GCSE Foundation Mathematics
Practice Test 1: Probability

Instructions:
Answer all questions. Show your working clearly.
Calculators may be used unless stated otherwise.
Time allowed: 90 minutes

Section A: Basic Probability Concepts

1. State whether these events are certain, likely, even chance, unlikely, or impossible:

    (a) Getting heads when flipping a fair coin

    (b) Rolling a 7 on a standard six-sided die

    (c) It will rain sometime next year

    (d) Getting a number less than 10 when rolling a standard die

    (e) Choosing a red card from a standard pack of cards

    (f) The sun rising tomorrow

2. Express these probabilities as fractions, decimals, and percentages:

    (a) $P(\text{certain}) = 1$

    (b) $P(\text{impossible}) = 0$

    (c) $P(\text{even chance}) = 0.5$

    (d) $P(\text{very likely}) = 0.8$

    (e) $P(\text{unlikely}) = \frac{1}{5}$

3. Complete these probability statements:

    (a) All probabilities are between _____ and _____

    (b) If $P(A) = 0.3$, then $P(\text{not } A) =$ _____

    (c) If $P(B) = \frac{2}{7}$, then $P(\text{not } B) =$ _____

    (d) The sum of all probabilities in a sample space equals _____

4. A spinner has 5 equal sections numbered 1, 2, 3, 4, 5. Write down:

    (a) The sample space

    (b) $P(\text{spinning a 3})$

    (c) $P(\text{spinning an even number})$

    (d) $P(\text{spinning a number greater than 3})$

    (e) $P(\text{spinning a number less than 6})$

Section B: Single Event Probability

5. A fair six-sided die is rolled. Find the probability of rolling:

   (a) A 4
   (b) An odd number
   (c) A number greater than 4
   (d) A number less than or equal to 2
   (e) A multiple of 3
   (f) A number between 2 and 5 (inclusive)

6. A bag contains 8 red balls, 5 blue balls, and 3 green balls. A ball is drawn at random. Find the probability of drawing:

   (a) A red ball
   (b) A blue ball
   (c) A green ball
   (d) A red or blue ball
   (e) Not a green ball
   (f) Not a red ball

7. A standard pack of 52 playing cards is shuffled. Find the probability of drawing:

   (a) An ace
   (b) A heart
   (c) A red card
   (d) The king of spades
   (e) A picture card (Jack, Queen, King)
   (f) A black ace

8. The probability that Sarah passes her driving test is $\frac{3}{4}$. What is the probability that she fails?

9. In a class of 24 students, 15 are right-handed. If a student is chosen at random, find the probability they are:

   (a) Right-handed
   (b) Left-handed

Section C: Sample Spaces and Outcomes

10. A coin is flipped twice.

    (a) List all possible outcomes
    (b) How many outcomes are in the sample space?
    (c) Find $P(\text{two heads})$
    (d) Find $P(\text{at least one tail})$
    (e) Find $P(\text{exactly one head})$

11. Two fair dice are rolled and their scores are added.

    (a) Complete the sample space table showing all possible totals:

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3					
3	4					
4	5					
5	6					
6	7					

    (b) Find $P(\text{total} = 7)$

    (c) Find $P(\text{total} = 12)$

    (d) Find $P(\text{total} > 10)$

    (e) Find $P(\text{total is even})$

12. A spinner has 4 equal sections: Red (R), Blue (B), Green (G), Yellow (Y). The spinner is spun twice.

    (a) List all possible outcomes

    (b) Find $P(\text{both colours the same})$

    (c) Find $P(\text{at least one red})$

    (d) Find $P(\text{no blue})$

13. A bag contains counters numbered 1, 2, 3, 4. Two counters are drawn without replacement.

    (a) List all possible pairs

    (b) Find $P(\text{both numbers even})$

    (c) Find $P(\text{sum of numbers} = 5)$

    (d) Find $P(\text{first number} > \text{second number})$

Section D: Probability Rules

14. For mutually exclusive events A and B, where $P(A) = 0.3$ and $P(B) = 0.5$:

    (a) Find $P(A \text{ or } B)$

    (b) Find $P(\text{neither } A \text{ nor } B)$

    (c) What is $P(A \text{ and } B)$? Explain your answer.

15. A card is drawn from a standard pack. Let A = "drawing a heart" and B = "drawing a king".

    (a) Find $P(A)$

    (b) Find $P(B)$

    (c) Find $P(A \text{ and } B)$

    (d) Find $P(A \text{ or } B)$

    (e) Are events A and B mutually exclusive? Explain.

16. The probability of rain on Monday is 0.4. The probability of rain on Tuesday is 0.6. Assuming the events are independent:

    (a) Find the probability of rain on both days

    (b) Find the probability of no rain on either day

    (c) Find the probability of rain on at least one day

    (d) Find the probability of rain on exactly one day

17. A biased coin has $P(\text{heads}) = 0.6$. The coin is flipped three times.

   (a) Find $P(\text{three heads})$
   (b) Find $P(\text{three tails})$
   (c) Find $P(\text{at least one head})$
   (d) Find $P(\text{exactly two heads})$

Section E: Tree Diagrams

18. A bag contains 3 red balls and 2 blue balls. Two balls are drawn without replacement.

   (a) Draw a tree diagram showing all possibilities
   (b) Find $P(\text{two red balls})$
   (c) Find $P(\text{two blue balls})$
   (d) Find $P(\text{one red and one blue})$
   (e) Find $P(\text{at least one red ball})$

19. The probability that a student passes Math is 0.8 and passes English is 0.7. Assume the subjects are independent.

   (a) Draw a tree diagram
   (b) Find the probability of passing both subjects
   (c) Find the probability of failing both subjects
   (d) Find the probability of passing exactly one subject
   (e) Find the probability of passing at least one subject

20. A factory has two machines. Machine A works 90% of the time, Machine B works 85% of the time.

   (a) Draw a tree diagram
   (b) Find the probability both machines work
   (c) Find the probability exactly one machine works
   (d) Find the probability at least one machine works
   (e) Find the probability neither machine works

21. Box 1 contains 4 red and 6 white balls. Box 2 contains 7 red and 3 white balls. A box is chosen at random, then a ball is drawn from that box.

   (a) Draw a tree diagram
   (b) Find the probability of drawing a red ball
   (c) Find the probability of drawing a white ball
   (d) If a red ball is drawn, what is the probability it came from Box 1?

Section F: Conditional Probability

22. The two-way table shows information about students and their pets:

	Has pet	No pet	Total
Boys	15	25	40
Girls	20	20	40
Total	35	45	80

A student is chosen at random. Find:

(a) $P(\text{has pet})$

(b) $P(\text{boy})$

(c) $P(\text{has pet and is a boy})$

(d) $P(\text{has pet} \mid \text{boy})$

(e) $P(\text{boy} \mid \text{has pet})$

23. In a survey of 100 people about tea and coffee preferences:

   - 60 people like tea
   - 45 people like coffee
   - 25 people like both tea and coffee

   Find the probability that a randomly chosen person:

   (a) Likes tea or coffee

   (b) Likes neither tea nor coffee

   (c) Likes coffee given they like tea

   (d) Likes only tea

   (e) Likes only coffee

24. A bag contains red and blue marbles. $P(\text{red}) = \frac{2}{5}$. Two marbles are drawn without replacement. If there are 15 marbles in total:

   (a) How many red marbles are there?

   (b) How many blue marbles are there?

   (c) Find $P(\text{second marble is red} \mid \text{first marble is red})$

   (d) Find $P(\text{second marble is red} \mid \text{first marble is blue})$

Section G: Experimental vs Theoretical Probability

25. A biased die is rolled 200 times with these results:

Number	1	2	3	4	5	6
Frequency	25	30	35	40	45	25

   (a) Calculate the experimental probability for each number

   (b) Which number is most likely to appear?

   (c) Compare with theoretical probabilities for a fair die

   (d) If the die is rolled 500 times, estimate how many 5s you would expect

26. A spinner is tested and gives these results: Red: 45 times, Blue: 35 times, Green: 20 times

   (a) How many times was the spinner used?

   (b) Calculate the experimental probability of each colour

   (c) If the spinner has equal sections, how many sections should there be?

   (d) Estimate how many times blue would appear in 400 spins

27. A coin is flipped 50 times and lands heads 32 times.

   (a) What is the experimental probability of heads?

   (b) What is the experimental probability of tails?

   (c) Is this coin likely to be fair? Explain your reasoning.

   (d) If the coin is flipped 200 more times, estimate how many heads you would expect

Section H: Problem Solving

28. In a lottery, the probability of winning the jackpot is $\frac{1}{14000000}$.

    (a) Express this as a decimal (to 3 significant figures)
    (b) What is the probability of not winning?
    (c) If 7 million people play, estimate how many will win
    (d) Is it sensible to expect to win? Explain.

29. A medical test is 95% accurate. This means:

    - If someone has the disease, there's a 95% chance the test is positive
    - If someone doesn't have the disease, there's a 95% chance the test is negative

    In a population where 2% of people have the disease:

    (a) Out of 1000 people, how many actually have the disease?
    (b) How many of those with the disease will test positive?
    (c) How many without the disease will test negative?
    (d) How many false positives will there be?

30. Three friends each roll a fair die. What is the probability that:

    (a) All three get the same number?
    (b) All three get different numbers?
    (c) At least two get the same number?
    (d) The total of all three dice is 18?

31. A password consists of 2 letters followed by 3 digits. Letters and digits can be repeated.

    (a) How many different passwords are possible?
    (b) What is the probability of guessing the correct password in one attempt?
    (c) If only capital letters are used and the first digit cannot be 0, how many passwords are possible?

32. In a game, you win if you roll two dice and get a total of 7 or 11.

    (a) List all ways to get a total of 7
    (b) List all ways to get a total of 11
    (c) What is the probability of winning?
    (d) If you play 100 games, estimate how many you would win
    (e) Is this a fair game if winning and losing have equal prizes?

Answer Space

Use this space for your working and answers.

END OF TEST

Total marks: 100

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