

CLASS 10 — MATHEMATICS

Chapter: Probability

Answer Key with Step-by-Step Solutions

Maximum Marks: 40

Time Allowed: 1 hour 30 minutes

Results used: $P(E) = \frac{\text{number of outcomes favourable to } E}{\text{number of all possible outcomes}}$ (for equally likely outcomes);
 $0 \leq P(E) \leq 1$; $P(\text{sure event}) = 1$; $P(\text{impossible event}) = 0$; $P(E) + P(\text{not } E) = 1$. Two dice give 36 equally likely outcomes; three coins give 8.

SECTION A — MCQ Answer Key

Q	Option	Answer	Explanation / calculation
Q1	(C)	1.2	Every probability lies between 0 and 1 (inclusive); $1.2 > 1$.
Q2	(B)	0.64	$P(\text{not } E) = 1 - P(E) = 1 - 0.36 = 0.64$.
Q3	(D)	$\frac{1}{2}$	Primes on a die: 2, 3, 5 — 3 out of 6 outcomes: $\frac{3}{6} = \frac{1}{2}$.
Q4	(B)	$\frac{1}{26}$	Red kings: king of hearts and king of diamonds — $\frac{2}{52} = \frac{1}{26}$.
Q5	(C)	$\frac{3}{4}$	Outcomes HH, HT, TH, TT; at least one head in 3 of them.
Q6	(A)	$\frac{4}{11}$	PROBABILITY has 11 letters; the vowels are O, A, I, I — 4 letters.
Q7	(C)	$\frac{1}{6}$	(1,6), (2,5), (3,4), (4,3), (5,2), (6,1): 6 of 36 outcomes — $\frac{1}{6}$.
Q8	(A)	10	Let there be b blue balls: $\frac{b}{5+b} = 2 \times \frac{5}{5+b} \Rightarrow b = 10$.
Q9	(A)	Both true; R explains A	No face of a die shows a number greater than 6, so this is an impossible event, and its probability is 0, as R states.
Q10	(D)	A false, R true	The 4 equally likely outcomes are HH, HT, TH, TT, so $P(\text{two heads}) = \frac{1}{4}$, not $\frac{1}{3}$. A is false; R is true.

Marking: 1 mark for each correct option; no part marks in Section A.

SECTION B — Very Short Answer

Q11. Balls in a bag [2 marks]

Total balls = $4 + 6 + 5 = 15$.

(i) $P(\text{white}) = \frac{6}{15} = \frac{2}{5}$. (ii) $P(\text{not green}) = \frac{15-5}{15} = \frac{10}{15} = \frac{2}{3}$.

Answer: (i) $\frac{2}{5}$ (ii) $\frac{2}{3}$

Marking scheme:

(i) $2/5$: 1 mark

(ii) $2/3$: 1 mark

Q12. Numbered discs [2 marks]

(i) Perfect squares from 1 to 50: 1, 4, 9, 16, 25, 36, 49 — 7 numbers. $P = \frac{7}{50}$.

(ii) Multiples of 6: 6, 12, ..., 48 — 8 numbers. $P = \frac{8}{50} = \frac{4}{25}$.

Answer: (i) $\frac{7}{50}$ (ii) $\frac{4}{25}$

Marking scheme:

(i) $7/50$: 1 mark

(ii) $4/25$: 1 mark

Q13. Cards [2 marks]

(i) Face cards: 4 kings + 4 queens + 4 jacks = 12. $P = \frac{12}{52} = \frac{3}{13}$.

(ii) Kings or hearts: 4 kings + 13 hearts – 1 (king of hearts counted twice) = 16.

Neither = $52 - 16 = 36$. $P = \frac{36}{52} = \frac{9}{13}$.

Answer: (i) $\frac{3}{13}$ (ii) $\frac{9}{13}$

Marking scheme:

(i) $3/13$: 1 mark

(ii) $9/13$ (avoiding double counting): 1 mark

Q14. Bulbs [2 marks]

(i) Good bulbs = $200 - 16 = 184$. $P(\text{good}) = \frac{184}{200} = \frac{23}{25}$.

(ii) After removing one defective bulb: 199 bulbs remain, all 184 good bulbs still present. $P(\text{good}) = \frac{184}{199}$.

Answer: (i) $\frac{23}{25}$ (ii) $\frac{184}{199}$

Marking scheme:

(i) $23/25$: 1 mark

(ii) $184/199$: 1 mark

Q15. Die thrown twice [2 marks]

There are $6 \times 6 = 36$ equally likely outcomes.

(i) Same number: (1,1), (2,2), ..., (6,6) — 6 outcomes. $P = \frac{6}{36} = \frac{1}{6}$.

(ii) Sum at least 11: (5,6), (6,5), (6,6) — 3 outcomes. $P = \frac{3}{36} = \frac{1}{12}$.

Answer: (i) $\frac{1}{6}$ (ii) $\frac{1}{12}$

Marking scheme:

(i) $1/6$: 1 mark

(ii) $1/12$: 1 mark

SECTION C — Short Answer

Q16. Three coins [3 marks]

Outcomes: HHH, HHT, HTH, THH, HTT, THT, TTH, TTT — 8 equally likely outcomes.

(i) Exactly two heads: HHT, HTH, THH — $P = \frac{3}{8}$.

(ii) At least two heads: HHH, HHT, HTH, THH — $P = \frac{4}{8} = \frac{1}{2}$.

(iii) No head: TTT — $P = \frac{1}{8}$.

Answer: (i) $\frac{3}{8}$ (ii) $\frac{1}{2}$ (iii) $\frac{1}{8}$

Marking scheme:

Listing all 8 outcomes: 1 mark

(i) $\frac{3}{8}$ and (ii) $\frac{1}{2}$: 1 mark

(iii) $\frac{1}{8}$: 1 mark

Q17. Two dice [3 marks]

36 equally likely outcomes. The table shades the outcomes whose sum is prime (part ii).

1st \ 2nd	1	2	3	4	5	6
1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

(i) Product 6: (1,6), (6,1), (2,3), (3,2) — 4 outcomes. $P = \frac{4}{36} = \frac{1}{9}$.

(ii) Sum prime (2, 3, 5, 7 or 11): 1 + 2 + 4 + 6 + 2 = 15 outcomes. $P = \frac{15}{36} = \frac{5}{12}$.

(iii) Differ by 2: (1,3), (3,1), (2,4), (4,2), (3,5), (5,3), (4,6), (6,4) — 8 outcomes. $P = \frac{8}{36} = \frac{2}{9}$.

Answer: (i) $\frac{1}{9}$ (ii) $\frac{5}{12}$ (iii) $\frac{2}{9}$

Marking scheme:

(i) $\frac{1}{9}$: 1 mark

(ii) $\frac{5}{12}$: 1 mark

(iii) $\frac{2}{9}$: 1 mark

Q18. Marbles [3 marks]

Red = $\frac{1}{4} \times 24 = 6$; green = $\frac{1}{3} \times 24 = 8$; blue = $24 - 6 - 8 = 10$.

(Check: $P(\text{blue}) = \frac{10}{24} = \frac{5}{12}$, and $\frac{1}{4} + \frac{1}{3} + \frac{5}{12} = 1$ ✓)

After adding 4 blue marbles: blue = 14, total = 28. $P(\text{blue}) = \frac{14}{28} = \frac{1}{2}$.

Answer: 10 blue marbles; new $P(\text{blue}) = \frac{1}{2}$

Marking scheme:

Red 6 and green 8: 1 mark

Blue = 10: 1 mark

New probability 1/2: 1 mark

Q19. Cards with aces and jacks removed [3 marks]

Removed: 4 aces + 4 jacks = 8 cards. Remaining = 44 cards.

(i) Red cards left: $26 - 2 \text{ red aces} - 2 \text{ red jacks} = 22$. $P = \frac{22}{44} = \frac{1}{2}$.(ii) Face cards left: 4 kings + 4 queens = 8. $P = \frac{8}{44} = \frac{2}{11}$.(iii) The 10 of hearts is still in the deck: $P = \frac{1}{44}$.**Answer: (i) $\frac{1}{2}$ (ii) $\frac{2}{11}$ (iii) $\frac{1}{44}$** **Marking scheme:**

44 cards remain and (i) 1/2: 1 mark

(ii) 2/11: 1 mark

(iii) 1/44: 1 mark

SECTION D — Long Answer

Q20. Cards numbered 2 to 101 [4 marks]

Total number of cards = $101 - 2 + 1 = 100$.

(i) Even numbers: 2, 4, ..., 100 — 50 numbers. $P = \frac{50}{100} = \frac{1}{2}$.

(ii) Perfect squares: 4, 9, 16, 25, 36, 49, 64, 81, 100 — 9 numbers (1 is not in the box). $P = \frac{9}{100}$.

(iii) Primes less than 20: 2, 3, 5, 7, 11, 13, 17, 19 — 8 numbers. $P = \frac{8}{100} = \frac{2}{25}$.

(iv) Divisible by both 3 and 5, i.e. by 15: 15, 30, 45, 60, 75, 90 — 6 numbers. $P = \frac{6}{100} = \frac{3}{50}$.

Answer: (i) $\frac{1}{2}$ (ii) $\frac{9}{100}$ (iii) $\frac{2}{25}$ (iv) $\frac{3}{50}$

Marking scheme:

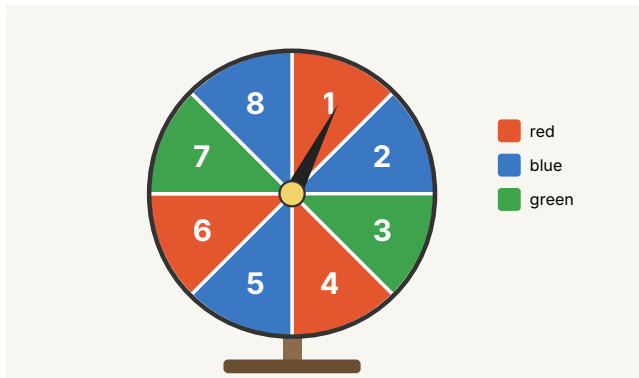
(i) $1/2$ with 100 cards: 1 mark

(ii) $9/100$: 1 mark

(iii) $2/25$: 1 mark

(iv) $3/50$: 1 mark

SECTION E — Case Study



Q21. Spinning wheel [4 marks]

From the figure: red — 1, 4, 6; blue — 2, 5, 8; green — 3, 7. There are 8 equally likely outcomes.

(i) Green sectors: 3, 7. $P(\text{green}) = \frac{2}{8} = \frac{1}{4}$.

(ii) Odd numbers: 1, 3, 5, 7. $P(\text{odd}) = \frac{4}{8} = \frac{1}{2}$.

(iii) (a) Primes: 2, 3, 5, 7. $P(\text{prime}) = \frac{4}{8} = \frac{1}{2}$. (b) Red and even: 4, 6. $P = \frac{2}{8} = \frac{1}{4}$.

Answer: (i) $\frac{1}{4}$ (ii) $\frac{1}{2}$ (iii) (a) $\frac{1}{2}$, (b) $\frac{1}{4}$

Marking scheme:

(i) $1/4$: 1 mark

(ii) $1/2$: 1 mark

(iii)(a) $1/2$: 1 mark; (b) $1/4$: 1 mark

Final Answer Summary

Q	Final answer	Q	Final answer
Q1	(C) 1.2	Q12	$\frac{7}{50}, \frac{4}{25}$
Q2	(B) 0.64	Q13	$\frac{3}{13}, \frac{9}{13}$
Q3	(D) $\frac{1}{2}$	Q14	$\frac{23}{25}, \frac{184}{199}$
Q4	(B) $\frac{1}{26}$	Q15	$\frac{1}{6}, \frac{1}{12}$
Q5	(C) $\frac{3}{4}$	Q16	$\frac{3}{8}, \frac{1}{2}, \frac{1}{8}$
Q6	(A) $\frac{4}{11}$	Q17	$\frac{1}{9}, \frac{5}{12}, \frac{2}{9}$
Q7	(C) $\frac{1}{6}$	Q18	10; $\frac{1}{2}$
Q8	(A) 10	Q19	$\frac{1}{2}, \frac{2}{11}, \frac{1}{44}$
Q9	(A)	Q20	$\frac{1}{2}, \frac{9}{100}, \frac{2}{25}, \frac{3}{50}$
Q10	(D)	Q21	$\frac{1}{4}, \frac{1}{2}, \frac{1}{2}, \frac{1}{4}$
Q11	$\frac{2}{5}, \frac{2}{3}$		

Marks: Section A 10 + Section B 10 + Section C 12 + Section D 4 + Section E 4 = **40**

— End of Solutions —