

**Math 142
Test #2
Spring 2022
(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:

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

Test Hypothesis:

Proof using Induction: