

## 1.4 Exponents and Radicals

1)

a)  $4 \cdot 3 = 3 + 3 + 3 + 3 = 12$

b)  $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

3) By FACT 1.10, we have  $(-1)^{\text{odd power}} = -1$  and  $(-1)^{\text{even power}} = 1$ .

5)

	Answer as a Fraction	Answer as a Decimal
$10^0$	$1 = \frac{1}{1}$	1
$10^{-1}$	$\frac{1}{10^1} = \frac{1}{10}$	0.1
$10^{-2}$	$\frac{1}{10^2} = \frac{1}{10 \cdot 10} = \frac{1}{100}$	0.01
$10^{-3}$	$\frac{1}{10^3} = \frac{1}{10 \cdot 10 \cdot 10} = \frac{1}{1000}$	0.001

7)

a)  $1,089 \frac{\text{ft}}{\text{sec}} = 1.089 \cdot 10^3 \frac{\text{ft}}{\text{sec}}$

b) 484 million miles = 484,000,000 mi =  $4.84 \cdot 10^8$  mi

c) 0.000000002 m =  $2 \cdot 10^{-9}$  m

9)

a) Since there are 365 days in a year, in 100 years there are  $365 \cdot 100 = 36,500$  days. Since the temperature will warm  $3.5^\circ\text{F}$  in the next 36,500 days (100 yrs), it will warm  $\frac{3.5}{36,500} \approx 9.60 \cdot 10^{-5}$  degrees per day.  
 $9.60 \cdot 10^{-5} \frac{^\circ\text{F}}{\text{day}} = 0.000096 \frac{^\circ\text{F}}{\text{day}}$ .

b)  $270,000,000 \cdot 51 = 1.377 \cdot 10^{10}$  g of protein = 13,770,000,000 g of protein

11)

a) 10 is slightly greater than 9, so  $\sqrt{10}$  is a bit more than 3. A good answer is  $\sqrt{10} \approx 3.1$ .

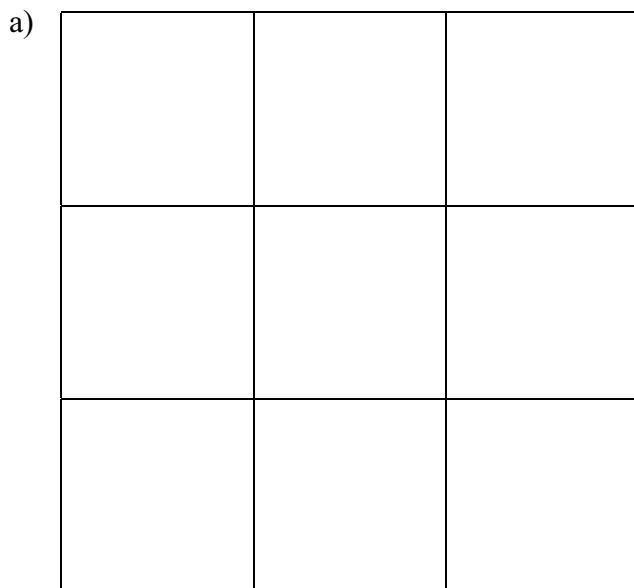
b) 42 is about halfway between  $36 = 6^2$  and  $49 = 7^2$ , so a good estimate for  $\sqrt{42}$  is 6.5.

c) 80 is slightly less than  $81 = 9^2$ , so a good estimate for  $\sqrt{80}$  is 8.9.

13)

The student's reasoning is wrong because  $5^3 = 5 \cdot 5 \cdot 5 = 125$ , whereas  $3 \cdot 5 = 5 + 5 + 5 = 15$ . Don't forget—*multiplication is repeated addition* ( $3 \cdot 5 = 5 + 5 + 5 = 15$ ), whereas *exponentiation is repeated multiplication* ( $5^3 = 5 \cdot 5 \cdot 5 = 125$ ).

15)



b) Length of each side = 3 in

c) For a square,  $A = s^2$ , where  $s$  is the length of a side. Here, since  $A = 9 \text{ in}^2$ , we have  $s^2 = 9$ , which upon solving for  $s$  requires us to take the square root of the area,  $9 \text{ in}^2$ , which is 3 in. Again, in general, for any square with area  $A$ , the length of a side of that square is  $\sqrt{A}$ .

### Skill and Review

17) The value of the 7 digit in the number 1,247,650.12 is 7,000 (or  $7 \times 10^3$ ). That is, the 7 is the thousands digit of the number.

19)

a)  $5 \frac{\text{m}}{\text{sec}} * 4.2 \text{ sec} = 21.0 \text{ m}$

b)  $7 \text{ ft} \div \frac{1}{3} \text{ min} = 7 \text{ ft} * \frac{3}{1 \text{ min}} = \frac{7*3 \text{ ft}}{1 \text{ min}} = 21 \frac{\text{ft}}{\text{min}}$

c)  $10 \frac{\text{cm}}{\text{hr}} * 92.76 \text{ hr} = 927.6 \text{ cm}$