SOLUTIONS TO 3.4

2, 3, 4, 6, 9, 12, 16, 22, 28, 36, 41, 46, 49, 50, 53, 60, 63, 66, 68

2. \( 9! = 362,880 \)
3. \( 14! \approx 87,178,291,000 \)
4. \( 8! = 40,320; \ 7! \cdot 3 = 15,120 \) (there are only 3 choices for the last character)
6. A given circle arrangement can be cut open in any of 6 places to form 6 different lines, so there are 6 times as many lines as circles, and there are 6! different lines. Hence there are \( 6!/6 \) different circles. \( 6!/6 = 5! = 120 \).
9. \( 19! \)
12. \( 19!/19 = 18! \) (see the explanation for Exercise 6.)
16. \( C(300, 25) = \frac{300!}{25!275!} \)
22. \( C(3, 1) \cdot C(30, 5) \) (1 from marketing, 5 from non-accounting and non-marketing)
28. \( 4 \cdot C(13, 2) \cdot C(13, 1) \cdot C(13, 1) \cdot C(13, 1) \) (pick the suit that has 2 cards, select the 2 cards, then select the 1 from each remaining suit)
36. \( C(16, 8) \cdot C(32, 6) \)
41. \( C(5, 4) + C(7, 4) = 5 + 35 = 40 \)
46. \( C(2, 1) \cdot C(58, 6) \)
49. no Democrats + no Republicans - all independents (so as not to count twice)
   \[ = C(7, 3) + C(9, 3) - C(4, 3) = 115 \]
50. all committees - (those without both) = 220 - 115 (from Exercises 47 and 49) = 105
53. all - both = \( C(14, 6) - C(12, 4) = 2508 \)
   or
   neither + exactly one = \( C(12, 6) + C(2, 1) \cdot C(12, 5) \)
60. a. \( \frac{12!}{4!2!2!} \)
   b. \( \frac{11!}{4!2!} \)
63. \( C(7, 5) \)
66. \( C(26, 12) \)

68. a. \( C(10, 8) \)
   b. \( C(7, 5) \) (3 of the 8 objects are fixed, choose the remaining 5 from among 3, with repetitions)
   c. \( C(9, 8) \) (choose 8 from 2 with repetitions)
   d. \( C(8, 6) \) (2 of the 8 objects are fixed, choose the remaining 6 from among 3, with repetitions)
   e. \( C(9, 8) + C(8, 7) + C(7, 6) \) (zero chocolate chip cookies used - choose 8 from 2 with repetitions) + (one chocolate chip cookie used - choose remaining 7 from among 2 with repetitions) + (two chocolate chip cookies used - choose remaining 6 from among 2 with repetitions)