CLASS IX – MATHEMATICS

Chapter Test: The Mathematics of Maybe – Introduction to Probability

Step-by-Step Solutions and Marking Scheme | M. M.: 40

Formulas used

Theoretical probability P(E) = (number of favourable outcomes) ÷ (number of possible outcomes), for equally likely outcomes. **Experimental probability** = (number of times the event occurred) ÷ (total number of trials). $0 \le P(E) \le 1$.

Section A (1 mark each)

Q	Ans	Reason
1	(C)	A probability always lies between 0 and 1. Since **1.2 > 1**, it cannot be a probability.
2	(B)	Primes on a die: 2, 3, 5 → 3 favourable out of 6. P = 3/6 = **1/2**.
3	(D)	Each die has 6 outcomes: n(S) = 6 × 6 = **36**.
4	(A)	STATISTICS has 10 letters; S occurs 3 times (S, T, A, T, I, S, T, I, C, S). P = **3/10**.
5	(C)	Relative frequency = 10/40 = **1/4**.
6	(A)	Total balls = 4 + 5 + 3 = 12. Not blue = 4 + 3 = 7. P = **7/12**.
7	(B)	Multiples of 3 in S: {3, 6} → 2 outcomes out of 8. P = 2/8 = **1/4**.
8	(B)	Numbers less than 4: 1, 2, 3 → 3 favourable out of 10 equal sectors. P = **3/10**.
9	(D)	Every face of a die (1 to 6) is less than 7, so ‘a number less than 7’ has probability 1: **certain**. A number greater than 6 is impossible.
10	(C)	S = {HH, HT, TH, TT}; exactly one head: HT, TH → 2/4 = **1/2**.
11	(D)	A is false: this is the Gambler’s Fallacy; the coin has no memory, so P(tails) is still 1/2. R is true. → **(D)**.
12	(C)	A is true: BANANA has 6 letters, 3 of them A, so P = 3/6 = 1/2. R is false: the letters are not equally likely (A: 3, N: 2, B: 1), so the probability is not 1/3 each. → **(C)**.

Section B (2 marks each)

Q.13 (2 marks)

Coin outcomes: H, T. Die outcomes: 1, 2, 3, 4, 5, 6. Pair each coin outcome with each die outcome. **[½]**

S = {H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6} **[1]**

Ans. n(S) = 2 × 6 = 12. [½]

Q.14 (2 marks)

(A) Total students = 60.

(i) P(cricket) = 24/60 = **2/5**. **[1]**

(ii) P(badminton or others) = (12 + 6)/60 = 18/60 = **3/10**. **[1]**

OR (B)

Experimental probability = 36/60 = **3/5** (= 0.6). Theoretical probability = 3/6 = **1/2** (= 0.5), since the even numbers are 2, 4, 6. **[1]**

They differ because only 60 trials were done. With a larger number of trials the experimental probability tends to move closer to 1/2 (Law of Large Numbers). **[1]**

Q.15 (2 marks)

MATHEMATICS has 11 letters: M, A, T, H, E, M, A, T, I, C, S (M, A and T occur twice each). **[½]**

(i) Vowels: A, A, E, I → 4. P(vowel) = **4/11**. **[1]**

(ii) T occurs 2 times. P(T) = **2/11**. **[½]**

Q.16 (2 marks)

(A) Total outcomes = 20.

(i) Primes up to 20: 2, 3, 5, 7, 11, 13, 17, 19 → 8 numbers. P = 8/20 = **2/5**. **[1]**

(ii) Perfect squares: 1, 4, 9, 16 → 4 numbers. P = 4/20 = **1/5**. **[1]**

OR (B)

(i) **Certain** (all marbles are red). (ii) **Equally likely / even chance** (P = 1/2). **[1]**

(iii) **Impossible** (a die has only 1 to 6). (iv) **More likely** (P = 5/6). **[1]**

Section C (3 marks each)

Q.17 (3 marks)

(A) Sample size = 50.

(i) P(Science) = 14/50 = **7/25**. **[1]**

(ii) P(Mathematics) = 18/50. Estimated number in the school = 18/50 × 1200 = 18 × 24 **[1]**

Ans. = 432 students. [1]

OR (B) Total balls = 6 + 4 + 5 = 15.

(i) P(yellow) = 5/15 = **1/3**. **[1]**

(ii) Not blue = 6 + 5 = 11. P(not blue) = **11/15**. **[1]**

(iii) Red or blue = 6 + 4 = 10. P = 10/15 = **2/3**. **[1]**

Q.18 (3 marks)

(A)

Sample space S = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}, n(S) = 8. **[1]**

(i) Exactly two heads: HHT, HTH, THH → 3. P = **3/8**. **[1]**

(ii) At least one tail: all outcomes except HHH → 7. P = **7/8**. **[1]**

OR (B) Total bulbs = 500.

(i) P(less than 500 h) = 25/500 = **1/20**. **[1]**

(ii) 500 to 2000 h = 130 + 215 = 345. P = 345/500 = **69/100**. **[1]**

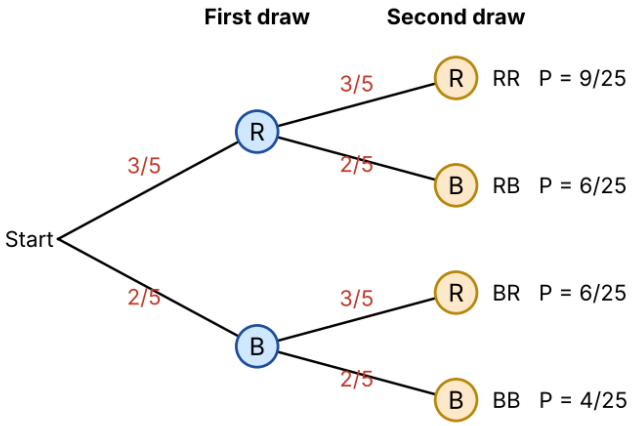
(iii) P(more than 2000 h) = 130/500 = **13/50**. **[1]**

Section D (5 marks each)

Q.19 (5 marks)

(A) With replacement: P(R) = 3/5 and P(B) = 2/5 on **both** draws.

(i) Tree diagram [2: correct branches 1, correct probabilities 1]:



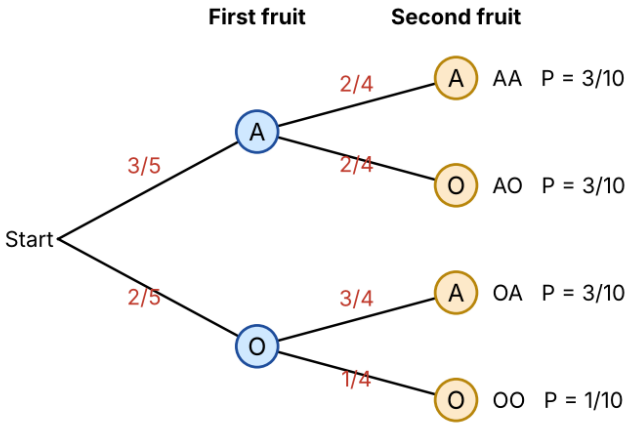
(ii) Sample space S = {RR, RB, BR, BB}. [1]

(iii) P(same colour) = P(RR) + P(BB) = 9/25 + 4/25 = **13/25**. [1]

(iv) P(exactly one red) = P(RB) + P(BR) = 6/25 + 6/25 = **12/25**. [1] *(Check: 9 + 6 + 6 + 4 = 25, so the probabilities add to 1.)*

OR (B) Without replacement: after the first pick only 4 fruits remain.

(i) Tree diagram [2: correct branches 1, correct probabilities 1]. If the first fruit is an apple, 2 apples and 2 oranges remain; if it is an orange, 3 apples and 1 orange remain.



(ii) Sample space S = {AA, AO, OA, OO}. [1]

(iii) P(same kind) = P(AA) + P(OO) = 3/10 + 1/10 = 4/10 = **2/5**. [1]

(iv) P(exactly one apple) = P(AO) + P(OA) = 3/10 + 3/10 = **3/5**. [1] *(Check: 3/10 + 3/10 + 3/10 + 1/10 = 1.)*

Q.20 (5 marks)

(A) Sample space (first die across, second die down):

	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) n(S) = 6 × 6 = **36**. [1]

(ii) Sum 9: (3,6), (4,5), (5,4), (6,3) → 4. P = 4/36 = **1/9**. [1]

(iii) Same number (doublet): (1,1), (2,2), (3,3), (4,4), (5,5), (6,6) → 6. P = 6/36 = **1/6**. [1]

(iv) Product 12: (2,6), (3,4), (4,3), (6,2) → 4. P = 4/36 = **1/9**. [1]

(v) Sum less than 4: (1,1), (1,2), (2,1) → 3. P = 3/36 = **1/12**. [1]

OR (B) Take π = 22/7.

Area of canvas = 6 × 4 = 24 m². Area of circle = π r² = 22/7 × 1 × 1 = 22/7 m² (radius = 1 m). Area of square = 2 × 2 = 4 m². **[2]**

(i) P(circle) = (22/7) ÷ 24 = 22/168 = **11/84**. **[1]**

(ii) P(square) = 4/24 = **1/6**. **[1]**

(iii) P(outside both) = 1 − 11/84 − 1/6 = 1 − 11/84 − 14/84 = 1 − 25/84 = **59/84**. **[1]**

Section E (4 marks)

Q.21 (4 marks)

Sample size = 200.

(i) P(bus) = 80/200 = **2/5**. **[1]**

(ii) Walk or cycle = 50 + 30 = 80. P = 80/200 = **2/5**. **[1]**

(iii) (A) P(car) = 40/200 = 1/5 [1]. Estimated number of students = 1/5 × 1500 = **300 students**. [1]

OR (iii) (B)

No, it would **not** be a good sample. Class 9 students do not represent all classes (younger children may come with parents by car or walk, while senior students may cycle or take the bus), so the sample is biased. [1]

To make the estimate more reliable, select students from **all classes (6 to 12)** at random, and/or use a larger sample. [1]

— End of Solutions —