C33

Probability

CHAPTER ASSIGNMENT

Name _____ Class _____ No. _____ Date _____

> Answer every question in the space given. Give probabilities as fractions in their simplest form unless a question says otherwise.

Practice questions from *Cambridge IGCSE Mathematics Core and Extended* (4th edition), Chapter 33 (Probability), for classroom use. The Check yourself and Chapter quiz questions are Guru Jazzy's own. Where a question needs a picture, the data is given in words or a table, and the question says so.

Exercise 33.1 · The probability scale

33.1.1 Copy the probability scale (a line from 0 to 1 marked impossible, unlikely, evens, likely, certain, with 0, 1/2 and 1 shown). Mark on the probability scale the probability that: (a) a day chosen at random is a Saturday, (b) a coin will show tails when spun, (c) the sun will rise tomorrow, (d) a woman will run a marathon in two hours, (e) the next car you see will be silver.

33.1.2 Express your answers to Question 1 as fractions, decimals and percentages.

Exercise 33.2 · Theoretical probability

33.2.1 Calculate the theoretical probability, when rolling an ordinary fair dice, of getting each of the following: (a) a score of 1 · (b) a score of 2, 3, 4, 5 or 6 · (c) an odd number · (d) a score less than 6 · (e) a score of 7 · (f) a score less than 7

33.2.2 (a) Calculate the probability of: (i) being born on a Wednesday, (ii) not being born on a Wednesday. (b) Explain the result of adding the answers to a i and ii together.

33.2.3 250 balls are numbered from 1 to 250 and placed in a box. A ball is picked at random. Find the probability of picking a ball with: (a) the number 1 · (b) an even number · (c) a three-digit number · (d) a number less than 300

33.2.4 In a class there are 25 girls and 15 boys. The teacher takes in all of their books in a random order. Calculate the probability that the teacher will: (a) mark a book belonging to a girl first, (b) mark a book belonging to a boy first.

33.2.5 Tiles, each lettered with one different letter of the alphabet, are put into a bag. If one tile is taken out at random, calculate the probability that it is: (a) an A or P · (b) a vowel · (c) a consonant · (d) an X, Y or Z · (e) a letter in your first name.

33.2.6 A boy was late for school 5 times in the previous 30 school days. If tomorrow is a school day, calculate the probability that he will arrive late.

33.2.7 (a) Three red, 10 white, 5 blue and 2 green counters are put into a bag. If one is picked at random, calculate the probability that it is: (i) a green counter (ii) a blue counter. (b) If the first counter taken out is green and it is not put back into the bag, calculate the probability that the second counter picked is: (i) a green counter (ii) a red counter.

33.2.8 A circular spinner has the numbers 0 to 36 equally spaced around its edge. Assuming that it is unbiased, calculate the probability on spinning it of getting: (a) the number 5 · (b) not 5 · (c) an odd number · (d) zero · (e) a number greater than 15 · (f) a multiple of 3 · (g) a multiple of 3 or 5 · (h) a prime number.

33.2.9 The letters R, C and A can be combined in several different ways. (a) Write the letters in as many different orders as possible. If a computer writes these three letters at random, calculate the probability that: (b) the letters will be written in alphabetical order, (c) the letter R is written before both the letters A and C, (d) the letter C is written after the letter A, (e) the computer will spell the word CART if the letter T is added.

33.2.10 A normal pack of playing cards contains 52 cards. These are made up of four suits (hearts, diamonds, clubs and spades). Each suit consists of 13 cards. These are labelled Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen and King. The hearts and diamonds are red; the clubs and spades are black. If a card is picked at random from a normal pack of cards, calculate the probability of picking: (a) a heart · (b) not a heart · (c) a 4 · (d) a red King · (e) a Jack, Queen or King · (f) the Ace of spades · (g) an even-numbered card · (h) a 7 or a club.

Exercise 33.3 · Probability from tables and charts

33.3.1 A student conducts a survey on the types of vehicle that pass his house. The results are shown below.

A	B	C	D	E	F
Car	Lorry	Van	Bicycle	Motorbike	Other
28	6	20	48	32	6

(a) How many vehicles passed the student's house? (b) A vehicle is chosen at random from the results. Calculate the probability that it is: (i) a car (ii) a lorry (iii) not a van.

33.3.2 In a class, data is collected about whether each student is right-handed or left-handed. The results are shown below.

A	Left-handed	Right-handed
Boys	2	12
Girls	3	15

(a) How many students are in the class? (b) A student is chosen at random. Calculate the probability that the student is: (i) a girl (ii) left-handed (iii) a right-handed boy (iv) not a right-handed boy.

33.3.3 A library keeps a record of the books that are borrowed during one day. The results are shown in the bar chart in the book. The bar heights are given here as a table.

A	B	C	D	E	F	G
Romance	Thriller	Horror	Historical	Cookery	Biography	Other
12	22	8	6	10	4	8

(a) How many books were borrowed that day? (b) A book is chosen at random from the ones borrowed. Calculate the probability that it is: (i) a thriller (ii) a horror or a romance (iii) not a horror or romance (iv) not a biography.

Exercise 33.4 · Venn diagrams

33.4.1 In a class of 30 students, all students study at least one language, either Spanish (S) or Mandarin Chinese (M). 16 students study only Spanish and 8 students study only Mandarin. (a) Copy and complete the Venn diagram for the number of students studying each language. (Draw two overlapping circles S and M inside a rectangle ξ.) (b) If a pupil is chosen at random, calculate: (i) $P(S)$ (ii) $P(M)$ (iii) $P(S \cap M)$ (iv) $P(S \cup M)$

33.4.2 One hundred students take part in a school sports event. 70 students take part in track events (T), 62 students take part in field events (F) and 8 students take part in neither. (a) Construct a Venn diagram to show this information. (b) If a student is chosen at random, calculate: (i) $P(T)$ (ii) $P(T \cap F)$ (iii) $P(F')$ (iv) $P(T \cup F')$

33.4.3 Sixty students were asked where they had travelled to in the last twelve months. The three most popular destinations were Singapore (S), Dubai (D) and Great Britain (B). The number of students travelling to each destination is shown in the Venn diagram in the book. Its regions are given here in words: only S 18; S and D only 3; only D 14; S and B only 5; all three 2; D and B only 4; only B 12; none of the three 2. If a student is chosen at random, calculate the probability of the following: (a) P(S) (b) P(B ∩ D) (c) P(S ∪ D) (d) P(S ∩ D ∩ B) (e) P(B') (f) P(S ∩ B ∩ D')

33.4.4 Cards numbered 1–20 are arranged in three sets as follows: A = {multiples of 2}, B = {multiples of 3}, C = {multiples of 4}. (a) Copy and complete the Venn diagram. (In the book, C is a smaller circle inside A, and B overlaps both, all inside a rectangle ξ.) (b) If a number is chosen at random, calculate each of the following probabilities: (i) P(A) (ii) P(A ∩ B) (iii) P(B ∩ C) (iv) P(B ∪ C) (v) P(A ∪ B)' (vi) P(A ∪ B ∪ C')

Exercise 33.5 · Relative frequency

33.5.1 A boy calculates that he has a probability of 0.004 of winning the first prize in a photography competition if the selection is made at random. If 500 photographs are entered into the competition, how many photographs did the boy enter?

33.5.2 The probability of getting any particular number on a spinner game is given as 0.04. How many numbers are there on the spinner?

33.5.3 A bag contains 7 red counters, 5 blue, 3 green and 1 yellow. If one counter is drawn, what is the probability that it is: (a) yellow (b) red (c) blue or green (d) red, blue or green (e) not blue?

33.5.4 A boy collects marbles. He has the following colours in a bag: 28 red, 14 blue, 25 yellow, 17 green and 6 purple. If he draws one marble from the bag, what is the probability that it is: (a) red (b) blue (c) yellow or blue (d) purple (e) not purple?

33.5.5 The probability of a boy drawing a marble of one of the following colours from another bag of marbles is: blue 0.25, red 0.2, yellow 0.15, green 0.35, white 0.05. If there are 49 green marbles, how many of each other colour does he have in his bag?

33.5.6 There are six red sweets in a bag. If the probability of randomly picking a red sweet is 0.02, calculate the number of sweets in the bag.

33.5.7 The probability of getting a bad egg in a batch of 400 is 0.035. How many bad eggs are there likely to be in a batch?

33.5.8 A sports arena has 25 000 seats, some of which are VIP seats. For a charity event, all the seats are allocated randomly. The probability of getting a VIP seat is 0.008. How many VIP seats are there?

33.5.9 The probability of Juan's favourite football team winning 4–0 is 0.05. How many times are they likely to win by this score in a season of 40 matches?

Student assessment 1

SA1.1 What is the probability of throwing the following numbers with a fair dice? (a) a 2 · (b) not a 2 · (c) less than 5 · (d) a 7

SA1.2 If you have a normal pack of 52 cards, what is the probability of drawing: (a) a diamond · (b) a 6 · (c) a black card · (d) a picture card · (e) a card less than 5?

SA1.3 250 coins, one of which is gold, are placed in a bag. What is the probability of getting the gold coin if I take, without looking, the following numbers of coins? (a) 1 · (b) 5 · (c) 20 · (d) 75 · (e) 250

SA1.4 A bag contains 11 blue, 8 red, 6 white, 5 green and 10 yellow counters. If one counter is taken from the bag, what is the probability that it is: (a) blue (b) green (c) yellow (d) not red?

SA1.5 The probability of drawing a red, blue or green marble from a bag containing 320 marbles is: red 0.5, blue 0.3, green 0.2. How many marbles of each colour are there?

SA1.6 In a small town there are a number of sports clubs. The clubs have 750 members in total. The table below shows the types of sports club and the number of members each has.

A	Tennis	Football	Golf	Hockey	Athletics
Men	30	110	40	15	10
Women	15	25	20	45	30
Boys	10	200	5	10	40
Girls	20	35	0	30	60

A sports club member is chosen at random from the town. Calculate the probability that the member is: (a) a man (b) a girl (c) a woman who does athletics (d) a boy who plays football (e) not a boy who plays football (f) not a golf player (g) a male who plays hockey.

SA1.7 A dice is thought to be biased. In order to test it, a boy rolls it 12 times and gets the following results:

A	1	2	3	4	5	6
Frequency	2	2	2	2	2	2

A girl decides to test the same dice and rolls it 60 times. The table below shows her results:

A	1	2	3	4	5	6
Frequency	3	3	47	3	2	2

(a) Which results are likely to be more reliable? Justify your answer. (b) What conclusion can you make about whether the dice is biased?

SA1.8 In a school, students can study science as the individual subjects of Physics, Chemistry and Biology. Each student must study at least one of the subjects. The Venn diagram in the book gives the number of students studying each subject. Its regions are given here in words: only P 12; P and C only 14; only C 18; P and B only 15; all three 8; C and B only 9; only B 24. If a student is chosen at random, calculate each of the following probabilities: (a) P(C) (b) P(P ∩ B) (c) P(P ∩ C ∩ B) (d) P(B ∩ C ∩ P') (e) P(P ∪ C)

Student assessment 2

SA2.1 An octagonal spinner has the numbers 1 to 8 on it (in order, one number on each of its eight equal sections). What is the probability of spinning: (a) a 7 · (b) not a 7 · (c) a factor of 12 · (d) a 9?

SA2.2 A game requires the use of all the playing cards in a normal pack from 6 to King inclusive. (a) How many cards are used in the game? (b) What is the probability of choosing: (i) a 6 (ii) a picture (iii) a club (iv) a prime number (v) an 8 or a spade?

SA2.3 180 students in a school are offered a chance to attend a football match for free. If the students are chosen at random, what is the chance of being picked to go if the following numbers of tickets are available? (a) 1 · (b) 9 · (c) 15 · (d) 40 · (e) 180

SA2.4 A bag contains 11 white, 9 blue, 7 green and 5 red counters. What is the probability that a single counter drawn will be: (a) blue (b) red or green (c) not white?

SA2.5 The probability of drawing a red, blue or green marble from a bag containing 320 marbles is: red 0.4, blue 0.25, green 0.35. If there are no other colours in the bag, how many marbles of each colour are there?

SA2.6 Students in a class conduct a survey to see how many friends they have on Facebook. The results were grouped and are shown in the pie chart in the book, given here as a table.

A	B	C	D	E	F
None	1–100	101–200	201–300	301–400	More than 400
2	4	6	12	8	8

A student is chosen at random. What is the probability that she: (a) has 101–200 Facebook friends (b) uses Facebook (c) has more than 200 Facebook friends?

SA2.7 (a) If I enter a competition and have a 0.000 02 probability of winning, how many people entered the competition? (b) What assumption do you have to make in order to answer part a?

SA2.8 A large bag contains coloured discs. The discs are either completely red (R), completely yellow (Y) or half red and half yellow. The Venn diagram in the book shows the probability of picking each type of disc: only R 0.6, both R and Y 0.1, only Y 0.3. If there are 120 discs containing the colour yellow (either fully or partly), calculate: (a) the number of discs coloured completely red, (b) the total number of discs in the bag.

Check yourself

C1 A fair dice is rolled. Write the probability of getting a number greater than 4, then the probability of not getting a number greater than 4.

C2 A bag has 5 red, 3 blue and 2 yellow counters. One counter is taken out at random. Find the probability that it is (a) blue (b) not red (c) red or yellow.

C3 The probability that a train is late is 0.08. In 250 journeys, about how many trains are late?

C4 A drawing pin was dropped 80 times and landed point up 52 times. Find the relative frequency of landing point up, and say what you would do to make the estimate more reliable.

C5 Of 40 students, 18 play football (F), 14 play tennis (T) and 6 play both. Draw a Venn diagram, then find (a) $P(F \cap T)$ (b) $P(F \cup T)$ (c) P(neither).

Chapter quiz

Q1 A fair dice is rolled. What is the probability of getting a prime number?

A	B	C	D
1/3	1/2	2/3	5/6

Q2 The probability that it rains tomorrow is 0.35. What is the probability that it does not rain?

A	B	C	D
0.35	0.65	0.75	1.35

Q3 A bag holds 4 red, 6 blue and 10 green counters. What is P(not green)?

A	B	C	D
1/2	1/3	1/5	3/4

Q4 Cards are numbered 1 to 20. What is the probability of picking a multiple of 5?

A	B	C	D
1/5	1/4	1/20	4/5

Q5 A coin is spun 200 times and lands heads 94 times. What is the relative frequency of heads?

A	B	C	D
0.47	0.53	0.94	2.13

Q6 The probability that an egg is bad is 0.03. How many bad eggs are expected in 500 eggs?

A	B	C	D
3	15	30	150

Q7 Which of these numbers cannot be a probability?

A	B	C	D
0	0.5	1.2	1

Q8 In a Venn diagram, $n(\xi) = 30$, $n(A) = 12$, $n(B) = 9$ and $n(A \cap B) = 4$. What is $P(A \cup B)$?

A	B	C	D
17/30	21/30	25/30	4/30

Q9 How can you get a better estimate of a probability from an experiment?

A	B	C	D
Use more trials	Use fewer trials	Stop at the first success	Use a bigger dice

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Q10 The probability of picking a green counter is 0.2. There are 12 green counters. How many counters in total?

A	B	C	D
2.4	24	60	240

Q11 A group of 50 students has $n(A) = 20$ and $n(A \cap B) = 8$. What is $P(A \cap B)$?

A	B	C	D
8/20	4/25	2/5	28/50

Q12 A fair dice is rolled 60 times. About how many sixes should you expect?

A	B	C	D
6	10	12	36

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/o-level-mathematics/chapter-33-probability/