

**Algebra 2 Trig Honors**  
**Probability mix up**

1. A standard die is to be rolled until a 6 comes up. What is the probability that at least 4 rolls are needed?

$$F F F \quad \left(\frac{5}{6}\right)\left(\frac{5}{6}\right)\left(\frac{5}{6}\right) = \frac{125}{216}$$

2. Each of 4 students is to write one of the letters C,H,E,M,I,S,T,R,Y on a card. If these students choose their letters at random, what is the probability that at least 2 of them write the same letter?

$$1 - P(\text{not same letter}) = 1 - \frac{9 \cdot 8 \cdot 7 \cdot 6}{9 \cdot 9 \cdot 9 \cdot 9} = \frac{131}{243}$$

3. The probability that A occurs is 0.3, the probability that B occurs is 0.4, and the probability that A or B occurs is 0.5. If B occurs, what is the probability that A occurs?

$$P(A|B) = \frac{P(A+B)}{P(B)} = \frac{.2}{.4} = \frac{1}{2}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A+B)$$

$$.5 = .3 + .4 - x$$

$$.2 = x$$

4. A baseball player's batting average may be assumed to be the probability of his getting a hit when he is batting. Suppose Mickey's batting average is 0.300. If he bats four times in a game, what is the probability that he will get at least one hit?

$$1 - P(\text{no hits}) = 1 - .7^4 = 0.7599$$

5. Suppose a company has 1,000 employees, 600 are male, and 750 are married. Four hundred fifty of the male employees are married. If an employee is selected at random, what is the probability that the employee is female or married?

600 male	750 married	$P(\text{F or married}) = P(F) + P(\text{married}) - P(F + \text{married})$
400 female	250 not married	
300 female + married	← 450 male + married	$= \frac{400}{1000} + \frac{750}{1000} - \frac{300}{1000} = 0.85$

6. The probability that the temperature is above 70 degrees outside is 0.387, the probability that it is raining is 0.148, and the probability that it is both above 70 degrees outside and raining is 0.036. If it is raining, find the probability that the temperature is below or equal to 70 degrees.

$$P(\text{below} + \text{raining}) = .148 - .036 = .112$$

$$P(\text{below} | \text{raining}) = \frac{P(\text{below} + \text{raining})}{P(\text{raining})} = \frac{.112}{.148} = \frac{28}{37}$$

7. Sheila is playing a game in which she rolls three standard six-sided dice, two of which are red and one of which is blue. If the sum on the red dice is at least nine, then what is the probability that the sum on all three dice is at least thirteen?

Red dice	
Roll 9	4 ways
10	3 ways
11	2 ways
12	1 way

Blue dice	
must be at least 4	1/2
at least 3	2/3
at least 2	5/6
anything	1

$$\frac{4}{10} \cdot \frac{1}{2} + \frac{3}{10} \cdot \frac{2}{3} + \frac{2}{10} \cdot \frac{5}{6} + \frac{1}{10} = \frac{2}{3}$$

8. A deck of 52 cards has 13 cards in each of four suits: clubs, diamonds, hearts, spades. If two cards are drawn at random (without replacement), what is the probability that they are the same suit?

$$\frac{1 \cdot 12}{51} = \frac{4}{17}$$

9. It is known that 30% of all people own dogs and, independently, 40% of all people own cats. In a survey, 60% of people who only own dogs say they need a pet hair vacuum cleaner, 75% of people who only own cats say they need one, and 90% of those who own both a dog and a cat say they need one. Pete buys a vacuum cleaner that is specifically designed for cat and dog hair. What is the probability that Pete owns cats (with or without dogs)? Answer as a decimal to the nearest thousandth.

$$\begin{aligned} 30\% \cdot 40\% &= 12\% \text{ own both} \rightarrow 90\% \text{ vacuum} && .108 \\ 18\% \text{ dog only} &\rightarrow 60\% && .108 \\ 28\% \text{ cat only} &\rightarrow 75\% && .21 \\ 42\% \text{ neither} &&& \end{aligned}$$

$$P(\text{cats} | \text{vacuum}) = \frac{(.108 + .21)}{.426} = 0.746$$

10. A person repeatedly picks a card from a standard 52-card deck and puts it back. What is the probability that the person will draw the Ace of spades for the first time on his third card draw? Give your answer as a decimal rounded to the nearest thousandth.

$$\frac{51}{52} \cdot \frac{51}{52} \cdot \frac{1}{52} = 0.018$$

11. There are the same number of people age 25-34 as there are age 35-44. Of the people age 25-34, 66.4% of them are registered to vote. Of the people age 35-44, 69.9% of them are registered to vote. If somebody not registered to vote is selected randomly from the 25-44 age group, what is the probability that the person is in the 25-34 age range? Give your answer as a percent rounded to the nearest tenth.

$$\begin{array}{l}
 25-34 \times \begin{cases} 66.4\% \text{ R} \\ 33.6\% \text{ NR} \end{cases} \\
 35-44 \times \begin{cases} 69.9\% \text{ R} \\ 30.1\% \text{ NR} \end{cases}
 \end{array}
 \quad
 P(25-34 | \text{NR}) = \frac{.336}{.301 + .336} = 0.527$$

12. According to an insurance company's actuarial tables, the probability of a 35 year old living to 75 is 0.57, and the probability of a 45 year old living to 85 is 0.43. If Tom is 35 and Alex is 45, what is the probability that at least one will be alive in 30 years?

$$\begin{aligned}
 1 - P(\text{both die}) &= 1 - (.43)(.57) \\
 &= 0.755
 \end{aligned}$$

13. In a tennis tournament the odds of Ashe beating Boris is 3 to 2 for a single game. The first player to win 2 games wins the match. What is the probability that Boris will win the match?

$$\begin{array}{l}
 \text{Ashe } 3/5 \quad \text{BB} \quad \text{ABB} \quad \text{BAB} \\
 \text{Boris } 2/5 \quad (2/5)^2 + 3/5 \cdot (2/5)^2 + 2/5 \cdot 3/5 \cdot 2/5 = \frac{44}{125}
 \end{array}$$

14. Tom is taking a multiple choice test with 5 choices for an answer. Assume that if he knows the correct answer then he will write it. If he doesn't know the correct answer then he will just guess at random and be correct one fifth of the time. Assume he knows 70% of the correct answers. Suppose he gets an answer to a problem, say #38, correct what is the probability he didn't know the answer to this problem and just guessed correctly?

$$\begin{array}{l}
 .7 \text{ knows} \\
 .3 \text{ Doesn't know} \\
 \quad .2 \text{ correct} \\
 \quad .8 \text{ not correct}
 \end{array}
 \quad
 P(\text{doesn't know} | \text{correct}) = \frac{.06}{.7 + .06} = 0.079$$