# 1.4 Proof & Reasoning

## Question Paper

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| Course | DP IB Maths |
| Section | 1. Number & Algebra |
| Topic | 1.4 Proof & Reasoning |
| Difficulty | Very Hard |

**Time allowed:** 60

**Score:** /44

**Percentage:** /100

## Question 1a

(a) (i) Prove that

$$\frac{a}{\left(\frac{b}{c}\right)} = \frac{ac}{b}$$

(ii) Specify any cases for which the relation in part (a)(i) is **not** valid.

**[3 marks]**

## Question 1b

(b) Prove that $(p-q)^2 = (q-p)^2$ for all numbers $p$ and $q$.

**[2 marks]**

## Question 2

Prove that the product of two odd numbers is odd.

**[4 marks]**

## Question 3

The sum of squares of two consecutive integers is 313. Find the possible values of the integers.

**[5 marks]**

## Question 4

Prove that the sum of the cubes of any two consecutive odd integers is divisible by four.

**[5 marks]**

### Question 5a

(a) Prove that $\frac{a^2-a-6}{a+4} \times \frac{a^2-16}{a^2+2a} = a - 7 + \frac{12}{a}$.

**[4 marks]**

### Question 5b

(b) State any values of $a$ for which this mathematical statement does **not** hold true.

**[1 mark]**

### Question 6

Prove that there are no integers $p$ and $q$ that satisfy the equation

$$4p^2 - q^2 = 49$$

**[4 marks]**

## Question 7

Prove the binomial coefficient identity

$$\binom{n}{k} = \binom{n-1}{k} + \binom{n-1}{k-1}.$$

**[8 marks]**

## Question 8

Prove that the sum of all integers between 600 and 1400 (inclusive) that are not divisible by 7 is equal to 685885.

**[8 marks]**