

### Junior-Senior Individual Test

**Directions:** Please answer all questions on the answer sheet provided. All answers must be written legibly in the correct blanks on the answer sheet and in simplest form. **Exact** answers are to be given unless otherwise specified in the question. No units of measurement are required. Each problem has the same point-value.

1. Find the sum of all distinct values of  $x$  such that  $\left[\log_k(x^2)\right](\log_{12} k) = 2$ .
2. Let  $i = \sqrt{-1}$ . Then  $-2i^2 + (\sqrt{-4})(\sqrt{4}) - (\sqrt{-3})(\sqrt{-3}) - 2i^5 = a + bi$ , where  $a$  and  $b$  are real numbers. Find

the value of  $(3a + 2b)$ .

3. If  $x$  is an integer, find the sum of all distinct values of  $x$  such that  $\frac{x-4}{x-9} - 3 \geq 0$ .

4. In the diagram,  $A$ ,  $B$ , and  $D$  lie on the circle with center  $O$ .



10. Find the value of  $\log_{27} \left( 9 \left( \frac{1}{27} \right)^{-2} \right)$ . Give your answer as a fully reduced **improper** fraction.
11. Find the eighth term of an arithmetic progression whose first term is 3 and whose 31<sup>st</sup> term is 73. Give your answer as a fully reduced **improper** fraction.
12. Suppose that  $\frac{8!}{3!k!} = 56$ . Find the value of  $k$ .
13. When 1, 2, 3, 4, and 5 are substituted for  $x$  in a polynomial expression for  $x$ , the results are, respectively, \_\_\_\_\_

Name: \_\_\_\_\_

Team Code: \_\_\_\_\_

**2014 John O'Bryan Mathematical Competition  
Junior/Senior Individual Test**

~~Note: All answers must be written legibly in the correct blanks on the answer sheet and in student files.~~

Exact answers are to be given unless otherwise specified in the question. No units of measurement are required. Each problem has the same point-value.

1. \_\_\_\_\_

11. \_\_\_\_\_

Name: ANSWERS

Team Code: \_\_\_\_\_

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