1. Express the requested ratio in lowest terms, using colon notation, then tell whether it is a part-to-part or part-to-whole ratio.

(a) Four out of five dentists recommend a certain toothpaste. What is the ratio of recommenders to non-recommenders?
(b) If 350 out of every 910 people smoke, what is the ratio of non-smokers to smokers?
(c) The incidence of a certain disease is 8 out of every thousand births. What is the ratio of those who don’t have the disease to those who do?
(d) A lemonade recipe calls for \(1 \frac{1}{2}\) cups of sugar for every third of a cup of lemon juice. What is the ratio of lemon to sugar?
(e) One quart out of every two gallons of local ground water contains an unhealthy contaminant. What is the ratio of available water to contaminated water?

2. Translate each ratio below to a complete, verbal sentence.

(a) A ratio of 1:3 for boys to girls
(b) A ratio of 7:9 for dogs to cats
(c) A ratio of 4:5 for female students to students
(d) A ratio of 6:1 for people tested for a disease to those who were positive for it

3. Use a “representative sets” approach to solve each problem below:

(a) The ratio of boys to girls in a club is 1:3. If there are 24 children, how many boys are there?
(b) The ratio of boys to girls in a club is 1:3. If there are 24 girls, how many boys are there?
(c) The ratio of boys to girls in a club is 1:3. If there are 24 boys, how many children are there?
(d) The ratio of red to black pieces in a game is 7:9, with 48 pieces total. How many are red?
(e) The ratio of red to black pieces is 2:3. How many pieces are there altogether if there are 12 black ones?

4. Use and explain a scaling approach for solving these problems:

(a) Allie bought half a dozen donuts for $1.80. How much would 9 donuts cost?
(b) On a map, 1\( \frac{1}{2}\) inch corresponds to 12 miles. Two cities are shown as 6 inches apart on the map. How far apart are they in reality?
(c) Jimmy paid $44 for 8 pizzas. How much will 20 pizzas cost?
(d) It took Lorenz 2 hours to grade the first term papers for his 15 students. If 5 students drop the class, how long will it take him to grade the second term papers for that class?
(e) Two thirds of a cup of sugar is needed to make 6 dozen dainty candies. How many dozen candies can be made using 4 cups of sugar?
1. (a) The ratio is 4:1, part-to-part.
   (b) The ratio is 8:5, part-to-part.
   (c) The ratio is 124:1, part-to-part.
   (d) The ratio is 2:9, part-to-part.
   (e) The ratio is 9:1, whole-to-part.

2. (a) There are 3 girls for every boy.
   (b) There are 7 dogs for every 9 cats.
   (c) 4 out of every 5 students are female.
   (d) 1 out of every 6 people tested is positive for the disease.

3. (a) The children occur in groups of 4. In a group of 24 children, there are 6 groups (representative sets) of 4. Each of those 6 sets has 1 boy and 3 girls, so there are $6 \times 1 = 6$ boys.
   (b) The children occur in groups of 4, but this problem tells a “concrete” number about girls, who come in groups of 3. In a group of 24 girls only, there are 8 groups of 3. Each of those 8 groups has 1 boy to go with it, so there are $8 \times 1 = 8$ boys.
   (c) The boys are mentioned concretely here; in a group of 24 boys, there are 24 sets of 1. Each of those sets has 3 girls to go with it, so there are $24 \times 3 = 72$ girls.
   (d) 21 are red.
   (e) 30 altogether

4. (a) She wants $1\frac{1}{2}$ times as many donuts, so they’ll cost $1\frac{1}{2}$ times as much: $(1.80)(1\frac{1}{2}) = 2.70$.
   (b) The legend describes $1\frac{1}{2}$ inch segments; the cities are 4 times that far apart. So they’re $4(12 \text{ miles}) = 48$ miles apart in reality.
   (c) That’s $2\frac{1}{2}$ times as many pizzas, so they’ll cost $2\frac{1}{2}$ times as much: $110$.
   (d) He’ll have $2/3$ as many students so it will take him $2/3$ as long: $2 \times \frac{2}{3} = \frac{4}{3} = 1$ hour and 20 minutes.
   (e) 4 cups is 6 times as much as $2/3$ cup ($4 \div \frac{2}{3} = 6$). That makes 6 times as many candies: 36 dozen.