# Probability 2

## Section 3.5 Probability involving permutations and combinations

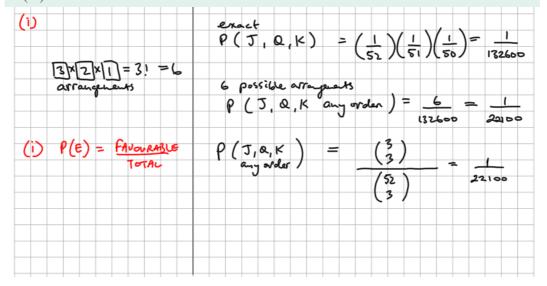




### Example 2

Three cards are drawn at random, and without replacement, from a pack of 52 playing cards. Find the probability that

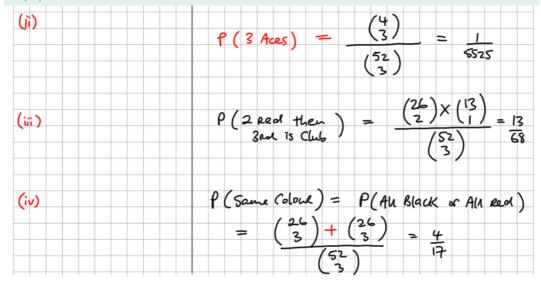
- (i) the three cards drawn are the Jack of spades, the Queen of clubs and the King of clubs
- (ii) the three cards are aces
- (iii) two cards are red and the third one is a club
- (iv) the three cards are of the same colour.



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#### **Events occurring at least once**

Many questions in probability contain phrases such as "at least once", "at least one red disc", etc. Take, for example, the probability of getting at least one 4 when a pair of dice are thrown.

First get the probability that no 4 is thrown.

$$P(\text{no 4}) = P(\text{no 4 on 1st throw}) \times P(\text{no 4 on 2nd throw}) = \frac{5}{6} \times \frac{5}{6} = \frac{25}{36}$$
  
 $P(\text{at least one 4}) = 1 - P(\text{no 4}) = 1 - \frac{25}{36} = \frac{11}{36}$ 

Similarly, if a coin is tossed four times, the probability of getting at least two heads is

$$P(\text{at least 2 heads}) = 1 - P(\text{no head}) - P(\text{1 head})$$

In general, if E is any event, then

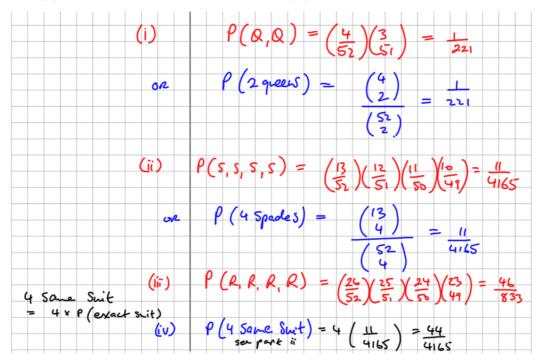
 $P(E ext{ occurring at least once}) = 1 - P(E ext{ not occurring at all})$ 

#### Exercise 3.5

- 1. A hand of four cards is dealt at random from a normal pack of 52 cards. Find the probability that the hand contains
  - (i) exactly two queens
- (ii) four spades

(iii) four red cards

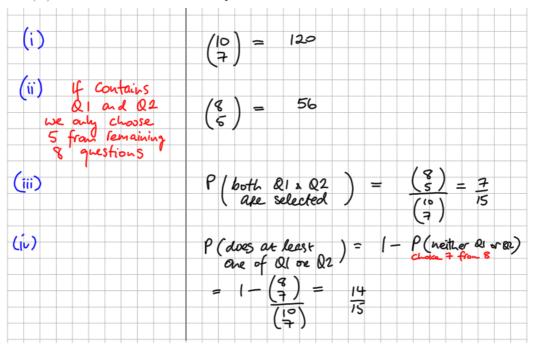
(iv) four cards of the same suit.



- **7.** In an examination a candidate is required to select any seven questions from ten.
  - (i) In how many ways can this be done?
  - (ii) How many of the selections contain the first and second questions?

Now calculate the probability that the candidate selects

- (iii) both the first and second questions
- (iv) at least one of the first two questions.



- **8.** A class of 16 pupils consists of 10 girls, 3 of whom are left-handed, and 6 boys, only one of whom is left-handed. Two pupils are to be chosen at random from the class to act as prefects. Calculate the probability that the chosen pupils will consist of
  - (i) one girl and one boy
  - (ii) one girl who is left-handed and one boy who is left-handed
  - (iii) two left-handed pupils
  - (iv) at least one pupil who is left-handed.

