Proofs of summation formulas

Name: _____ Date: _____

6 questions | 36 marks

1. Prove $1+2+\cdots+n=\frac{n(n+1)}{2}$ for all integers $n \geq 1$. [6 marks]

(a) Verify the first case and state the induction hypothesis. [2 marks]

(b) Prove the next case and conclude. [4 marks]

2. Prove $1+3+\cdots+(2n-1)=n^2$ for all integers $n \geq 1$. [6 marks]

(a) Verify the first case and state the induction hypothesis. [2 marks]

(b) Prove the next case and conclude. [4 marks]

3. Prove $\sum_{r=1}^{n} r^2 = \frac{n(n+1)(2n+1)}{6}$ for all integers $n \geq 1$. [6 marks]

(a) Verify the first case and state the induction hypothesis. [2 marks]

(b) Prove the next case and conclude. [4 marks]

4. Prove $\sum_{r=1}^{n} r^3 = [\frac{n(n+1)}{2}]^2$ for all integers $n \geq 1$. [6 marks]

(a) Verify the first case and state the induction hypothesis. [2 marks]

(b) Prove the next case and conclude. [4 marks]

5. Prove $\sum_{r=1}^{n} \frac{1}{r(r+1)} = \frac{n}{n+1}$ for all integers $n \geq 1$. [6 marks]

(a) Verify the first case and state the induction hypothesis. [2 marks]

(b) Prove the next case and conclude. [4 marks]

6. Prove $\sum_{r=1}^{n} r(r+1) = \frac{n(n+1)(n+2)}{3}$ for all integers $n \geq 1$. [6 marks]

(a) Verify the first case and state the induction hypothesis. [2 marks]

(b) Prove the next case and conclude. [4 marks]