EXAMPLE 11 Using the meaning of a power of a number, we have

$$(-2)^2 = (-2)(-2) = 4 \qquad (-2)^3 = (-2)(-2)(-2) = -8$$
$$(-2)^4 = 16 \qquad (-2)^5 = -32 \qquad (-2)^6 = 64 \qquad (-2)^7 = -128$$

EXAMPLE 12 A wire made of a special alloy has an electric resistance R (in Ω) given by $R = a + 0.0115T^3$, where T (in °C) is the temperature (between -4°C and 4°C). Find R for $a = 0.838\ \Omega$ and $T = -2.87$°C.

Substituting these values, we have

$$R = 0.838 + 0.0115(-2.87)^3 \qquad \text{estimation:}$$
$$= 0.566\ \Omega \qquad 0.8 + 0.01(-3)^3 = 0.8 + 0.01(-27) = 0.53$$

Note in the estimation that $(-3)^3 = -27$.

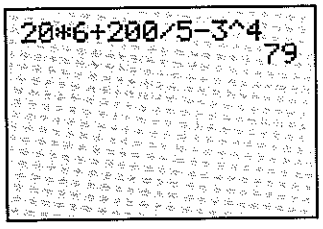

Fig 1.9

Graphing calculators generally use computer symbols in the display for some of the operations to be performed. These symbols are as follows:

Multiplication: * Division: / Powers: ^

Therefore, to calculate the value of $20 \times 6 + 200/5 - 3^4$, we use the key sequence

20 [×] 6 [+] 200 [÷] 5 [−] 3 [^] 4

CAUTION ▶ with the result of 79 shown in the display of Fig. 1.9. ***Note carefully that* 200 *is divided only by* 5.** If it were divided by $5 - 3^4$, then we would use parentheses and show the expression to be evaluated as $20 \times 6 + 200/(5 - 3^4)$.

EXERCISES 1.4

In Exercises 1–4, make the given changes in the indicated examples of this section, and then simplify the resulting expression.

1. In Example 4(a), change $(-x^2)^3$ to $(-x^3)^2$.
2. In Example 6(b), change $(2x)^0$ to $2x^0$.
3. In Example 8(d), interchange the a^3 and b^2.
4. In Example 9, change $(-1)^2$ to $(-1)^3$.

In Exercises 5–52, simplify the given expressions. Express results with positive exponents only.

5. x^3x^4
6. y^2y^7
7. $2b^4b^2$
8. $3k(k^5)$
9. $\dfrac{m^5}{m^3}$
10. $\dfrac{x^6}{x}$
11. $\dfrac{n^5}{n^9}$
12. $\dfrac{s}{s^4}$
13. $(P^2)^4$
14. $(x^8)^3$
15. $(t^5)^4$
16. $(n^3)^7$
17. $(2n)^3$
18. $(ax)^5$
19. $(nT^2)^{30}$
20. $(3a^2)^3$
21. $\left(\dfrac{2}{b}\right)^3$
22. $\left(\dfrac{F}{t}\right)^{20}$
23. $\left(\dfrac{x^2}{2}\right)^4$
24. $\left(\dfrac{3}{n^3}\right)^3$
25. 7^0
26. $(8a)^0$
27. $-3x^0$
28. $6v^0$
29. 6^{-1}
30. $-w^{-5}$
31. $\dfrac{1}{R^{-2}}$
32. $\dfrac{1}{t^{-48}}$
33. $(-t^2)^7$
34. $(-y^3)^5$
35. $(2x^2)^6$
36. $-(-c^4)^4$
37. $(4xa^{-2})^0$
38. $3(LC^{-1})^0$
39. $-\dfrac{b^{-3}}{b^{-5}}$
40. $2i^{40}i^{-70}$
41. $\dfrac{2v^4}{(2v)^4}$
42. $\dfrac{x^2x^3}{(x^2)^3}$
43. $\dfrac{(n^2)^4}{(n^4)^2}$
44. $\dfrac{(3t)^{-1}}{3t^0}$
45. $(5^0x^2a^{-1})^{-1}$
46. $(3m^{-2}n^4)^{-2}$
47. $\left(\dfrac{4x^{-1}}{a^{-1}}\right)^{-3}$
48. $\left(\dfrac{2b^2}{y^5}\right)^{-2}$
49. $(-8gs^3)^2$
50. $ax^2(-a^2x)^2$
51. $\dfrac{15n^2T^5}{3nT^6}$
52. $\dfrac{(nRT^{-2})^{32}}{R^{-2}T^{32}}$