GCSE Foundation Mathematics
Practice Test 2: 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 tails when flipping a fair coin

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

   (c) Snow falling somewhere in the world this year

   (d) Getting a number greater than 0 when rolling a standard die

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

   (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) $P(\text{quite likely}) = 0.7$

   (e) $P(\text{unlikely}) = \frac{1}{4}$

3. Complete these probability statements:

   (a) All probabilities are between _____ and _____

   (b) If $P(C) = 0.4$, then $P(\text{not } C) =$ _____

   (c) If $P(D) = \frac{3}{8}$, then $P(\text{not } D) =$ _____

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

4. A spinner has 6 equal sections numbered 2, 4, 6, 8, 10, 12. Write down:

   (a) The sample space

   (b) $P(\text{spinning an 8})$

   (c) $P(\text{spinning a number divisible by 4})$

   (d) $P(\text{spinning a number greater than 8})$

   (e) $P(\text{spinning a number less than 15})$

Section B: Single Event Probability

5. A fair eight-sided die numbered 1-8 is rolled. Find the probability of rolling:
   (a) A 6
   (b) An even number
   (c) A number greater than 5
   (d) A number less than or equal to 3
   (e) A multiple of 4
   (f) A number between 3 and 7 (inclusive)
6. A box contains 12 white balls, 7 black balls, and 5 yellow balls. A ball is drawn at random. Find the probability of drawing:
   (a) A white ball
   (b) A black ball
   (c) A yellow ball
   (d) A white or black ball
   (e) Not a yellow ball
   (f) Not a white ball
7. A standard pack of 52 playing cards is shuffled. Find the probability of drawing:
   (a) A king
   (b) A spade
   (c) A black card
   (d) The ace of hearts
   (e) A number card (2-10)
   (f) A red king
8. The probability that James wins a tennis match is $\frac{5}{8}$. What is the probability that he loses?
9. In a group of 30 people, 18 wear glasses. If a person is chosen at random, find the probability they:
   (a) Wear glasses
   (b) Don't wear glasses

Section C: Sample Spaces and Outcomes

10. A coin is flipped three times.
    (a) List all possible outcomes
    (b) How many outcomes are in the sample space?
    (c) Find P(three heads)
    (d) Find P(at least two tails)
    (e) Find P(exactly two heads)
11. Two fair dice are rolled and their scores are multiplied.
    (a) Complete the sample space table showing all possible products:

×	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2					
3	3					
4	4					
5	5					
6	6					

(b) Find $P(\text{product} = 12)$

(c) Find $P(\text{product} = 36)$

(d) Find $P(\text{product} > 20)$

(e) Find $P(\text{product is odd})$

12. A bag has 3 equal sections: Orange (O), Purple (P), White (W). The bag is selected twice.

(a) List all possible outcomes

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

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

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

13. A deck contains cards numbered 2, 3, 4, 5. Two cards are drawn without replacement.

(a) List all possible pairs

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

(c) Find $P(\text{sum of numbers} = 7)$

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

Section D: Probability Rules

14. For mutually exclusive events X and Y, where $P(X) = 0.4$ and $P(Y) = 0.3$:

(a) Find $P(X \text{ or } Y)$

(b) Find $P(\text{neither } X \text{ nor } Y)$

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

15. A card is drawn from a standard pack. Let C = "drawing a club" and D = "drawing a queen".

(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 sun on Wednesday is 0.3. The probability of sun on Thursday is 0.5. Assuming the events are independent:

(a) Find the probability of sun on both days

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

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

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

17. A biased coin has $P(\text{heads}) = 0.7$. The coin is flipped three times.

(a) Find P(three heads)

(b) Find P(three tails)

(c) Find P(at least one tail)

(d) Find P(exactly one head)

Section E: Tree Diagrams

18. A jar contains 4 green balls and 3 purple balls. Two balls are drawn without replacement.

    (a) Draw a tree diagram showing all possibilities

    (b) Find P(two green balls)

    (c) Find P(two purple balls)

    (d) Find P(one green and one purple)

    (e) Find P(at least one green ball)

19. The probability that a student passes Science is 0.9 and passes History is 0.6. 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 garage has two pumps. Pump A works 95% of the time, Pump B works 80% of the time.

    (a) Draw a tree diagram

    (b) Find the probability both pumps work

    (c) Find the probability exactly one pump works

    (d) Find the probability at least one pump works

    (e) Find the probability neither pump works

21. Bag X contains 6 red and 4 blue balls. Bag Y contains 3 red and 7 blue balls. A bag is chosen at random, then a ball is drawn from that bag.

    (a) Draw a tree diagram

    (b) Find the probability of drawing a red ball

    (c) Find the probability of drawing a blue ball

    (d) If a blue ball is drawn, what is the probability it came from Bag Y?

Section F: Conditional Probability

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

	Has smartphone	No smartphone	Total
Year 10	28	12	40
Year 11	32	8	40
Total	60	20	80

    A student is chosen at random. Find:

(a) P(has smartphone)
(b) P(Year 10)
(c) P(has smartphone and Year 10)
(d) P(has smartphone — Year 10)
(e) P(Year 10 — has smartphone)

23. In a survey of 120 people about pizza and burger preferences:

- 75 people like pizza
- 50 people like burgers
- 30 people like both pizza and burgers

Find the probability that a randomly chosen person:

(a) Likes pizza or burgers
(b) Likes neither pizza nor burgers
(c) Likes burgers given they like pizza
(d) Likes only pizza
(e) Likes only burgers

24. A container has red and green marbles. $P(\text{red}) = \frac{3}{7}$. Two marbles are drawn without replacement.

If there are 21 marbles in total:

(a) How many red marbles are there?
(b) How many green marbles are there?
(c) Find P(second marble is red — first marble is red)
(d) Find P(second marble is red — first marble is green)

Section G: Experimental vs Theoretical Probability

25. A biased die is rolled 300 times with these results:

Number	1	2	3	4	5	6
Frequency	40	35	50	60	65	50

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

26. A wheel is tested and gives these results: Yellow: 55 times, Blue: 25 times, Red: 40 times

(a) How many times was the wheel spun?
(b) Calculate the experimental probability of each colour
(c) If the wheel has equal sections, how many sections should there be?
(d) Estimate how many times yellow would appear in 360 spins

27. A coin is flipped 80 times and lands heads 28 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 160 more times, estimate how many tails you would expect

Section H: Problem Solving

28. In a raffle, the probability of winning first prize is $\frac{1}{25000000}$.
    (a) Express this as a decimal (to 3 significant figures)
    (b) What is the probability of not winning?
    (c) If 5 million people enter, estimate how many will win
    (d) Is it sensible to expect to win? Explain.

29. A virus test is 98% accurate. This means:
    - If someone has the virus, there's a 98% chance the test is positive
    - If someone doesn't have the virus, there's a 98% chance the test is negative

    In a population where 3% of people have the virus:
    (a) Out of 1000 people, how many actually have the virus?
    (b) How many of those with the virus will test positive?
    (c) How many without the virus will test negative?
    (d) How many false positives will there be?

30. Four friends each roll a fair die. What is the probability that:
    (a) All four get the same number?
    (b) All four get different numbers?
    (c) At least three get the same number?
    (d) The total of all four dice is 24?

31. A security code consists of 3 letters followed by 2 digits. Letters and digits can be repeated.
    (a) How many different codes are possible?
    (b) What is the probability of guessing the correct code in one attempt?
    (c) If only consonants are used and the first digit cannot be 0, how many codes are possible?

32. In a game, you win if you roll two dice and get a total of 6 or 8.
    (a) List all ways to get a total of 6
    (b) List all ways to get a total of 8
    (c) What is the probability of winning?
    (d) If you play 150 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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