GCSE Foundation Mathematics
Practice Test 7: 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 a factor of 12 when rolling a fair die

   (b) Rolling a 10 on a standard six-sided die

   (c) A baby being born on a Tuesday

   (d) Getting a number greater than 3 when rolling a standard die

   (e) Choosing a black card from a standard pack

   (f) A year having 13 months

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

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

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

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

   (d) $P(\text{probable}) = 0.85$

   (e) $P(\text{infrequent}) = \frac{1}{12}$

3. Complete these probability statements:

   (a) All probabilities are between _____ and _____

   (b) If $P(T) = 0.38$, then $P(\text{not } T) =$ _____

   (c) If $P(U) = \frac{7}{18}$, then $P(\text{not } U) =$ _____

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

4. A board has 12 equal spaces with these numbers: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48.
   Write down:

   (a) The sample space

   (b) $P(\text{landing on 28})$

   (c) $P(\text{landing on a multiple of 12})$

   (d) $P(\text{landing on a number greater than 35})$

   (e) $P(\text{landing on a number with digit 4})$

Section B: Single Event Probability

5. A fair sixteen-sided die numbered 1-16 is rolled. Find the probability of rolling:

    (a) A 12
    (b) A perfect square
    (c) A number greater than 11
    (d) A number less than or equal to 5
    (e) A multiple of 4
    (f) A number between 6 and 12 (inclusive)

6. A collection contains 16 ceramic items, 9 glass items, and 6 metal items. An item is chosen at random. Find the probability of choosing:

    (a) A ceramic item
    (b) A glass item
    (c) A metal item
    (d) A ceramic item or glass item
    (e) Not a metal item
    (f) Not a ceramic item

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

    (a) A 7
    (b) A heart
    (c) A red card
    (d) The queen of spades
    (e) A 4 or 6
    (f) A black ace

8. The probability that Emma scores a goal in hockey is $\frac{6}{13}$. What is the probability that she doesn't score?

9. In a reading club of 72 members, 54 prefer fiction books. If a member is chosen at random, find the probability they:

    (a) Prefer fiction books
    (b) Don't prefer fiction books

Section C: Sample Spaces and Outcomes

10. A six-sided die (numbered 1-6) is rolled twice.

    (a) List all possible outcomes
    (b) How many outcomes are in the sample space?
    (c) Find P(both rolls show 5)
    (d) Find P(at least one roll shows 2)
    (e) Find P(sum of rolls equals 7)

11. Two fair dice are rolled and their scores are compared. Record whether the first die is greater than (¿), less than (¡), or equal to (=) the second die.

(a) Complete the sample space table:

Compare	1	2	3	4	5	6
1	=	¿	¿	¿	¿	¿
2	¿					
3	¿					
4	¿					
5	¿					
6	¿					

(b) Find $P(\text{first die} > \text{second die})$

(c) Find $P(\text{dice show equal values})$

(d) Find $P(\text{first die} < \text{second die})$

(e) What do you notice about these three probabilities?

12. A spinner has 4 equal sections: Pink (P), Lime (L), Teal (T), Navy (N). The spinner is used twice.

   (a) How many possible outcomes are there?

   (b) Find $P(\text{same color both times})$

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

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

13. A set contains multiples of 3: 9, 12, 15, 18. Two numbers are drawn without replacement.

   (a) List all possible pairs

   (b) Find $P(\text{both numbers are multiples of 3})$

   (c) Find $P(\text{sum of numbers} = 27)$

   (d) Find $P(\text{product of numbers} > 150)$

Section D: Probability Rules

14. For mutually exclusive events K and L, where $P(K) = 0.29$ and $P(L) = 0.47$:

   (a) Find $P(K \text{ or } L)$

   (b) Find $P(\text{neither } K \text{ nor } L)$

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

15. A card is drawn from a standard pack. Let C = "drawing a diamond" and D = "drawing an ace".

   (a) Find $P(C)$

   (b) Find $P(D)$

   (c) Find $P(C \text{ and } D)$

   (d) Find $P(C \text{ or } D)$

   (e) Are events C and D mutually exclusive? Explain.

16. The probability of fog on Wednesday is 0.35. The probability of fog on Thursday is 0.55. Assuming the events are independent:

   (a) Find the probability of fog on both days

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

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

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

17. A biased coin has $P(\text{heads}) = 0.63$. 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 box has 7 hardcover books and 5 paperback books. Two books are drawn without replacement.

    (a) Draw a tree diagram showing all possibilities

    (b) Find $P(\text{two hardcover books})$

    (c) Find $P(\text{two paperback books})$

    (d) Find $P(\text{one hardcover and one paperback})$

    (e) Find $P(\text{at least one hardcover book})$

19. The probability that a student passes Mathematics is 0.87 and passes Physics is 0.73. 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 restaurant has two coffee machines. Machine X works 89% of the time, Machine Y works 95% 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. Container 1 has 4 triangular pieces and 6 circular pieces. Container 2 has 7 triangular pieces and 3 circular pieces. A container is chosen at random, then a piece is drawn from that container.

    (a) Draw a tree diagram

    (b) Find the probability of drawing a triangular piece

    (c) Find the probability of drawing a circular piece

    (d) If a circular piece is drawn, what is the probability it came from Container 1?

Section F: Conditional Probability

22. The two-way table shows information about restaurant customers and their meal choices:

	Meat	Vegetarian	Total
Adults	56	24	80
Children	32	48	80
Total	88	72	160

A customer is chosen at random. Find:

(a) $P(\text{vegetarian})$

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

(c) $P(\text{vegetarian and adult})$

(d) $P(\text{vegetarian} \mathbin{—} \text{adult})$

(e) $P(\text{adult} \mathbin{—} \text{vegetarian})$

23. In a survey of 320 people about video streaming:

- 200 people use YouTube
- 160 people use Twitch
- 96 people use both YouTube and Twitch

Find the probability that a randomly chosen person:

(a) Uses YouTube or Twitch

(b) Uses neither YouTube nor Twitch

(c) Uses Twitch given they use YouTube

(d) Uses only YouTube

(e) Uses only Twitch

24. A container has blue and yellow tokens. $P(\text{blue}) = \frac{5}{14}$. Two tokens are drawn without replacement.

If there are 28 tokens in total:

(a) How many blue tokens are there?

(b) How many yellow tokens are there?

(c) Find $P(\text{second token is blue} \mathbin{—} \text{first token is blue})$

(d) Find $P(\text{second token is blue} \mathbin{—} \text{first token is yellow})$

Section G: Experimental vs Theoretical Probability

25. A biased die is rolled 720 times with these results:

Number	1	2	3	4	5	6
Frequency	105	120	135	150	120	90

(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 2160 times, estimate how many 4s you would expect

26. A raffle drum is tested and gives these results: Gold: 90 times, Silver: 60 times, Bronze: 45 times, Copper: 30 times

    (a) How many times was the drum spun?
    (b) Calculate the experimental probability of each metal
    (c) What pattern do you notice in the frequencies?
    (d) Estimate how many times gold would appear in 675 spins

27. A die is rolled 160 times and shows a number greater than 4 exactly 96 times.

    (a) What is the experimental probability of rolling a number greater than 4?
    (b) What is the experimental probability of rolling 4 or less?
    (c) Is this die likely to be fair? Explain your reasoning.
    (d) If the die is rolled 240 more times, estimate how many will be greater than 4

Section H: Problem Solving

28. In a sweepstake, the probability of winning the jackpot is $\frac{1}{75000000}$.

    (a) Express this as a decimal (to 3 significant figures)
    (b) What is the probability of not winning?
    (c) If 15 million people enter, estimate how many will win
    (d) Is it practical to expect to win? Explain.

29. A screening test is 96% accurate. This means:

    - If someone has the condition, there's a 96% chance the test is positive
    - If someone doesn't have the condition, there's a 96% chance the test is negative

    In a population where 18% of people have the condition:

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

30. Five friends each choose a vowel (A, E, I, O, U). What is the probability that:

    (a) All five choose the same vowel?
    (b) All five choose different vowels?
    (c) At least four choose the same vowel?
    (d) No one chooses the letter A?

31. A computer login uses 2 different letters from A-Z. No letter can be repeated and order matters.

    (a) How many different logins are possible?
    (b) What is the probability of guessing the login correctly in one attempt?
    (c) If consonants only can be used (21 letters), how many logins are possible?

32. In a board game, you win if you roll three dice and get exactly two of the same number.

    (a) In how many ways can you choose which two dice show the same number?
    (b) If the two dice both show 4s, how many outcomes are possible for the third die?
    (c) What is the probability of getting exactly two 4s?
    (d) If you play 864 games, estimate how many you would win with exactly two 4s
    (e) Is this game advantageous if you need exactly two of any number to win?

Answer Space

Use this space for your working and answers.

END OF TEST

Total marks: 100

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