2016 John O'Bryan Mathematical Competition
### Junior-Senior Individual Test

Directions: Please answer all questions on the answer sheet provided. All answers must be written legibly and in simplest form. Exact answers are to be given unless otherwise specified in the question. No units of

1. Find the **exact** distance between the centers of the two circles whose respective equations are $x^2 - 8x + y^2 + 6y = -16$ and $(x+5)^2 + (y-1)^2 = 81$.

2. Let $i = \sqrt{-1}$ and let r represent a real number. If $r - 5i + x = -7 + 2i$ is solved for x, then $x = -10 + 7i$. Find the value of r.

3. Given the arithmetic sequence $-10, -9, -8, ..., 10$, find the **sum** of all distinct members k of that arithmetic sequence for which $0.5^k < 0.49$.

11. In $\triangle XYZ$ with right angle at Z, $\dfrac{XZ}{YX} = \dfrac{9}{41}$. Find $\sin(\angle YXZ)$. Express your answer as a **common fraction** reduced to lowest terms.

$\overline{AF}$ than $\overline{FB}$?
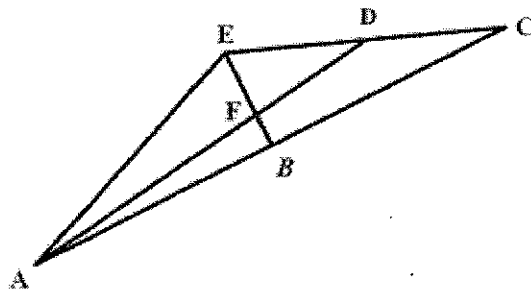
13. Let n represent a positive integer such that $0 < n < 92$. If $n!$ is an integral multiple of 11, find the **sum** of all possible distinct values of n.

14. In a finite geometric sequence, the last term is 1458, the common ratio is 3, and the sum of the terms is

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1. _____ $\sqrt{97}$ Must be this exact answer

11. _____ $\dfrac{40}{41}$ Must be this fraction

2. _____ **3**

12. _____ **7**

3. _____ **54**

13. _____ **4131**

4. _____ $\dfrac{1}{50}$ Must be this fraction.

14. _____ **-6**

5. _____ $\dfrac{1}{2}$ Must be this fraction.

15. _____ **0.01796** Must be this decimal

6. _____ **40** Degrees Optional

16. _____ $\dfrac{24}{143}$ Must be this fraction