GCSE Foundation Mathematics
Practice Test 8: 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 an odd number when rolling a fair die

   (b) Rolling an 8 on a standard six-sided die

   (c) A baby being born on a Saturday

   (d) Getting a number less than 8 when rolling a standard die

   (e) Choosing a red card from a standard pack

   (f) A week having 8 days

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) $P(\text{very likely}) = 0.9$

   (e) $P(\text{unusual}) = \frac{1}{10}$

3. Complete these probability statements:

   (a) All probabilities are between _____ and _____

   (b) If $P(X) = 0.27$, then $P(\text{not } X) =$ _____

   (c) If $P(Y) = \frac{5}{12}$, then $P(\text{not } Y) =$ _____

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

4. A spinner has 10 equal sections with these numbers: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50. Write down:

   (a) The sample space

   (b) $P(\text{spinning 25})$

   (c) $P(\text{spinning a multiple of 15})$

   (d) $P(\text{spinning a number greater than 30})$

   (e) $P(\text{spinning a one-digit number})$

Section B: Single Event Probability

5. A fair twelve-sided die numbered 1-12 is rolled. Find the probability of rolling:
   (a) A 9
   (b) A prime number
   (c) A number greater than 8
   (d) A number less than or equal to 4
   (e) A multiple of 3
   (f) A number between 5 and 10 (inclusive)

6. A basket contains 14 plastic balls, 11 rubber balls, and 7 foam balls. A ball is drawn at random. Find the probability of drawing:
   (a) A plastic ball
   (b) A rubber ball
   (c) A foam ball
   (d) A plastic ball or rubber ball
   (e) Not a foam ball
   (f) Not a plastic ball

7. A standard pack of 52 playing cards is shuffled. Find the probability of drawing:
   (a) A 10
   (b) A club
   (c) A black card
   (d) The jack of diamonds
   (e) A 5 or 8
   (f) A red king

8. The probability that Alex wins a chess game is $\frac{4}{9}$. What is the probability that he loses or draws?

9. In a drama club of 63 members, 49 participate in school productions. If a member is chosen at random, find the probability they:
   (a) Participate in school productions
   (b) Don't participate in school productions

Section C: Sample Spaces and Outcomes

10. A three-sided die (numbered 1-3) is rolled twice.
    (a) List all possible outcomes
    (b) How many outcomes are in the sample space?
    (c) Find P(both rolls show 2)
    (d) Find P(at least one roll shows 3)
    (e) Find P(sum of rolls equals 4)

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(first die > second die)

(c) Find P(dice show equal values)

(d) Find P(first die < second die)

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

12. A spinner has 5 equal sections: White (W), Silver (S), Gray (G), Charcoal (C), Black (B). The spinner is used twice.

(a) How many possible outcomes are there?

(b) Find P(same color both times)

(c) Find P(at least one white)

(d) Find P(no black)

13. A set contains even numbers 8, 10, 12, 14. Two numbers are drawn without replacement.

(a) List all possible pairs

(b) Find P(both numbers are even)

(c) Find P(sum of numbers = 22)

(d) Find P(product of numbers > 100)

Section D: Probability Rules

14. For mutually exclusive events P and Q, where $P(P) = 0.31$ and $P(Q) = 0.54$:

(a) Find $P(P \text{ or } Q)$

(b) Find P(neither P nor Q)

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

15. A card is drawn from a standard pack. Let A = "drawing a spade" and B = "drawing a number card (2-10)".

(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 snow on Monday is 0.2. The probability of snow on Tuesday is 0.7. Assuming the events are independent:

(a) Find the probability of snow on both days

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

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

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

17. A biased coin has $P(\text{heads}) = 0.58$. The coin is flipped three times.

(a) Find $P(\text{three heads})$

(b) Find $P(\text{three tails})$

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

(d) Find $P(\text{exactly one head})$

Section E: Tree Diagrams

18. A drawer has 11 cotton shirts and 5 silk shirts. Two shirts are drawn without replacement.

(a) Draw a tree diagram showing all possibilities

(b) Find $P(\text{two cotton shirts})$

(c) Find $P(\text{two silk shirts})$

(d) Find $P(\text{one cotton and one silk})$

(e) Find $P(\text{at least one cotton shirt})$

19. The probability that a student passes English is 0.82 and passes Science is 0.89. 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 hotel has two air conditioning units. Unit A works 93% of the time, Unit B works 87% of the time.

(a) Draw a tree diagram

(b) Find the probability both units work

(c) Find the probability exactly one unit works

(d) Find the probability at least one unit works

(e) Find the probability neither unit works

21. Box 1 contains 6 square tiles and 4 round tiles. Box 2 contains 3 square tiles and 7 round tiles. A box is chosen at random, then a tile is drawn from that box.

(a) Draw a tree diagram

(b) Find the probability of drawing a square tile

(c) Find the probability of drawing a round tile

(d) If a round tile is drawn, what is the probability it came from Box 2?

Section F: Conditional Probability

22. The two-way table shows information about gym members and their workout preferences:

	Cardio	Weights	Total
Male	28	52	80
Female	42	18	60
Total	70	70	140

A member is chosen at random. Find:

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

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

(c) $P(\text{weights and male})$

(d) $P(\text{weights} \mid \text{male})$

(e) $P(\text{male} \mid \text{weights})$

23. In a survey of 280 people about music streaming:

- 170 people use Spotify
- 140 people use Apple Music
- 85 people use both Spotify and Apple Music

Find the probability that a randomly chosen person:

(a) Uses Spotify or Apple Music

(b) Uses neither Spotify nor Apple Music

(c) Uses Apple Music given they use Spotify

(d) Uses only Spotify

(e) Uses only Apple Music

24. A bag has green and orange counters. $P(\text{green}) = \frac{11}{24}$. Two counters are drawn without replacement.

If there are 48 counters in total:

(a) How many green counters are there?

(b) How many orange counters are there?

(c) Find $P(\text{second counter is green} \mid \text{first counter is green})$

(d) Find $P(\text{second counter is green} \mid \text{first counter is orange})$

Section G: Experimental vs Theoretical Probability

25. A biased die is rolled 900 times with these results:

Number	1	2	3	4	5	6
Frequency	135	150	165	180	150	120

(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 2700 times, estimate how many 4s you would expect

26. A prize wheel is tested and gives these results: Diamond: 84 times, Emerald: 56 times, Ruby: 42 times, Sapphire: 28 times

    (a) How many times was the wheel spun?

    (b) Calculate the experimental probability of each gem

    (c) What pattern do you notice in the frequencies?

    (d) Estimate how many times diamond would appear in 630 spins

27. A spinner is used 180 times and lands on blue 117 times.

    (a) What is the experimental probability of landing on blue?

    (b) What is the experimental probability of not landing on blue?

    (c) Is this spinner likely to be fair (assuming equal sections)? Explain your reasoning.

    (d) If the spinner is used 300 more times, estimate how many blues you would expect

Section H: Problem Solving

28. In a competition, the probability of winning the grand prize is $\frac{1}{95000000}$.

    (a) Express this as a decimal (to 3 significant figures)

    (b) What is the probability of not winning?

    (c) If 19 million people enter, estimate how many will win

    (d) Is it logical to expect to win? Explain.

29. A diagnostic test is 97% accurate. This means:

    - If someone has the disease, there's a 97% chance the test is positive
    - If someone doesn't have the disease, there's a 97% chance the test is negative

    In a group where 15% 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. Seven friends each pick a color from the rainbow (red, orange, yellow, green, blue, indigo, violet). What is the probability that:

    (a) All seven pick the same color?

    (b) All seven pick different colors?

    (c) At least six pick the same color?

    (d) No one picks blue?

31. A phone PIN uses 3 different numbers from 1-9. No number can be repeated and order matters.

    (a) How many different PINs are possible?

    (b) What is the probability of guessing the PIN correctly in one attempt?

    (c) If even numbers (2, 4, 6, 8) cannot be used, how many PINs are possible?

32. In a lottery game, you win if you select six numbers and get exactly five correct.

    (a) In how many ways can you choose which five numbers are correct?

(b) If the five correct numbers are 2, 5, 8, 12, 19, how many possibilities are there for the sixth number?

(c) What is the probability of getting exactly five numbers correct?

(d) If you play 1512 games, estimate how many you would win with exactly five correct

(e) Is this game favorable if you need exactly five correct to win?

Answer Space

Use this space for your working and answers.

END OF TEST

Total marks: 100

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