**1** **a** Prove by induction that for all positive integers *n*,  **(5 marks)**

**b** Hence deduce an expression, in terms of *n*, for  in the form an where *a*, *b* and *c* are rational numbers to be found. **(2 marks)**

**2** Prove by induction that for all positive integer *n*,  **(6 marks)**

**3** Prove by induction that for all positive integers *n*,  is divisible by 6 **(7 marks)**

**4** Prove by induction that for all positive integers *n*,  is divisible by 4 **(7 marks)**

**5** Prove by induction that for all positive integers *n*,  is divisible by 3 **(7 marks)**

**6** Prove by inducution that for all positive integers *n*, **(6 marks)**

**7 a** Prove by induction that for all positive integers *n*, **(7 marks)**

**b** Given that matrix   
Hence find an expression for  in terms of *n* **(3 marks)**