 (D) 8 (E) None of these (0)

37. Clara is on a bike ride. If she bikes uphill 4 miles at a rate of 16.3391 SQ/F16 9.9626 Tf 77.286 311.191 Td [

41. Quadrilateral  $ABCD$  is inscribed in a circle with  $m\angle C = 85^\circ$ . Find  $m\angle A$ .

(A) 85

(B)  95

(C) 105

(D) 115

(E) Not enough information