# Math 142
# Test #2
# Spring 2024
# (Proof Portion)

***Prove any three of the following four statements. Your choice!***

***Circle the 3 proofs you would like me to grade.***

***Should you wish, *star* the 4th proof of your choice for me to grade as extra credit.***

Use the given method where indicated. (Each proof is worth 5 points).

1. Prove:

If m is even, then $m^3 + 2m$ is divisible by 4.

**Test Hypothesis:**

**Proof:**

2. Prove using ***an indirect proof:***

If $n^3$ is even, then $n$ is even.

[HINT: Remember that $(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$]

**Test Hypothesis:**

**Proof:**

3. Prove for any integer, $x^2 + x$ is always even. [**HINT:** Use two cases for x].

**Test Hypothesis:**

**Proof:**

4. Using induction, prove that:

$$1 + 3 + 6 + 10 + \cdots \ldots \ldots \ldots \frac{n(n+1)}{2} = \frac{n(n+1)(n+2)}{6}$$

**Test Hypothesis:**

**Proof using Induction:**