**CSE230: Discrete Mathematics**  
Practice Sheet 2: **Proofs: Direct, Indirect, Contradiction, Induction**

| Q1 | Prove that,  For all integers n, if n3 + 5 is odd then n is even. |
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| Q2 | Prove the following:  Suppose a, b ∈ Z. If a + b ≥ 19, then a ≥ 10 or b ≥ 10. |
| Q3 | Prove the following:  Suppose a, b, and c are positive real numbers. If ab = c then a ≤ √c or  b ≤ √c. |
| Q4 | Prove the following:  The sum of a rational number and an irrational number is irrational. |
| Q5 | Prove the following:  Every nonzero rational number can be expressed as a product of two irrational numbers. |
| Q6 | Prove the following:  Suppose a,b,c ∈ Z. If a2 +b2 = c2, then a or b is even. |
| Q7 | Prove the following:  If a and b are positive real numbers, then . |
| Q8 | Prove by mathematical induction that if n is a positive integer then  13 + 23 + 33 + . . . + n3 = |
| Q9 | Prove by mathematical induction that if n is a positive integer then  (1 × 2) + (2 × 3) + (3 × 4) + . . . + (n × (n + 1)) = |
| Q10 | Prove by mathematical induction that  =  for all n ∈ N. |
| Q11 | Prove by mathematical induction that if n is a positive integer then  1 + 5 + 9 + 13 + . . . + (4n - 3) = |
| Q12 | Prove by mathematical induction that,  =  where n > 0 and n ∈ N. |
| Q13 | Prove by mathematical induction that,  =  where n > 0 and n ∈ N. |
| Q14 | Prove by mathematical induction that,  =  where n > 1 and n ∈ N. |
| Q15 | Prove by mathematical induction that,  =  where n > 0 and n ∈ N. |
| Q16 | Prove by mathematical induction that,  =  where n > 0 and n ∈ N. |
| Q17 | Prove by mathematical induction that,  =  where n > 0 and n ∈ N. |
| Q18 | Prove by mathematical induction that,  =  where n > 0 and n ∈ N. |
| Q19 | Prove by mathematical induction that,  =  where n > 0 and n ∈ N. |
| Q20  (updated) | Prove by mathematical induction that,  =  where n > 0 and n ∈ N. |
| Q21 | Prove by mathematical induction that,  where n > 0 and n ∈ N. |
| Q22 | Prove by mathematical induction that,  is divisible by 18  where n > 0 and n ∈ N. |
| Q23 | Prove by mathematical induction that,  is divisible by 9  where n > 0 and n ∈ N. |
| Q24 | Prove by mathematical induction that,  is divisible by 6  where n ∈ N. |
| Q25 | Prove by mathematical induction that,  is divisible by 8  where n ∈ N. |
| Q26 | Prove by mathematical induction that,  is divisible by 9  where n ∈ N. |
| Q27 | Prove by mathematical induction that,  is divisible by 4  where n ∈ N. |
| Q28 | Prove by mathematical induction that,  is divisible by 5  where n ∈ N. |
| Q29 | Prove by mathematical induction that,  is divisible by 4  where n ∈ N. |
| Q30 | Prove by mathematical induction that,  is divisible by 16  where n ∈ N. |
| Q31 | Prove by mathematical induction that,  the sum of the cubes of any three consecutive positive integers is always divisible by 9 . |
| Q32 | Prove by mathematical induction that,  is divisible by 7  where n>1 and n ∈ N. |
| Q33 | Prove by mathematical induction that,  is divisible by 4  where n>1 and n ∈ N. |
| Q34 | Prove by mathematical induction that,  is divisible by 5  where n>1 and n ∈ N. |
| Q35 | Prove by mathematical induction that,  is divisible by 12  where n ∈ N. |
| Q36 | Prove by mathematical induction that,  is divisible by 4  where n>1 and n ∈ N. |
| Q37 | Prove by mathematical induction that,  is divisible by 21  where n ∈ N. |
| Q38 | Prove by mathematical induction that,  is divisible by 8  where n ∈ N. |
| Q39 | Prove by mathematical induction that,  is divisible by 6  where n is a positive integer. |
| Q40 | Prove by mathematical induction that,  is divisible by 16  where n ∈ N. |