PHILADELPHIA UNIVERSITY

DEPARTMENT OF BASIC SCIENCES

Exam 1 **Problem Solving** 19–11–2014

1. How many terminating zeros does the number 2015! have?

2. Find the following sum with proof. Express your answer as a single fraction $\frac{f(n)}{g(n)}$.

$$\frac{1}{1\cdot 4} + \frac{1}{2\cdot 5} + \frac{1}{3\cdot 6} + \cdots \frac{1}{(n-2)(n+1)}$$

3. Given that

$$1 + 2 + 3 + \cdots + n = \frac{n(n+1)}{2}$$
$$1^2 + 2^2 + 3^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

Derive the formula for the sum $1^3 + 2^3 + 3^3 + \cdots + n^3$.

4. Write the identity for the following pattern and prove it using induction.

$$1^3 = 1^2$$
$$1^3 + 2^3 = (1+2)^2$$
$$1^3 + 2^3 + 3^3 = (1+2+3)^2$$
$$1^3 + 2^3 + 3^3 + 4^3 = (1+2+3+4)^2$$
$$\cdots = \cdots$$

–Amin Witno