MATH 1210 A01 Summer 2013 Problem Workshop 1

Use mathematical to prove the following:

1. For $n \geq 1$,
$$2 + 5 + 8 + \cdots + (3n - 1) = \frac{3n^2 + n}{2}.$$

2. 6 divides $n^3 + 9n^2 + 26n + 24$ for all $n \geq 1$.

3. For $n \geq 1$,
$$1(3) + 2(3^2) + \cdots + n(3^n) = \frac{1}{4}\Big((2n - 1)3^{n+1} + 3\Big)$$

4. For $n \geq 1$,
$$1^2 + 2^2 + 3^2 + \cdots + (3n)^2 = \frac{1}{2}n(3n + 1)(6n + 1).$$

5. Use mathematical induction to prove that for $n \geq 1$,
$$(2n + 1) + (2n + 3) + (2n + 5) + \cdots + (4n + 1) = 3n^2 + 4n + 1.$$

6. For $n \geq 1$,
$$a^{n+1} - 1 = (a - 1)(a^n + a^{n-1} + \cdots + a + 1).$$