GCSE Foundation Mathematics
Practice Test 3: 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 even number when rolling a fair die

   (b) Rolling a 9 on a standard six-sided die

   (c) A football match ending in a draw

   (d) Getting a number less than 7 when rolling a standard die

   (e) Choosing a diamond from a standard pack of cards

   (f) February having 30 days

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) $P(\text{very unlikely}) = 0.1$

   (e) $P(\text{likely}) = \frac{4}{5}$

3. Complete these probability statements:

   (a) All probabilities are between _____ and _____

   (b) If $P(E) = 0.6$, then $P(\text{not } E) = $ _____

   (c) If $P(F) = \frac{5}{9}$, then $P(\text{not } F) = $ _____

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

4. A spinner has 8 equal sections with colours: Red, Red, Blue, Blue, Blue, Green, Yellow, Yellow. Write down:

   (a) The sample space

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

   (c) $P(\text{spinning blue})$

   (d) $P(\text{spinning green or yellow})$

   (e) $P(\text{not spinning blue})$

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 bag contains 9 silver coins, 6 gold coins, and 4 copper coins. A coin is drawn at random. Find the probability of drawing:

   (a) A silver coin
   (b) A gold coin
   (c) A copper coin
   (d) A silver or gold coin
   (e) Not a copper coin
   (f) Not a silver coin

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

   (a) A jack
   (b) A diamond
   (c) A red card
   (d) The queen of clubs
   (e) An ace or king
   (f) A black jack

8. The probability that Maria scores a goal in hockey is $\frac{2}{7}$. What is the probability that she doesn't score?

9. In a college class of 35 students, 21 have laptops. If a student is chosen at random, find the probability they:

   (a) Have a laptop
   (b) Don't have a laptop

Section C: Sample Spaces and Outcomes

10. A coin is flipped and a die is rolled simultaneously.

    (a) List all possible outcomes
    (b) How many outcomes are in the sample space?
    (c) Find P(heads and 6)
    (d) Find P(tails and even number)
    (e) Find P(heads and number greater than 4)

11. Two fair dice are rolled and the difference between their scores is calculated (larger - smaller).

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

Difference	1	2	3	4	5	6
1	0	1	2	3	4	5
2	1					
3	2					
4	3					
5	4					
6	5					

(b) Find $P(\text{difference} = 0)$

(c) Find $P(\text{difference} = 5)$

(d) Find $P(\text{difference} > 3)$

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

12. A bag has 4 equal sections: Pink (P), Turquoise (T), Silver (S), Gold (G). The bag is selected twice.

    (a) List all possible outcomes

    (b) Find $P(\text{same colour twice})$

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

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

13. A box contains cards numbered 3, 5, 7, 9. Two cards are drawn without replacement.

    (a) List all possible pairs

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

    (c) Find $P(\text{sum of numbers} = 12)$

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

Section D: Probability Rules

14. For mutually exclusive events P and Q, where $P(P) = 0.2$ and $P(Q) = 0.6$:

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

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

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

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

    (a) Find $P(E)$

    (b) Find $P(F)$

    (c) Find $P(E \text{ and } F)$

    (d) Find $P(E \text{ or } F)$

    (e) Are events E and F mutually exclusive? Explain.

16. The probability of wind on Friday is 0.8. The probability of wind on Saturday is 0.4. Assuming the events are independent:

    (a) Find the probability of wind on both days

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

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

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

17. A biased coin has $P(\text{heads}) = 0.4$. 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 $P(\text{exactly two tails})$

Section E: Tree Diagrams

18. A container has 5 orange balls and 2 pink balls. Two balls are drawn without replacement.

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

19. The probability that a student passes Art is 0.85 and passes Music is 0.75. 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 ovens. Oven A works 88% of the time, Oven B works 92% of the time.

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

21. Drawer 1 contains 8 black and 2 white socks. Drawer 2 contains 5 black and 5 white socks. A drawer is chosen at random, then a sock is drawn from that drawer.

    (a) Draw a tree diagram
    (b) Find the probability of drawing a black sock
    (c) Find the probability of drawing a white sock
    (d) If a white sock is drawn, what is the probability it came from Drawer 2?

Section F: Conditional Probability

22. The two-way table shows information about workers and their transport:

	Drives car	Uses public transport	Total
Full-time	45	15	60
Part-time	25	15	40
Total	70	30	100

A worker is chosen at random. Find:

(a) P(drives car)

(b) P(full-time)

(c) P(drives car and full-time)

(d) P(drives car — full-time)

(e) P(full-time — drives car)

23. In a survey of 150 people about chocolate and ice cream preferences:

- 90 people like chocolate
- 70 people like ice cream
- 40 people like both chocolate and ice cream

Find the probability that a randomly chosen person:

(a) Likes chocolate or ice cream

(b) Likes neither chocolate nor ice cream

(c) Likes ice cream given they like chocolate

(d) Likes only chocolate

(e) Likes only ice cream

24. A jar has red and yellow marbles. $P(\text{red}) = \frac{4}{9}$. Two marbles are drawn without replacement. If there are 18 marbles in total:

(a) How many red marbles are there?

(b) How many yellow marbles are there?

(c) Find P(second marble is red — first marble is red)

(d) Find P(second marble is red — first marble is yellow)

Section G: Experimental vs Theoretical Probability

25. A biased die is rolled 250 times with these results:

Number	1	2	3	4	5	6
Frequency	30	45	40	55	35	45

(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 750 times, estimate how many 2s you would expect

26. A roulette wheel is tested and gives these results: Black: 48 times, Red: 44 times, Green: 8 times

(a) How many times was the wheel spun?

(b) Calculate the experimental probability of each colour

(c) If the wheel should be fair between black and red, what might the green represent?

(d) Estimate how many times black would appear in 200 spins

27. A coin is flipped 60 times and lands heads 39 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 100 more times, estimate how many heads you would expect

Section H: Problem Solving

28. In a competition, the probability of winning the grand prize is $\frac{1}{50000000}$.

    (a) Express this as a decimal (to 3 significant figures)
    (b) What is the probability of not winning?
    (c) If 10 million people enter, estimate how many will win
    (d) Is it sensible to expect to win? Explain.

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

    • If someone uses drugs, there's a 96% chance the test is positive
    • If someone doesn't use drugs, there's a 96% chance the test is negative

    In a population where 5% of people use drugs:

    (a) Out of 1000 people, how many actually use drugs?
    (b) How many of those who use drugs will test positive?
    (c) How many who don't use drugs will test negative?
    (d) How many false positives will there be?

30. Five friends each choose a number from 1 to 6. What is the probability that:

    (a) All five choose the same number?
    (b) All five choose different numbers?
    (c) At least four choose the same number?
    (d) No one chooses the number 6?

31. A PIN code consists of 4 digits. Each digit can be 0-9 and digits can be repeated.

    (a) How many different PIN codes are possible?
    (b) What is the probability of guessing the correct PIN in one attempt?
    (c) If the first digit cannot be 0 and no digit can be repeated, how many PINs are possible?

32. In a carnival game, you win if you roll three dice and get at least two 6s.

    (a) List all ways to get exactly two 6s
    (b) What is the probability of getting exactly three 6s?
    (c) What is the probability of winning (at least two 6s)?
    (d) If you play 216 games, estimate how many you would win
    (e) Is this a fair game if the prize is worth 5 times the entry fee?

Answer Space

Use this space for your working and answers.

END OF TEST

Total marks: 100

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