

PROBABILITY

08 SEPTEMBER 2014



Lesson Description

In this lesson we:

- Look at the techniques used in solving probability problems:
 - Tree Diagrams, Venn Diagrams,
 - The Addition Rule for Mutually Exclusive Events: $P(A \text{ and } B) = P(A) + P(B)$
 - The Identity: $p(A \text{ or } B) = p(A) + P(B) - P(A \text{ and } B)$
 - The Product Rule for Independent Events: $(PA \text{ and } B) = P(A) \times P(B)$



Test Yourself

Question 1

(Adapted from Nov 2010, NSC, Paper 3, Question 1.1)

A school organised a camp for their 103 Grade 12 learners. The learners were asked to indicate their food preferences for the camp. They had to choose from chicken, vegetables and fish.

The following information was collected:

- 2 learners do not eat chicken, fish or vegetables
- 5 learners eat only vegetables
- 2 learners only eat chicken
- 21 learners do not eat fish
- 3 learners eat only fish
- 66 learners eat chicken and fish
- 75 learners eat vegetables and fish

Let the number of learners who eat chicken, vegetables and fish be x .

- 1.1 Draw an appropriate Venn diagram to represent the information. (7)
- 1.2 Calculate x . (2)
- 1.3 Calculate the probability that a learner, chosen at random:
 - 1.3.1 Eats only chicken and fish, and no vegetables. (2)
 - 1.3.2 Eats any TWO of the given food choices: chicken, vegetables and fish. (2)

Question 2

(Adapted from Aug 2011, St Mary's DSG Kloof, Paper 3, Question 2.1)

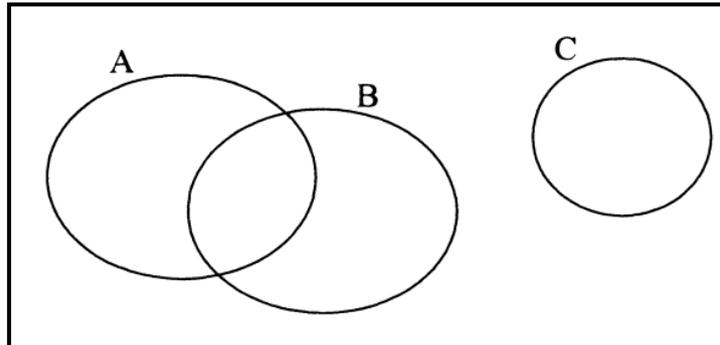
A smoke detector system in a large warehouse uses two devices, A and B. If smoke is present, the probability that it will be detected by device A is 0,95. The probability that it will be detected by device B is 0,98 and the probability that it will be detected by both devices simultaneously is 0,94.

- 2.1 If smoke is present, what is the probability that it will be detected by device A or device B or both devices? (3)
- 2.2 What is the probability that the smoke will not be detected? (1)

Question 3

(Adapted from Nov 2013, NSC, Paper 3, Question 3.1)

Consider events A, B and C represented in the Venn diagram below. Events A and B are independent.



It is given that $P(A) = 0,45$, $P(B) = 0,3$ and $P(C) = 0,32$.

- 3.1 Mary claims that events A and B are mutually exclusive. Explain why you agree or disagree with Mary. (2)
- 3.2 Calculate the probability that of the three events:
 - 3.2.1 At least one of B or C occurs. (2)
 - 3.2.2 At least one of A or B occurs/ (2)

Question 4

Each of the 200 employees of a company wrote a competency test. The results are indicated in the table below:

	PASS	FAIL	TOTAL
Males	46	32	78
Females	72	50	122
Total	118	82	200

- 4.1 Are the events PASS and FAIL mutually exclusive? Explain your answer. (2)
- 4.2 Is passing the competency test independent of gender? Substantiate your answer with the necessary calculations. (4)



Improve your Skills

Question 1

(Adapted from Nov 2012, NSC, Paper 3, Question 3.1)

During summer in a certain city in South Africa the probability of a sunny day is $\frac{4}{7}$ and the probability of a rainy day is $\frac{3}{7}$.

- If it is a sunny day, then the probability that Vusi cycles to work is $\frac{7}{10}$, the probability that Vusi drives to work is $\frac{1}{5}$ and the probability that Vusi takes the train to work is $\frac{1}{10}$.
- If it is a rainy day, then the probability that Vusi cycles to work is $\frac{1}{9}$, the probability that Vusi drives to work is $\frac{5}{9}$ and the probability that Vusi takes the train to work is $\frac{1}{3}$.

- 1.1 Draw a tree diagram to represent the above information. Indicate on your diagram the probabilities associated with each branch as well as all the outcomes. (5)
- 1.2 For a day selected at random, what is the probability that:
 - 1.2.1 It is rainy and Vusi will cycle to work (2)
 - 1.2.2 Vusi takes the train to work (3)
- 1.3 If Vusi works 245 days in a year, on approximately how many occasions does he drive to work? (4)

Question 2

(Adapted from Feb/Mar 2013, NSC, Paper 3, Question 6)

A survey is conducted among 174 students. The results are shown below.

- 37 study Life Sciences
 - 60 study Physical Sciences
 - 111 study Mathematics
 - 29 study Life Sciences and Mathematics
 - 50 study Mathematics and Physical Sciences
 - 13 study Physical Sciences and Life Sciences
 - 45 do not study any of Life Sciences, Mathematics or Physical Sciences
 - x students study Life Sciences, Mathematics and Physical Sciences
- 2.1 Draw a Venn diagram to represent the information above. (6)
 - 2.2 Show that $x = 13$. (3)
 - 2.3 If a student were selected at random, calculate the probability that he studies the following:
 - 2.3.1 Mathematics and Physical Sciences but not Life Sciences (2)
 - 2.3.2 Only one of Mathematics or Physical Sciences or Life Sciences (2)

Question 3

(Adapted from Feb/Mar 2011, NSC, Paper 3, Question 3.1)

The probability that it will rain on a given day is 63%. A child has a 12% chance of falling in dry weather and is three times as likely to fall in wet weather.

- 3.1 Draw a tree diagram to represent all outcomes of the above information. (6)
- 3.2 What is the probability that a child will not fall on any given day? (3)
- 3.3 What is the probability that a child will fall in dry weather? (2)

Question 4

The events A, B and C are such: A and B are independent, B and C are independent and A and C are mutually exclusive. Their probabilities are $P(A) = 0,3$, $P(B) = 0,4$ and $P(C) = 0.2$.

Calculate the probability of the following events occurring:

- 4.1 Both A and C occur. (2)
- 4.2 Both B and C occur. (2)
- 4.3 At least one of A or B occur. (4)