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Logic: Probability Word Problems

Study Guide — Probability

Pre-med style, no-calculator probability word problems (students, dice, coins, cards, balls) covering complements, conditional probability, independence, counting, expected value, Bayes/base-rate traps, and classic reasoning setups.

75 items — Study Guide with Answers

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1 A fair six-sided die is rolled once. What is the probability of getting an even number?

- A $1/6$
- B $1/3$
- C $1/2$ ✓
- D $2/3$
- E $5/6$

► **Explanation:** Even outcomes are $\{2,4,6\}$: 3 favorable out of 6 equally likely outcomes, so $3/6 = 1/2$.



2 A fair six-sided die is rolled once. What is the probability of getting a number greater than 4 OR an even number?

- A $1/3$
- B $1/2$
- C $2/3$ ✓
- D $5/6$
- E 1

► **Explanation:** Numbers >4 are $\{5,6\}$. Even numbers are $\{2,4,6\}$. The union is $\{2,4,5,6\}$: $4/6 = 2/3$.



3 Two fair dice are rolled. What is the probability that the sum is exactly 7?

- A $1/12$
- B $1/9$





C $1/6$ ✓

D $5/36$

E $1/3$

► **Explanation:** There are 36 equally likely outcomes. Sum 7 occurs in 6 ways: (1,6),(2,5),(3,4),(4,3),(5,2),(6,1). So $6/36 = 1/6$.

4 Two fair dice are rolled. What is the probability that the sum is at least 11?



A $1/6$

B $1/12$ ✓

C $1/9$

D $1/18$

E $1/3$

► **Explanation:** Sums ≥ 11 are 11 and 12. Sum 11 has 2 outcomes, sum 12 has 1 outcome $\rightarrow 3/36 = 1/12$.

5 Two fair dice are rolled. What is the probability that at least one die shows a 6?



A $1/6$

B $5/36$

C $11/36$ ✓

D $1/2$

E $25/36$





► **Explanation:** Use the complement: $P(\text{no } 6) = (5/6)*(5/6)=25/36$, so $P(\text{at least one } 6)=1-25/36=11/36$.

6 Two fair dice are rolled. What is the probability of rolling a double (both dice show the same number)?



- A $1/12$
- B $1/6$ ✓
- C $5/36$
- D $1/3$
- E $1/2$

► **Explanation:** There are 6 doubles: (1,1) to (6,6) out of 36 outcomes, so $6/36 = 1/6$.

7 A fair coin is tossed twice. What is the probability of getting at least one head?



- A $1/4$
- B $1/2$
- C $3/4$ ✓
- D $2/3$
- E 1

► **Explanation:** Use the complement: the only way to get no heads is TT with probability $(1/2)^2=1/4$. So $P(\text{at least one head})=1-1/4=3/4$.





8 A fair coin is tossed twice. What is the probability of getting exactly one head?



- A $1/4$
- B $1/2$ ✓
- C $3/4$
- D $1/3$
- E $2/3$

► **Explanation:** Exactly one head occurs as HT or TH: 2 outcomes out of 4, so $2/4 = 1/2$.

9 A fair coin is tossed three times. What is the probability that all three tosses show the same face?



- A $1/8$
- B $1/4$ ✓
- C $3/8$
- D $1/2$
- E $3/4$

► **Explanation:** All the same means HHH or TTT: 2 outcomes out of 8 equally likely outcomes, so $2/8 = 1/4$.

10 A fair coin is tossed three times. Given that the first toss was Head, what is the probability that there are exactly two heads in total?



- A $1/4$





B $1/2$ ✓

C $3/4$

D $1/8$

E $2/3$

► **Explanation:** If the first toss is H, then among the remaining two tosses you need exactly one more H. That happens in 2 of the 4 equally likely outcomes (HT or TH), so probability $1/2$.

11 A standard 52-card deck is shuffled. One card is drawn. What is the probability the card is a heart OR a king?



A $1/4$

B $4/13$ ✓

C $1/3$

D $5/13$

E $17/52$

► **Explanation:** Hearts: 13 cards. Kings: 4 cards. Overlap: king of hearts counted twice, subtract once. So $(13+4-1)/52 = 16/52 = 4/13$.

12 A standard 52-card deck is shuffled. One card is drawn. Given that the card is red, what is the probability it is a heart?



A $1/4$

B $1/2$ ✓

C $13/52$

D $2/3$





E $3/4$

► **Explanation:** Given red, the sample space is the 26 red cards. Hearts are 13 of them, so $13/26 = 1/2$.

13 A bag contains 3 red balls and 2 blue balls. Two balls are drawn WITHOUT replacement. What is the probability both are red?



A $3/10$ ✓

B $6/25$

C $1/2$

D $2/5$

E $1/5$

► **Explanation:** Without replacement: $P(R \text{ then } R) = (3/5)*(2/4)=6/20=3/10$.

14 A bag contains 3 red balls and 2 blue balls. Two balls are drawn WITHOUT replacement. Given that the first ball drawn was red, what is the probability the second ball is red?



A $1/4$

B $1/2$ ✓

C $2/3$

D $3/4$

E $3/5$

► **Explanation:** After drawing a red first, 2 red and 2 blue remain (4 total). So $P(\text{second red}) = 2/4 = 1/2$.





15 A bag contains 3 red balls and 2 blue balls. Two balls are drawn WITHOUT replacement. What is the probability of drawing at least one red ball?



- A $1/10$
- B $3/10$
- C $9/10$ ✓
- D $4/5$
- E $2/5$

► **Explanation:** Use the complement: no red means both blue. $P(B \text{ then } B) = (2/5) * (1/4) = 2/20 = 1/10$.
So at least one red = $1 - 1/10 = 9/10$.

16 A bag contains 2 red, 2 blue, and 1 green ball. Two balls are drawn WITHOUT replacement. What is the probability the two balls are different colors?



- A $1/5$
- B $2/5$
- C $3/5$
- D $4/5$ ✓
- E $1/2$

► **Explanation:** There are $C(5,2) = 10$ pairs total. Same-color pairs: RR (1) and BB (1), total 2. So different-color pairs = $10 - 2 = 8 \rightarrow 8/10 = 4/5$.





17 A bag contains 4 white balls and 1 black ball. A ball is drawn, its color noted, then replaced. A second ball is drawn. What is the probability both draws are black?

- A $1/25$ ✓
- B $1/5$
- C $2/25$
- D $1/10$
- E $1/20$

► **Explanation:** With replacement, the draws are independent. $P(\text{black}) = 1/5$ each time, so $P(\text{two blacks}) = (1/5)^2 = 1/25$.



18 A bag contains 4 white balls and 1 black ball. Two balls are drawn WITHOUT replacement. What is the probability both draws are black?

- A 0 ✓
- B $1/25$
- C $1/5$
- D $1/10$
- E $4/25$

► **Explanation:** There is only one black ball. Without replacement you cannot draw two black balls, so the probability is 0.



19 A drawer contains 3 black socks and 3 white socks. Two socks are drawn at random WITHOUT replacement. What is the probability they are the same color?

- A $1/5$





B $2/5$ ✓

C $1/3$

D $1/2$

E $3/5$

► **Explanation:** Total pairs: $C(6,2)=15$. Same color: $C(3,2)$ black + $C(3,2)$ white = $3+3=6$. So $6/15=2/5$.

20 A drawer contains 3 black socks and 3 white socks. Two socks are drawn **WITHOUT** replacement. Given that the socks are the same color, what is the probability they are both black?



A $1/3$

B $1/2$ ✓

C $2/5$

D $3/5$

E $2/3$

► **Explanation:** Condition on "same color": the favorable same-color pairs are 3 black-pairs and 3 white-pairs, equally many. So $P(\text{black} \mid \text{same}) = 3/(3+3)=1/2$.

21 A class has 10 students: 6 girls and 4 boys. Two students are chosen at random **WITHOUT** replacement. What is the probability both are girls?



A $1/3$ ✓

B $2/5$

C $1/2$

D $4/9$





E $3/10$

► **Explanation:** $P(\text{girl then girl}) = (6/10) * (5/9) = 30/90 = 1/3$.

22 A class has 10 students: 6 girls and 4 boys. Two students are chosen at random **WITHOUT** replacement. What is the probability at least one is a girl?



A $2/15$

B $13/15$ ✓

C $1/3$

D $4/5$

E $11/15$

► **Explanation:** Use the complement: no girls means both are boys. $P(\text{boy then boy}) = (4/10) * (3/9) = 12/90 = 2/15$. So at least one girl = $1 - 2/15 = 13/15$.

23 A class has 10 students: 6 girls and 4 boys. Two students are chosen at random **WITHOUT** replacement. What is the probability exactly one is a girl?



A $8/15$ ✓

B $1/3$

C $2/3$

D $7/15$

E $4/15$

► **Explanation:** Exactly one girl means one girl and one boy: $P(\text{G then B}) + P(\text{B then G}) = (6/10)(4/9) + (4/10)(6/9) = 4/15 + 4/15 = 8/15$.





24 A teacher randomly selects 3 students from a class of 8 (all groups of 3 equally likely). What is the probability that Alex is selected?



- A $1/8$
- B $3/8$ ✓
- C $5/8$
- D $3/5$
- E $1/3$

► **Explanation:** By symmetry, each student has the same chance to be included. In a group of 3 chosen from 8, the chance a particular student is included is $3/8$.

25 From 5 students, two are chosen at random to represent the class. What is the probability that both Alice and Bob are chosen?



- A $1/10$ ✓
- B $2/5$
- C $1/5$
- D $1/4$
- E $1/2$

► **Explanation:** There are $C(5,2)=10$ possible pairs, and only 1 favorable pair (Alice & Bob), so probability = $1/10$.

26 From 6 students, a committee of 3 is chosen. What is the probability that exactly one of the two students A and B is on the committee?





- A $3/5$ ✓
- B $2/5$
- C $1/2$
- D $3/10$
- E $4/5$

► **Explanation:** Total committees: $C(6,3)=20$. Choose exactly one of $\{A,B\}$ (2 ways), and choose the other 2 members from the remaining 4: $C(4,2)=6$. Favorable = $2*6=12 \rightarrow 12/20=3/5$.

27 Four students A, B, C, D sit in a row in random order. What is the probability that A and B sit next to each other?



- A $1/3$
- B $1/2$ ✓
- C $2/3$
- D $1/4$
- E $3/4$

► **Explanation:** Total arrangements: $4!=24$. Treat AB as one block: then $3!$ arrangements of the block with C and D, and AB can be AB or BA ($*2$). So favorable = $3!*2=12 \rightarrow 12/24=1/2$.

28 Five students sit in a row in random order. What is the probability that student A sits at one of the two ends?



- A $1/5$
- B $2/5$ ✓
- C $3/5$
- D $1/2$





E $2/3$

► **Explanation:** A has 5 equally likely positions; 2 of them are ends, so probability $2/5$.

29 Five students sit in a row in random order. What is the probability that A and B are adjacent?



A $2/5$ ✓

B $1/5$

C $3/5$

D $1/2$

E $2/3$

► **Explanation:** Total arrangements: $5!=120$. Treat AB as a block: $4!$ arrangements, and AB/BA gives $*2 \rightarrow 4!*2=48$. So probability $48/120=2/5$.

30 A fair coin is tossed 5 times. What is the expected number of heads?



A 1

B 2

C 2.5 ✓

D 3

E 4

► **Explanation:** Expected value adds: each toss has $P(H)=1/2$, so expected heads = $5*(1/2)=2.5$.





31 A fair six-sided die is rolled once. What is the expected value of the number shown?



- A 3
- B 3.5 ✓
- C 4
- D 2.5
- E 7

► **Explanation:** The expected value is the average of 1 through 6: $(1+2+3+4+5+6)/6 = 21/6 = 3.5$.

32 A game: toss a fair coin once. If it lands Head you win 2 points; if Tail you lose 1 point. What is the expected score from one play?



- A 0
- B 0.5 ✓
- C 1
- D -0.5
- E 2

► **Explanation:** Expected score = $(1/2)(+2) + (1/2)(-1) = 1 - 0.5 = 0.5$ points.

33 A student flips a fair coin and gets Heads five times in a row. What is the probability the next flip is Tail?



- A $1/6$
- B $1/3$





C $1/2$ ✓

D $2/3$

E $5/6$

► **Explanation:** Coin flips are independent. Past results do not change the probability of the next flip, so $P(\text{Tail})=1/2$.

34 Two fair dice are rolled. Given that the first roll is even, what is the probability that the sum of the two rolls is 7?



A $1/12$

B $1/6$ ✓

C $1/9$

D $1/3$

E $1/18$

► **Explanation:** Condition on first being even: possible first values $\{2,4,6\}$. To sum to 7, the second must be $\{5,3,1\}$. Each required second value has probability $1/6$, so favorable outcomes are 3 out of 18 conditional outcomes $\rightarrow 1/6$.

35 Two fair dice are rolled. Given that the sum is even, what is the probability that both dice are odd?



A $1/2$ ✓

B $1/3$

C $2/3$

D $1/4$

E $3/4$





► **Explanation:** An even sum happens when both dice are even or both are odd. There are 9 odd-odd outcomes and 9 even-even outcomes, so $P(\text{odd-odd} \mid \text{even sum}) = 9/18 = 1/2$.

36 Two fair dice are rolled. Given that at least one die shows a 6, what is the probability that both dice show 6?



- A $1/6$
- B $1/11$ ✓
- C $1/12$
- D $2/11$
- E $1/36$

► **Explanation:** Condition on "at least one 6": there are 11 such outcomes (all outcomes with a 6 on either die). Only 1 of those is (6,6), so probability = $1/11$.

37 Two fair dice are rolled. Which sum is more likely: 7 or 8?



- A Sum 7 ✓
- B Sum 8
- C Equally likely
- D Neither can happen
- E Depends on the dice color

► **Explanation:** Sum 7 has 6 combinations; sum 8 has 5 combinations. More combinations means higher probability, so 7 is more likely.





38 Two fair dice are rolled. What is the probability that the product of the two numbers is even?



- A $1/4$
- B $1/2$
- C $3/4$ ✓
- D $2/3$
- E $5/6$

► **Explanation:** The product is odd only if both dice are odd. $P(\text{both odd}) = (3/6)^2 = 1/4$, so $P(\text{product even}) = 1 - 1/4 = 3/4$.

39 Two fair dice are rolled. What is the probability that the maximum of the two numbers is exactly 4?



- A $1/9$
- B $1/6$
- C $7/36$ ✓
- D $1/4$
- E $1/3$

► **Explanation:** $P(\text{max}=4) = P(\text{both} \leq 4) - P(\text{both} \leq 3) = (4/6)^2 - (3/6)^2 = 16/36 - 9/36 = 7/36$.

40 Two fair dice are rolled. What is the probability that the minimum of the two numbers is exactly 2?



- A $1/4$ ✓





- B $1/6$
- C $7/36$
- D $5/36$
- E $1/3$

► **Explanation:** $P(\min=2)=P(\text{both } \geq 2)-P(\text{both } \geq 3)=(5/6)^2-(4/6)^2=25/36-16/36=9/36=1/4$.

41 A spinner has four equal sectors labeled 1, 2, 3, 4. It is spun once and a fair coin is tossed once. What is the probability of getting an even number AND a head?



- A $1/8$
- B $1/4$ ✓
- C $1/2$
- D $3/4$
- E $3/8$

► **Explanation:** Even on the spinner has probability $2/4=1/2$. Head has probability $1/2$. Independent events multiply: $(1/2)(1/2)=1/4$.

42 A student guesses answers on 2 multiple-choice questions, each with 5 options and exactly one correct answer. What is the probability they get at least one correct?



- A $1/5$
- B $9/25$ ✓
- C $16/25$
- D $2/5$





E $1/25$

► **Explanation:** Use the complement: $P(\text{get none correct}) = (4/5)^2 = 16/25$. So $P(\text{at least one correct}) = 1 - 16/25 = 9/25$.

43 A student answers 3 True/False questions by random guessing. What is the probability they get exactly 2 correct?



A $1/8$

B $3/8$ ✓

C $1/2$

D $5/8$

E $3/4$

► **Explanation:** Each question has $P(\text{correct}) = 1/2$. Exactly 2 correct in 3 means choose which 2 are correct: $C(3,2) = 3$. Probability = $3 * (1/2)^3 = 3/8$.

44 A student answers 3 True/False questions by random guessing. What is the probability they get at least 2 correct?



A $1/4$

B $3/8$

C $1/2$ ✓

D $5/8$

E $3/4$

► **Explanation:** At least 2 correct means 2 or 3 correct: $P(2) = 3/8$ and $P(3) = 1/8$, total $4/8 = 1/2$.





45 A bag contains 2 red balls and 3 blue balls. Two balls are drawn WITH replacement. What is the probability the two balls are different colors?



- A 12/25 ✓
- B 3/5
- C 4/25
- D 6/25
- E 13/25

► **Explanation:** With replacement, draws are independent. Different colors means RB or BR:
 $2*(2/5)(3/5)=12/25$.

46 A bag contains 2 red balls and 3 blue balls. Two balls are drawn WITHOUT replacement. What is the probability the two balls are different colors?



- A 3/5 ✓
- B 12/25
- C 2/5
- D 1/2
- E 4/5

► **Explanation:** Without replacement: $P(R \text{ then } B)+P(B \text{ then } R)=(2/5)(3/4)+(3/5)(2/4)=6/20+6/20=12/20=3/5$.





47 In a class of 12 students, 5 are in the chess club, 4 are in the drama club, and 2 are in both clubs. If a student is chosen at random, what is the probability they are in chess OR drama?

- A $7/12$ ✓
- B $3/4$
- C $5/12$
- D $1/2$
- E $1/6$

► **Explanation:** Use inclusion-exclusion: $|C \cup D| = |C| + |D| - |C \cap D| = 5 + 4 - 2 = 7$. Probability = $7/12$.



48 In a class of 12 students, 5 are in chess, 4 are in drama, and 2 are in both. Given that a student is in drama, what is the probability they are also in chess?

- A $1/2$ ✓
- B $2/12$
- C $2/5$
- D $7/12$
- E $1/4$

► **Explanation:** Condition on drama: 4 students are in drama, and 2 of those are also in chess. So $P(\text{chess} \mid \text{drama}) = 2/4 = 1/2$.



49 A jar contains 3 red, 2 blue, and 1 green ball. Two balls are drawn WITHOUT replacement. What is the probability of drawing exactly one red ball?





- A $3/5$ ✓
- B $1/2$
- C $2/5$
- D $4/5$
- E $3/10$

► **Explanation:** Exactly one red means one red and one non-red. Non-red count is 3. So $P=2*(3/6)(3/5)=18/30=3/5$ (or 9 favorable pairs out of 15).

50 A jar contains 3 red, 2 blue, and 1 green ball. Two balls are drawn **WITHOUT** replacement. What is the probability that both balls are non-red?



- A $1/5$ ✓
- B $2/5$
- C $3/5$
- D $1/3$
- E $1/2$

► **Explanation:** There are 3 non-red balls. Probability of drawing two non-red without replacement is $(3/6)(2/5)=6/30=1/5$ (equivalently $C(3,2)/C(6,2)=3/15=1/5$).

51 A student randomly chooses an integer from 1 to 10 inclusive. What is the probability it is divisible by 2 **OR** by 5?



- A $3/5$ ✓
- B $1/2$
- C $2/5$





D $3/10$

E $4/5$

► **Explanation:** Divisible by 2: 5 numbers. Divisible by 5: 2 numbers. Overlap (divisible by both): 10 (1 number). So union = $5+2-1=6$ numbers $\rightarrow 6/10=3/5$.

52 A student randomly chooses an integer from 1 to 6 inclusive. What is the probability it is prime?



A $1/2$ ✓

B $1/3$

C $2/3$

D $1/6$

E $5/6$

► **Explanation:** Prime numbers from 1 to 6 are 2, 3, and 5: 3 favorable out of 6 $\rightarrow 3/6=1/2$. (1 is not prime.)

53 A student randomly chooses 2 different integers from 1 to 10 (without replacement). What is the probability that both chosen numbers are even?



A $2/9$ ✓

B $1/5$

C $1/4$

D $5/9$

E $4/9$

► **Explanation:** There are 5 even numbers. Probability = $C(5,2)/C(10,2)=10/45=2/9$.





54 A student randomly chooses 2 different integers from 1 to 10. Given that at least one chosen number is even, what is the probability that both are even?



A $2/7$ ✓

B $2/9$

C $1/2$

D $5/7$

E $1/7$

► **Explanation:** $P(\text{both even})=2/9$. $P(\text{at least one even})=1-P(\text{both odd})=1-2/9=7/9$. So $P(\text{both even} \mid \text{at least one even})=(2/9)/(7/9)=2/7$.

55 In a very large school, $2/5$ of students are left-handed. A computer randomly selects a student, records handedness, and then selects again with replacement (3 selections total). What is the probability that at least one selected student is left-handed?



A $98/125$ ✓

B $27/125$

C $2/5$

D $3/5$

E $1/2$

► **Explanation:** With replacement the selections are independent. $P(\text{no left-handed in 3 picks})=(3/5)^3=27/125$. So $P(\text{at least one left-handed})=1-27/125=98/125$.





56 A fair die is rolled 3 times. What is the probability of getting at least one 6?



- A 91/216 ✓
- B 125/216
- C 1/6
- D 1/2
- E 1/3

► **Explanation:** Use the complement: $P(\text{no 6 in 3 rolls}) = (5/6)^3 = 125/216$. So $P(\text{at least one 6}) = 1 - 125/216 = 91/216$.

57 A fair die is rolled 4 times. What is the probability that no 6 appears?



- A 625/1296 ✓
- B 671/1296
- C 1/6
- D 5/36
- E 25/36

► **Explanation:** Each roll has probability 5/6 of not being a 6. With independence: $(5/6)^4 = 625/1296$.

58 Two fair coins are tossed. Let A be the event "the first coin is Head" and B be the event "the second coin is Head". Which statement is correct?



- A A and B are independent ✓
- B A and B are mutually exclusive





- C A implies B
- D B implies A
- E A and B cannot happen together

► **Explanation:** The two tosses do not affect each other. $P(A \text{ intersection } B) = P(HH) = 1/4$ equals $P(A)P(B) = (1/2)(1/2) = 1/4$, so A and B are independent (not mutually exclusive).

59 Two fair coins are tossed. Let A be "at least one Head" and B be "at least one Tail". Are A and B independent?



- A Yes, independent
- B No, not independent ✓
- C Yes, because A implies B
- D Yes, because B implies A
- E They are mutually exclusive

► **Explanation:** $P(A) = 3/4$ and $P(B) = 3/4$, but $P(A \text{ intersection } B) = P(HT \text{ or } TH) = 1/2$. Since $1/2 \neq (3/4)(3/4) = 9/16$, the events are not independent. They are also not mutually exclusive because both can occur.

60 In a school, 60% of students take Biology, 50% take Chemistry, and 30% take both. What is the probability a randomly chosen student takes at least one of these subjects?



- A 1/5
- B 1/2
- C 4/5 ✓
- D 3/5
- E 9/10





► **Explanation:** Use inclusion-exclusion: $P(B \cup C) = 0.6 + 0.5 - 0.3 = 0.8 = 4/5$. The trap is adding 0.6 and 0.5 without subtracting the overlap.

61 In a school, 60% of students take Biology, 50% take Chemistry, and 30% take both. What is the probability a randomly chosen student takes neither Biology nor Chemistry?



- A 1/5 ✓
- B 1/2
- C 4/5
- D 3/5
- E 2/5

► **Explanation:** From the previous result, $P(\text{at least one}) = 0.8$. So $P(\text{neither}) = 1 - 0.8 = 0.2 = 1/5$.

62 A screening test is used in a school. 10% of students have a condition. The test detects the condition correctly 90% of the time, and has a 10% false-positive rate. If a student tests positive, what is the probability they actually have the condition?



- A 1/2 ✓
- B 9/10
- C 1/10
- D 1/5
- E 2/3

► **Explanation:** Out of 100 students: 10 have the condition \rightarrow 9 test positive. 90 do not \rightarrow 9 false positives. So positives are 18 total, and 9 are true $\rightarrow 9/18 = 1/2$. Base rate matters.





63 A condition affects 20% of students. A test detects it correctly 90% of the time, and has a 20% false-positive rate. If a student tests positive, what is the probability they have the condition?



- A 9/17 ✓
- B 1/2
- C 9/10
- D 3/5
- E 8/17

► **Explanation:** Use Bayes reasoning with easy numbers: True positives = $0.20 \times 0.90 = 0.18$. False positives = $0.80 \times 0.20 = 0.16$. So $P(\text{condition} | +) = 0.18 / (0.18 + 0.16) = 18/34 = 9/17$.

64 In a school, 60% of students take the bus. 10% of bus riders are late. Among students who do NOT take the bus, 5% are late. If a student is late, what is the probability they took the bus?



- A 3/4 ✓
- B 2/3
- C 1/2
- D 3/5
- E 1/4

► **Explanation:** $P(\text{bus and late}) = 0.6 \times 0.1 = 0.06$. $P(\text{not bus and late}) = 0.4 \times 0.05 = 0.02$. Total late = 0.08. So $P(\text{bus} | \text{late}) = 0.06 / 0.08 = 3/4$.





65 A bag contains balls numbered 1, 2, 3, 4, 5. Two balls are drawn WITHOUT replacement. What is the probability that their sum is 6?



- A $1/5$ ✓
- B $2/5$
- C $1/10$
- D $1/2$
- E $3/10$

► **Explanation:** Possible pairs from 1-5: $C(5,2)=10$. Sums to 6 occur for (1,5) and (2,4) only \rightarrow 2 favorable pairs. Probability $2/10=1/5$.

66 Balls numbered 1-5 are in a bag. Two are drawn without replacement. Given that the sum is 6, what is the probability that one of the numbers is 1?



- A $1/2$ ✓
- B $1/5$
- C $2/5$
- D $1/10$
- E $2/3$

► **Explanation:** Given sum 6, the only possible pairs are (1,5) and (2,4), equally likely. Only one contains 1, so the probability is $1/2$.

67 A student picks one die at random from a box containing two identical fair dice, then rolls it once. What is the probability of rolling a 6?



- A $1/6$ ✓





- B $1/3$
- C $1/12$
- D $2/6$
- E $5/6$

► **Explanation:** Choosing between identical fair dice changes nothing. By total probability, $P(6) = P(\text{die1}) * 1/6 + P(\text{die2}) * 1/6 = 1/6$.

68 A biased coin lands Heads with probability $2/3$. It is tossed twice. What is the probability of getting exactly one head?



- A $4/9$ ✓
- B $1/9$
- C $2/3$
- D $5/9$
- E $2/9$

► **Explanation:** Exactly one head occurs as HT or TH: $2 * (2/3)(1/3) = 4/9$.

69 A biased coin lands Heads with probability $2/3$. It is tossed twice. What is the probability of getting at least one head?



- A $8/9$ ✓
- B $4/9$
- C $2/3$
- D $1/9$
- E $7/9$





► **Explanation:** Use the complement: no heads means TT with probability $(1/3)^2=1/9$. So at least one head = $1-1/9=8/9$.

70 A fair die is rolled until a 6 appears. What is the probability that the first 6 occurs on the second roll?



- A 5/36 ✓
- B 1/6
- C 1/36
- D 25/36
- E 5/6

► **Explanation:** First 6 on the second roll means: first roll is not 6 ($5/6$) and second roll is 6 ($1/6$). Multiply: $(5/6)(1/6)=5/36$.

71 Names Ana, Ben, Cam, Dee are in a hat. Three different names are drawn **WITHOUT** replacement. What is the probability that Ana is drawn exactly once?



- A 3/4 ✓
- B 1/4
- C 1/2
- D 1
- E 0

► **Explanation:** Without replacement, Ana can be drawn at most once. So "exactly once" is the same as "Ana is included in the 3 names." The only way she isn't included is if Ben, Cam, and Dee are drawn, which happens with probability $1/4$. So the answer is $1-1/4=3/4$.





72 A box contains 3 coins: two fair coins and one double-headed coin. A coin is chosen at random and tossed once. It lands Heads. What is the probability the chosen coin was the double-headed coin?



- A $1/2$ ✓
- B $1/3$
- C $2/3$
- D $3/4$
- E $1/4$

► **Explanation:** Let DH be the double-headed coin. $P(\text{DH})=1/3$ and $P(\text{H}|\text{DH})=1$. $P(\text{H}|\text{fair})=1/2$ and $P(\text{fair})=2/3$. So $P(\text{H})=1/3 + (2/3)(1/2)=2/3$. Thus $P(\text{DH}|\text{H})=(1/3)/(2/3)=1/2$.

73 In a school, 70% of students pass Math. Among those who pass Math, 60% pass Physics. Among those who fail Math, 20% pass Physics. What is the probability a randomly chosen student passes Physics?



- A $12/25$ ✓
- B $3/5$
- C $2/5$
- D $24/25$
- E $7/10$

► **Explanation:** Use total probability: $P(\text{P})=P(\text{P}|\text{M})P(\text{M})+P(\text{P}|\text{not M})P(\text{not M})=0.6*0.7+0.2*0.3=0.42+0.06=0.48=12/25$.





74 A game show has 3 boxes: one contains a prize and two are empty. You pick one box. The host (who knows the prize location) opens one of the other two boxes and shows it is empty. You may switch to the remaining unopened box. If you switch, what is your probability of winning the prize?

- A $1/3$
- B $1/2$
- C $2/3$ ✓
- D $3/4$
- E 1

► **Explanation:** Your first pick is correct with probability $1/3$. With probability $2/3$ you initially picked an empty box; then the host is forced to open the other empty box, and switching wins. So switching wins with probability $2/3$.



75 In a large school, $1/10$ of students are left-handed and $1/5$ wear glasses. Assume these traits are independent. What is the probability a randomly chosen student is both left-handed AND wears glasses?

- A $1/50$ ✓
- B $1/15$
- C $1/2$
- D $1/10$
- E $1/5$

► **Explanation:** For independent events, multiply probabilities: $P(L \text{ and } G) = P(L)P(G) = (1/10)(1/5) = 1/50$.

