Homework 18 Section 4.3

1. a $32 \bullet 32 = 2^5 \bullet 2^5 = 2^{5+5} = 2^{10} = 1024$
   b. $1024 \div 256 = 2^{10} \div 2^8 = 2^{10-8} = 2^2 = 4$
   c. $4096 \div 32 = 4 \bullet 1024 \div 32 = 2^2\, 2^{10} \div 2^5 = 2^{12} \div 2^5 = 2^7 = 2^{8-1} = 256 \div 2 = 128$

2. a. $2^8 \bullet 2^7 \div 2^{11} = 2^{15} \div 2^{11} = 2^4 = 16$ b. $(2^3)^5 \div 2^9 = 2^{15} \div 2^9 = 2^6 = 64$
   d. $8^5 \div 512 = (2^3)^5 \div 2^9 =$ the answer to b.
   f. $256 \times 99 = 256 \times (100 - 1) = 25600 - 256 = 25244$
   h. $80^3 = (8 \bullet 10)^3 = 8^3\, 10^3 = (2^3)^3\, 10^3 = 2^9\, 10^3 = 2 \bullet 2^3\, 10^3 = 2 \bullet 256 \bullet 10^3 = 512{,}000$

3. Primary Math 6A, page 11:
   (15) a. 9 b. 18 c. 9/5
   (16) a. 8 b. 9 c. 4 + 8 = 12
   (17) g. 47 h. 130 i. 125 – 5 = 120

4. a. $(5^2)^3 = 5^2 \bullet 5^2 \bullet 5^2 = (5 \bullet 5)\,(5 \bullet 5)\,(5 \bullet 5) = 5^{2 \bullet 3} = 5^6$
   b. $(5^2)^m = 5^2 \bullet 5^2 \bullet \bullet \bullet 5^2 = (5 \bullet 5) \bullet (5 \bullet 5) \bullet \bullet \bullet (5 \bullet 5) = 5^{2 \bullet m} = 5^{2m}$]
   c. $(a^2)^3 = a^2 \bullet a^2 \bullet a^2 = (a \bullet a)\,(a \bullet a)\,(a \bullet a) = a^{2 \bullet 3} = a^6$

5. a. $3^4\, 5^4 = (3 \bullet 3 \bullet 3 \bullet 3) \bullet (5 \bullet 5 \bullet 5 \bullet 5) = (3 \bullet 5)\,(3 \bullet 5)\,(3 \bullet 5)\,(3 \bullet 5) = (3 \bullet 5)^4 = 15^4$
   b. $3^4\, b^4 = (3 \bullet 3 \bullet 3) \bullet (b \bullet b \bullet b) = (3 \bullet b)\,(3 \bullet b)\,(3 \bullet b) = (3 \bullet b)^4 = (3b)^4$

6. a. $2^5 3^2$ b. $2^5 b^2$

   c. $\dfrac{a^5(ab)^2(ab^2)^2}{b^4(a^2)^2} = \dfrac{a^5a^2b^2a^2b^4}{b^4a^4} = \dfrac{a^9b^6}{a^4b^4} = \dfrac{a^9}{a^4} \bullet \dfrac{b^6}{b^4} = a^{9-4}\, b^{6-4} = a^5\, b^2$

   d. a=2 b=3. To see how to get the answers for parts a) and b) above, substitute the values a = 2 and b = 3 into the calculation for part c).

7. a. $\dfrac{5^3 \bullet 24^2 \bullet 10^0}{8 \bullet 15^2 \bullet 3} = \dfrac{5^3 \bullet (2^3 \bullet 3)^2 \bullet 1}{2^3 \bullet (3 \bullet 5)^2 \bullet 3} = \dfrac{2^6 \bullet 3^2 \bullet 5^3}{2^3 \bullet 3^3 \bullet 5^2} = \dfrac{2^6}{2^3} \bullet \dfrac{3^2}{3^3} \bullet \dfrac{5^3}{5^2} = 2^3 \bullet \dfrac{1}{3} \bullet 5 = 40/3$

   b. The calculation for part b is the same as in part a if you replace 5 by a, 3 by b, and c by 2.

   c. Let a = 5, b = 3, c = 2

8. a. $\dfrac{6^{21} \bullet 10^{18} \bullet 15^{22}}{30^{11} \bullet 16^7} = \dfrac{(2 \bullet 3)^{21} \bullet (2 \bullet 5)^{18} \bullet (3 \bullet 5)^{22}}{(2 \bullet 3 \bullet 5)^{11} \bullet (2^4)^7} = \dfrac{2^{21} \bullet 3^{21} \bullet 2^{18} \bullet 5^{18} \bullet 3^{22} \bullet 5^{22}}{2^{11} \bullet 3^{11} \bullet 5^{11} \bullet 2^{28}}$

$$= \frac{2^{39} \bullet 3^{43} \bullet 5^{40}}{2^{39} \bullet 3^{11} \bullet 5^{11}} = \frac{3^{43} \bullet 5^{40}}{3^{11} \bullet 5^{11}} = 3^{32} \bullet 5^{29}$$

8b. $$\frac{6^{3n} \bullet 10^{n+11} \bullet 15^{22}}{30^{11} \bullet 16^{n}} = \frac{(2 \bullet 3)^{3n} \bullet 10^{n} \bullet 10^{11} \bullet (3 \bullet 5)^{22}}{(3 \bullet 10)^{11} \bullet (2^{4})^{n}} = \frac{(2 \bullet 3)^{3n} \bullet (2 \bullet 5)^{n} \bullet 10^{11} \bullet (3 \bullet 5)^{22}}{3^{11} \bullet 10^{11} \bullet 2^{4n}}$$

$$= \frac{(2 \bullet 3)^{3n} \bullet (2 \bullet 5)^{n} \bullet (3 \bullet 5)^{22}}{3^{11} \bullet 2^{4n}} \bullet \frac{10^{11}}{10^{11}} = \frac{2^{3n} \bullet 3^{3n} \bullet 2^{n} \bullet 5^{n} \bullet 3^{22} \bullet 5^{22}}{3^{11} \bullet 2^{4n}}$$

$$= \frac{2^{3n+n} \bullet 5^{n} \bullet 5^{22}}{2^{4n}} \bullet \frac{3^{3n+22}}{3^{11}} = \frac{2^{4n} \bullet 5^{n+22}}{2^{4n}} \bullet \frac{3^{3n+22}}{3^{11}} = 3^{3n+22-11} \bullet 5^{n+22} = 3^{3n+11} \bullet 5^{n+22}$$

10. a. $1030 = 1.03 \times 10^{3}$ $15600 = 1.56 \times 10^{4}$ $345{,}000{,}000 = 3.45 \times 10^{8}$

b. Use the distributive property:

$(3.4 \times 10^{7}) + (5.2 \times 10^{7}) = (3.4 + 5.2) \times 10^{7} = 8.6 \times 10^{7}$

$(6 \times 10^{8}) + (9.3 \times 10^{8}) = (6 + 9.3) \times 10^{8} = 15.3 \times 10^{8} = 1.53 \times 10^{9}$