**Question 1**

In general, you should give your answers as fractions. Where you give an answer as a decimal, you should give it correct to four decimal places.

(a) In this part of the question, state which rule of probability you use for each calculation.

A standard pack of 52 playing cards is shuﬄed thoroughly and then cut. The pack is then shuﬄed and cut for a second time. Within the pack, a ‘picture’ card is deﬁned to be a card showing an ace, king, queen or jack (that is, not a card showing any of the numbers 2, 3,... , 10).

**(i)** Find the probability that the ﬁrst time the pack is cut, the card displayed is a picture card.

**(ii)** Find the probability that a picture card is displayed on both of the occasions that the pack is cut.

**(iii)** Find the probability that a picture card is displayed on at least one of the occasions that the pack is cut.

(b) In this part of the question, state which distribution you use.

Nicholas Bernoulli suggested that the births of boys and girls could be modelled by rolling a die with 35 faces, of which 18 represent a boy and 17 represent a girl.

**(i)** Find the probability that, according to this model, a couple who continue to have children until they have a boy will have precisely 5 children.

**(ii)** Find the probability that, according to this model, a couple who continue to have children until they have a boy will have more than 5 children.