placed on the shelf with the remaining three books. This gives us, in effect, four "books" to arrange, one of them being the set of three. There are then 4 choices for the left-hand book, 3 for the next, and so on, making $4 \cdot 3 \cdot 2 \cdot 1 = 24$ arrangements. Hence, by the fundamental principle, there are $(6)(24) = 144$ ways to arrange the books.

If the three-volume set can be arranged in only one way, as might be the case if they were volumes 1, 2, and 3 of one book, then the total number of admissible arrangements would be only $(1)(24) = 24$.

Exercises [A]

1. In how many ways can 3 people take seats in a row of 7 chairs?

2. In how many ways can a consonant and then a vowel be chosen from the letters *c, o, a, s, t*? Draw a tree graph to represent the possible choices.

3. Four boys start a club. They want to choose a president, a vice-president, and a treasurer. In how many ways can this be done if nobody may hold more than one office?

4. If 5 swimmers compete in a race, in how many ways can the first 3 places be won? Neglect the possibility of ties.

5. If a cafeteria offers 3 choices of appetizer, 4 of main course, 3 of dessert, and 3 of beverage, how many different complete meals are available?

6. A combination lock has 4 dials with 10 digits on each dial. How many combinations are possible?

7. How many odd numbers of 3 digits can be written using the digits 1, 2, 3, 4 without repetition? Draw a tree graph to illustrate the possible choices.

8. How many 3-digit numbers can be written using the digits 0, 1, 2, 3 without repetition? Draw a tree graph.

9. How many 3-letter "words" can be made using the letters *a, b, c, d, e* (**a**) without repetition? (**b**) if repetition is allowed? (In exercises of this kind any arrangement of letters counts as a word.)

10. How many 3-letter words can be made using the letters of the English alphabet (**a**) without repetition? (**b**) if repetition is allowed? (Leave your answers as indicated products; don't multiply out.)

11. (a) In how many ways can 3 letters be mailed if there are 5 mailboxes available?

(b) In how many ways can r letters be mailed if there are n mailboxes available?

12. In how many ways can 5 people line up for service in a cafeteria if 2 of them insist on standing together?

13. In how many ways can 4 people take places for a drive in a 5-passenger car if (a) any of them can drive? (b) only 2 of them can drive?

14. A family of six has two rows of three seats each in an airplane. In how many ways can they be seated so that the two youngest children have the two window seats?

15. In an 8-oared crew, 4 men row port and 4 row starboard. If 2 out of 8 oarsmen can only row port and 3 can only row starboard, in how many ways can the 8 be assigned to positions in a boat?

16. How many 5-digit numbers are there in which the sum of the first and last digits is 6?

17. (a) In how many ways can a consonant and a vowel be selected from the English alphabet of 21 consonants and 5 vowels?

(b) Given one consonant and one vowel, in how many ways can they be arranged to form a two-letter word?

(c) How many two-letter words can be written, each containing one consonant and one vowel, from the alphabet of (a)?

18. How many three-letter words can be written using the letters a, b, c, d, e if repetitions are allowed but no letter may follow itself?

19. In how many arrangements of the letters a, e, i, o, u, x do the five vowels come in alphabetical order?

20. Given ten consecutive integers, in how many ways can two of them be chosen so that their sum will be odd?

Pages 472–473

1. 210 **3.** 24 **5.** 108 **7.** 12 **9.** (a) 60 (b) 125 **11.** (a) 125 (b) n^r
13. (a) 96 (b) 48 **15.** 1728 **17.** (a) 105 (b) 2 (c) 80 **19.** 6

Pages 449–451

1. (a) 8 (b) k **3.** (a) 90 (b) k^2+3k+2
5. (a) 10 (b) 1 (c) 15 (d) 190 (e) 190

Pages 454–455

1. $1+5x+10x^2+10x^3+5x^4+x^5$
3. $1-12x+60x^2-160x^3+240x^4-192x^5+64x^6$
5. $81x^4+108x^3y+54x^2y^2+12xy^3+y^4$
7. $1-7\sqrt{x}+21x-35x\sqrt{x}+35x^2-21x^2\sqrt{x}+7x^3-x^3\sqrt{x}$
9. (a) $1+12x+66x^2+220x^3+495x^4+\cdots$ (b) 1.127 (approx.)
11. $x^8+16x^7y+112x^6y^2+448x^5y^3+\cdots$ **13.** $\frac{15}{128}$ **15.** $\frac{63}{256}$

Pages 457–458

1. (a) $1+\frac{1}{2}x-\frac{1}{8}x^2+\frac{1}{16}x^3-\cdots$ (b) 1.0198 (approx.)
3. (a) $1-2x+3x^2-4x^3+\cdots$ (b) 1.0203 (approx.)
7. $1+\frac{1}{4}+\frac{3}{32}+\frac{5}{128}+\cdots$

Pages 461–463

3. Convergent **5.** Convergent **7.** 2.718 (approx.) **9.** 1.0152 (approx.)
13. -0.223 (approx.) **15.** 0.09983 (approx.) **17.** $1-\frac{x^2}{3!}+\frac{x^4}{5!}-\frac{x^6}{7!}+\cdots$
19. (b) -0.22307, 0.18227 (c) -0.32843, 0.36454, 0.69297

Chapter Review, Pages 463–466

1. (a) $-\frac{5}{2}$ (b) -35 **3.** (a) $\frac{9[1-(\frac{1}{3})^n]}{2}$ (b) $\frac{9}{2}$ **5.** (a) $\frac{7}{9}$ (b) $\frac{17}{45}$
9. (a) 0 (b) 1 (c) 0 (d) none (e) 3 (f) none **11.** $|x|<2$; $\frac{x}{2-x}$
13. (a) yes (b) no **15.** (a) $\frac{1}{3}$ (b) no
17. (a) convergent, $\frac{4}{3}$ (b) divergent (c) convergent, $\frac{2}{3}$ (d) convergent, 1
19. $x^5+10x^4+40x^3+80x^2+80x+32$
21. $2187x^7-10206x^6y+20412x^5y^2-22680x^4y^3+15120x^3y^4-6048x^2y^5+1344xy^6-128y^7$ **23.** (a) $1-\frac{1}{3}x+\frac{2}{9}x^2-\frac{14}{81}x^3+\cdots$ (b) 1.712 (approx.)
25. (a) convergent (b) divergent

Pages 472–473

1. 210 **3.** 24 **5.** 108 **7.** 12 **9.** (a) 60 (b) 125 **11.** (a) 125 (b) n^r
13. (a) 96 (b) 48 **15.** 1728 **17.** (a) 105 (b) 2 (c) 80 **19.** 6