## Section 9.7 Probability

### Solutions to Even-Numbered Exercises

**2.** {2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12}

**4.** {(red, red), (red, blue), (red, black), (blue, blue), (blue, black)}

**6.** {SSS, SSF, SFS, FSS, SFF, FFS, FSF, FFF}

**8.** $E = \{\text{HHH, HHT, HTH, HTT}\}$

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{8} = \frac{1}{2}$$

**10.** $E = \{\text{HHH, HHT, HTH, THH}\}$

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{8} = \frac{1}{2}$$

**12.** The probability that the card is *not* a face card is the complement of getting a face card. (See Exercise 11.)

$$P(E') = 1 - P(E) = 1 - \frac{3}{13} = \frac{10}{13}$$

**14.** There are 8 possible cards in each of 4 suits: $8 \cdot 4 = 32$

$$P(E) = \frac{n(E)}{n(S)} = \frac{32}{52} = \frac{8}{13}$$

**16.** $E = \{(2, 6), (3, 5), (3, 6), (4, 4), (4, 5), (4, 6), (5, 3), (5, 4), (5, 5), (5, 6), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$

$$P(E) = \frac{n(E)}{n(S)} = \frac{15}{36} = \frac{5}{12}$$

**18.** $E = \{(1, 1), (1, 2), (2, 1), (6, 6)\}$

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{36} = \frac{1}{9}$$

**20.** $E = \{(1, 1), (1, 2), (1, 4), (1, 6), (2, 1), (2, 3), (2, 5), (3, 2), (3, 4), (3, 6), (4, 1), (4, 3), (4, 5), (5, 2), (5, 4), (5, 6), (6, 1), (6, 3), (6, 5)\}$

$$P(E) = \frac{n(E)}{n(S)} = \frac{19}{36}$$

**22.** $P(E) = \dfrac{{}_2C_2}{{}_6C_2} = \dfrac{1}{15}$

**24.**
$$P(E) = \frac{{}_1C_1 \cdot {}_2C_1 + {}_1C_1 \cdot {}_3C_1 + {}_2C_1 \cdot {}_3C_1}{{}_6C_2} = \frac{2 + 3 + 6}{15} = \frac{11}{15}$$

**26.** $P(E') = 1 - P(E) = 1 - p = 1 - 0.36 = 0.64$

**28.** $P(E') = 1 - P(E) = 1 - \dfrac{5}{6} = \dfrac{1}{6}$

**30.** $P(E) = 1 - P(E') = 1 - p = 1 - 0.84 = 0.16$

**32.** $P(E) = 1 - P(E') = 1 - \dfrac{59}{100} = \dfrac{41}{100}$

**34.** (a) $0.33(111) = 36.63$ million $= 36{,}630{,}000$

(b) 0.27

(c) $0.29 + 0.27 = 0.56$

**36.** (a) $\frac{34}{100} = 0.34$

(b) $\frac{45}{100} = 0.45$

(c) $\frac{23}{100} = 0.23$

**38.** (a) $\frac{48 + 56}{128} = \frac{104}{128} = \frac{13}{16}$

(b) $\frac{4 + 20}{128} = \frac{24}{128} = \frac{3}{16}$ $\left[\text{Note: } 1 - \frac{13}{16} = \frac{3}{16}\right]$

(c) $\frac{4}{128} = \frac{1}{32}$

**40.** $\frac{54}{31 + 54 + 42 + 20 + 47 + 58} = \frac{54}{252} = \frac{3}{14}$

**42.** (a) $\frac{{}_6C_5}{{}_8C_5} = \frac{6}{56} = \frac{3}{28}$

(b) $\frac{{}_6C_4 \cdot {}_2C_1}{{}_8C_5} = \frac{15 \cdot 2}{56} = \frac{15}{28}$

(c) $\frac{3}{28} + \frac{15}{28} = \frac{18}{28} = \frac{9}{14}$

**44.** Total ways to insert paychecks: $5! = 120$ ways

5 correct: 1 way

4 correct: not possible

3 correct: 10 ways

2 correct: 20 ways

1 correct: 45 ways

0 correct: 44 ways

(a) $\frac{45}{120} = \frac{3}{8}$

(b) $\frac{45 + 20 + 10 + 1}{120} = \frac{19}{30}$

**46.** (a) $\frac{({}_8C_2)({}_{100}C_5)}{{}_{108}C_7} = 0.0756$

(b) $\frac{({}_8C_2)({}_{25}C_2)({}_{25}C_3)}{{}_{108}C_7} \approx 6.929 \times 10^{-4}$

**48.** $\frac{{}_{13}C_1 \cdot {}_4C_3 \cdot {}_{12}C_1 \cdot {}_4C_2}{{}_{52}C_5} = \frac{13 \cdot 4 \cdot 12 \cdot 6}{2{,}598{,}960}$

$= \frac{3744}{2{,}598{,}960}$

$= \frac{6}{4165}$

**50.** (a) $\frac{{}_{16}C_5}{{}_{20}C_5} = \frac{4368}{15{,}504} = \frac{91}{323} \approx 0.282$ (5 good units)

(b) $\frac{{}_{16}C_4 \cdot {}_4C_1}{{}_{20}C_5} = \frac{1820 \cdot 4}{15{,}504} = \frac{455}{969} \approx 0.470$ (4 good units)

(c) The probability is 1 because there are only 4 defective units.

**52.** (a) $P(EE) = \frac{20}{40} \cdot \frac{20}{40} = \frac{1}{4}$

(b) $P(EO \text{ or } OE) = 2\left(\frac{20}{40}\right)\left(\frac{20}{40}\right) = \frac{1}{2}$

(c) $P(N_1 < 30, N_2 < 30) = \frac{29}{40} \cdot \frac{29}{40} = \frac{841}{1600}$

(d) $P(N_1N_1) = \frac{40}{40} \cdot \frac{1}{40} = \frac{1}{40}$

**54.** (a) $P(AA) = (0.90)^2 = 0.81$

(b) $P(NN) = (0.10)^2 = 0.01$

(c) $P(A) = 1 - P(NN) = 1 - 0.01 = 0.99$

**56.** (a) $P(BBBB) = \left(\frac{1}{2}\right)^4 = \frac{1}{16}$

(b) $P(BBBB) + P(GGGG) = \left(\frac{1}{2}\right)^4 + \left(\frac{1}{2}\right)^4 = \frac{1}{8}$

(c) $P(\text{at least one boy}) = 1 - P(\text{no boys})$

$= 1 - P(GGGG) = 1 - \frac{1}{16} = \frac{15}{16}$

**58.** $(0.78)^3 = 0.474552$

**60.** (a) If the *center* of the coin falls within the circle of radius $d/2$ around a vertex, the coin will cover the vertex.

$$P(\text{coin covers a vertex}) = \frac{\text{Area in which coin may fall so that it covers a vertex}}{\text{Total area}}$$

$$= \frac{n\left[\pi\left(\frac{d}{2}\right)^2\right]}{nd^2} = \frac{1}{4}\pi$$

(b) Experimental results will vary.

**62.** False. The first sentence is true, but the second is false. The complement is to roll a number greater than 2, and its probability is $\frac{2}{3}$.

**64.** If a weather forecast indicates that the probability of rain is 40%, this means the meteorological records indicate that over an extended period of time with similar weather conditions it will rain 40% of the time.

**66.** $\dfrac{3}{2x+3} - 4 = \dfrac{-1}{2x+3}$

$$\frac{4}{2x+3} = 4$$

$$1 = 2x + 3$$

$$2x = -2$$

$$x = -1$$

**68.** $\dfrac{2}{x} - \dfrac{5}{x-2} = \dfrac{-13}{x^2-2x} = \dfrac{-13}{x(x-2)}$

$$2(x-2) - 5(x) = -13$$

$$-3x = -9$$

$$x = 3$$

**70.** $3 - 4\ln x = 6$

$$4\ln x = -3$$

$$\ln x = -\tfrac{3}{4}$$

$$x = e^{-3/4} \approx 0.4724$$

**72.** $5\ln 2x - 4 = 11$

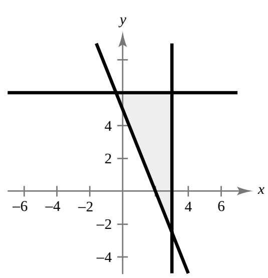
$$\ln 2x = 3$$

$$2x = e^3$$

$$x = \tfrac{1}{2}e^3 \approx 10.0428$$

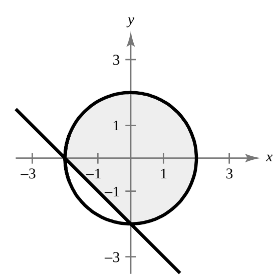
**74.**

$$x \le 3$$
$$y \le 6$$
$$5x + 2y \ge 10$$




**76.** $x^2 + y^2 \le 4$ circle

$$x + y \ge -2$$




**78.** ${}_9C_5 = 126$

**80.** ${}_{16}C_{13} = 560$