Ratios

For questions in the Quantitative Comparison format ("Quantity A" and "Quantity B" given), the answer choices are always as follows:

(A) Quantity A is greater.
(B) Quantity B is greater.
(C) The two quantities are equal.
(D) The relationship cannot be determined from the information given.

For questions followed by a numeric entry box ☐, you are to enter your own answer in the box. For questions followed by a fraction-style numeric entry box $\frac{\square}{\square}$, you are to enter your answer in the form of a fraction. You are not required to reduce fractions. For example, if the answer is $\frac{1}{4}$, you may enter $\frac{25}{100}$ or any equivalent fraction.

All numbers used are real numbers. All figures are assumed to lie in a plane unless otherwise indicated. Geometric figures are not necessarily drawn to scale. You should assume, however, that lines that appear to be straight are actually straight, points on a line are in the order shown, and all geometric objects are in the relative positions shown. Coordinate systems, such as *xy*-planes and number lines, as well as graphical data presentations, such as bar charts, circle graphs, and line graphs, *are* drawn to scale. A symbol that appears more than once in a question has the same meaning throughout the question.

The ratio of men to women in a garden club is 5 to 4.

1.

Quantity A	**Quantity B**
The smallest possible number of garden club members	20

2. A pantry holds *x* cans of beans, twice as many cans of soup, and half as many cans of tomato paste as there are cans of beans. If there are no other cans in the pantry, which of the following could be the total number of cans in the pantry?

Indicate <u>two</u> such numbers.

- ☐ 6
- ☐ 7
- ☐ 36
- ☐ 45
- ☐ 63

3. If there are 20 birds and 6 dogs in a park, which of the following represents the ratio of dogs to birds in the park?

(A) 3 : 13
(B) 3 : 10
(C) 10 : 3
(D) 13 : 3
(E) 1 : 26

4. If there are 7 whole bananas, 14 whole strawberries, and no other fruit in a basket, what is the ratio of strawberries to the total pieces of fruit in the basket?

Give your answer as a fraction.

$\frac{\square}{\square}$

5. The ratio of cheese to sauce for a single pizza is 1 cup to $\frac{1}{2}$ cup. If Bob used 15 cups of sauce to make a number of pizzas, how many cups of cheese did he use on those pizzas?

$\square$ cups of cheese

6. Laura established a new flower garden, planting 4 tulip plants for every 1 rose plant, and no other plants. If she planted a total of 50 plants in the garden, how many of those plants were tulips?

$\square$ tulip plants

7. A certain automotive dealer sells only cars and trucks, and the ratio of cars to trucks on the lot is 1 to 3. If there are currently 51 trucks for sale, how many cars does the dealer have for sale?

(A) 17
(B) 34
(C) 68
(D) 153
(E) 204

8. A steel manufacturer combines 98 ounces of iron with 2 ounces of carbon to make one sheet of steel. How many ounces of iron were used to manufacture $\frac{1}{2}$ of a sheet of steel?

(A) 1
(B) 49
(C) 50
(D) 198
(E) 200

9. Maria uses a recipe for 36 cupcakes that requires 8 cups of flour, 12 cups of milk, and 4 cups of sugar. How many cups of milk would Maria require for a batch of 9 cupcakes?

(A) 2
(B) 3
(C) 4
(D) 6
(E) 8

10. In a certain orchestra, each musician plays only one instrument and the ratio of musicians who play either the violin or the viola to musicians who play neither instrument is 5 to 9. If 7 members of the orchestra play the viola and four times as many play the violin, how many play neither?

(A) 14
(B) 28
(C) 35
(D) 63
(E) 72

11. The ratio of 0.4 to 5 equals which of the following ratios?

(A) 4 to 55
(B) 5 to 4
(C) 2 to 25
(D) 4 to 5
(E) 4 to 45

12. On a wildlife preserve, the ratio of giraffes to zebras is 37 : 43. If there are 300 more zebras than giraffes, how many giraffes are on the wildlife preserve?

(A) 1,550
(B) 1,850
(C) 2,150
(D) 2,450
(E) 2,750

13. At a certain company, the ratio of male to female employees is 3 to 4. If there are 5 more female employees than male employees, how many male employees does the company have?

(A) 12
(B) 15
(C) 18
(D) 21
(E) 24

14. On Monday, a class has 8 girls and 20 boys. On Tuesday, a certain number of girls joined the class just as twice that number of boys left the class, changing the ratio of girls to boys to 7 to 4. How many boys left the class on Tuesday?

(A) 5
(B) 6
(C) 11
(D) 12
(E) 18

15. If a dak is a unit of length and 14 daks = 1 jin, how many squares with a side length of 2 daks can fit in a square with a side length of 2 jins?

(A) 14
(B) 28
(C) 49
(D) 144
(E) 196

In a group of adults, the ratio of women to men is 5 to 6, while the ratio of left-handed people to right-handed people is 7 to 9. Everyone is either left- or right-handed; no one is both.

	Quantity A	**Quantity B**
16.	The number of women in the group	The number of left-handed people in the group

Party Cranberry is 3 parts cranberry juice and 1 part seltzer. Fancy Lemonade is 1 part lemon juice and 2 parts seltzer. An amount of Party Cranberry is mixed with an equal amount of Fancy Lemonade.

	Quantity A	**Quantity B**
17.	The fraction of the resulting mix that is cranberry juice	The fraction of the resulting mix that is seltzer

The ratio of 16 to g is equal to the ratio of g to 49.

	Quantity A	**Quantity B**
18.	g	28

19. In a parking lot, $\frac{1}{3}$ of the vehicles are black and $\frac{1}{5}$ of the remainder are white. How many vehicles could be parked on the lot?

(A) 8
(B) 12
(C) 20
(D) 30
(E) 35

20. Oil, vinegar, and water are mixed in a 3 to 2 to 1 ratio to make salad dressing. If Larry has 8 cups of oil, 7 cups of vinegar, and access to any amount of water, what is the maximum number of cups of salad dressing he can make with the ingredients he has available, if fractional cup measurements are possible?

(A) 12
(B) 13
(C) 14
(D) 15
(E) 16

21. With y dollars, 5 oranges can be bought. If all oranges cost the same, how many dollars do 25 oranges cost, in terms of y?

(A) $\frac{y}{5}$
(B) y
(C) $y + 5$
(D) $5y$
(E) $25y$

22. A woman spent $\frac{5}{8}$ of her weekly salary on rent and $\frac{1}{3}$ of the remainder on food, leaving \$40 available for other expenses. What is the woman's weekly salary?

(A) \$160
(B) \$192
(C) \$216
(D) \$240
(E) \$256

23. In a certain rectangle, the ratio of length to width of a rectangle is 3 : 2 and the area is 150 square centimeters. What is the perimeter of the rectangle, in centimeters?

(A) 10
(B) 15
(C) 25
(D) 40
(E) 50

At a certain college, the ratio of students to professors is 8 : 1 and the ratio of students to administrators is 5 : 2. No person is in more than one category (for instance, there are no administrators who are also students).

	Quantity A	**Quantity B**
24.	The fractional ratio of professors to administrators	$\frac{5}{8}$

25. In a certain country, 8 rubels are worth 1 schilling, and 5 schillings are worth 1 lemuw. In this country, 6 lemuws are equivalent in value to how many rubels?

(A) $\frac{20}{3}$
(B) 30
(C) 40
(D) 48
(E) 240

26. Team A and team B are raising money for a charity event. The ratio of money collected by team A to money collected by team B is 5 : 6. The ratio of the number of students on team A to the number of students on team B is 2 : 3. What is the ratio of money collected per student on team A to money collected per student on team B?

(A) 4 : 5
(B) 5 : 4
(C) 5 : 6
(D) 5 : 9
(E) 9 : 5

27. Jarod uses $\frac{2}{3}$ of an ounce of vinegar in every 2 cups of sushi rice that he prepares. To prepare 7 cups of sushi rice in the same proportion, how many ounces of vinegar does Jarod need?

(A) $\frac{3}{2}$
(B) $\frac{4}{3}$
(C) $\frac{7}{3}$

(D) $\frac{7}{2}$

(E) $\frac{14}{3}$

The total cost of 3 bananas, 2 apples, and 1 mango is \$3.50. The total cost of 3 bananas, 2 apples, and 1 papaya is \$4.20. The ratio of the cost of a mango to the cost of a papaya is 3 : 5.

	Quantity A	**Quantity B**
28.	The cost of a papaya	\$2.00

29. In a certain town, $\frac{2}{5}$ of the total population is employed. Among the unemployed population, the ratio of males to females is 5 : 7. If there are 40,000 employed people in the town, how many females are unemployed?

(A) 16,000
(B) 25,000
(C) 35,000
(D) 65,000
(E) 75,000

30. On a certain map of the United States, $\frac{3}{5}$ of an inch represents a distance of 400 miles. If Oklahoma City and Detroit are separated on the map by approximately $\frac{3}{2}$ of an inch, what is the approximate distance between them in miles?

(A) 240
(B) 360
(C) 600
(D) 800
(E) 1,000

31. A machine can manufacture 20 cans per hour, and exactly 10 such cans fit into every box. Maria packs cans in boxes at a constant rate of 3 boxes per hour. If the machine ran for 2 hours and was then turned off before Maria started packing the cans in boxes, how many minutes would it take Maria to pack all the cans that the machine had made?

(A) 40
(B) 45
(C) 80
(D) 160
(E) 800

32. If Beth has $\frac{1}{4}$ more money than Ari, and each person has an integer number of dollars, which of the following could be the combined value of Beth and Ari's money?

Indicate <u>all</u> such values.

- ☐ $12
- ☐ $54
- ☐ $72
- ☐ $200

33. If salesperson A sold 35% more motorcycles than salesperson B, which of the following could be the total number of motorcycles sold by both salespeople?

Indicate <u>all</u> such total numbers of motorcycles.

- ☐ 47
- ☐ 70
- ☐ 135
- ☐ 235

34. A zoo has twice as many zebras as lions and four times as many monkeys as zebras. Which of the following could be the total number of zebras, lions, and monkeys at the zoo?

Indicate <u>all</u> such totals.

- ☐ 14
- ☐ 22
- ☐ 28
- ☐ 55
- ☐ 121

35. In nation Z, 10 terble coins equal 1 galok. In nation Y, 6 barbar coins equal 1 murb. If a galok is worth 40% more than a murb, what is the ratio of the value of 1 terble coin to the value of 1 barbar coin?

(A) $\frac{3}{5}$

(B) $\frac{11}{13}$

(C) $\frac{3}{7}$

(D) $\frac{21}{23}$

(E) $\frac{21}{25}$

36. Autolot has a 2 : 1 ratio of blue cars to red cars and a 6 : 1 ratio of red cars to orange cars on the lot. What could be the total number of blue, red, and orange cars on the lot?

(A) 38
(B) 39
(C) 40
(D) 41
(E) 42

Ratios Answers

1. **(B).** The ratio of men to women is 5 to 4. Since both 5 and 4 are whole numbers, they could actually *be* the number of men and women, respectively. These are also the *lowest* possible numbers of men and women, because reducing the ratio of 5 to 4 any further is impossible without making one part a non-integer (e.g., 2.5 to 2) or both parts negative, and the numbers of men and women must be positive integers.

Therefore, the smallest possible number of garden club members is 5 + 4 = 9. Quantity B is greater.

2. **7 and 63 only.** Write the number of each type of can:

Cans of beans = x Cans of soup = $2x$ Cans of tomato paste = $0.5x$

Since each number of cans must be an integer, x must be even or there would be partial cans of tomato paste. The total number of cans is $x + 2x + 0.5x = 3.5x$ and since x must be even, the total number of cans could be 7, 14, 21, etc. Thus, the total number of cans must be a multiple of 7. Of the answer choices, only 7 and 63 are multiples of 7.

3. **(B).** If there are 6 dogs and 20 birds in the park, the ratio of dogs to birds is 6 : 20, which reduces to 3 : 10.

4. $\frac{2}{3}$ **or any equivalent fraction.** If there are 7 bananas and 14 strawberries, then there are 7 + 14 = 21 total pieces of fruit. The ratio of strawberries to the total is therefore 14 : 21. Write this ratio as a fraction and cancel the common factor of 7 from top and bottom: $\frac{14}{21} = \frac{2 \times 7}{3 \times 7} = \frac{2}{3}$. The original ratio of $\frac{14}{21}$ would also be counted as correct if entered as is.

5. **30 cups of cheese.** Bob used cheese to sauce in a 1 : 1/2 ratio, which could be multiplied by 2 to yield the equivalent cheese to sauce ratio of 2 : 1. In words, there are twice as many cups of cheese as there are cups of sauce in the pizzas. Bob actually used 15 cups of sauce, so he used 2 × 15 = 30 cups of cheese.

6. **40 tulip plants.** To solve for the number of tulips, work with the Part : Part : Whole ratio. The ratio of tulips to roses is 4 : 1, so the Tulip : Rose : Total relationship is 4 : 1 : 5. This ratio can be written as $4x : 1x : 5x$, with x as the unknown integer multiplier. There are 50 total plants in the garden, so set $5x$ equal to 50 and solve for x:

$$5x = 50$$

$x = 10$

Now plug this value into the expression for the actual number of tulips: $4x = 4(10) = 40$. Laura planted 40 tulip plants in the garden.

7. **(A).** Focus on the given Part : Part ratio. The ratio of cars to trucks is 1 : 3, or x : $3x$ with x as the unknown multiplier. Since there are 51 trucks for sale, set $3x$ equal to 51 and solve for x.

$$3x = 51$$
$$x = 17$$

Since x also represents the number of cars, the dealer has 17 cars for sale.

8. **(B).** Iron and carbon combine to make steel in a specific given ratio. The ratio of iron (ounces) to carbon (ounces) to steel (sheets) is 98 : 2 : 1. Because there are different units (ounces and sheets), the Part numbers do not sum to the Whole number as they typically do, but don't be concerned.

This ratio can be written as $98x$: $2x$: x, with x as the unknown multiplier, which is also the number of sheets. To make 1/2 a sheet of steel, set x equal to 1/2.

Now plug this value into the expression for the number of iron ounces: $98x = (98)(1/2) = 49$. To make 1/2 a sheet of steel, 49 ounces of iron are required.

9. **(B).** As a ratio, Flour : Milk : Sugar : Cupcakes is equal to 8 : 12 : 4 : 36, where the first three numbers are in cups. Because there are different units (cups and cupcakes), the Part numbers do not sum to the Whole number, but don't be concerned.

This ratio can be written as $8x$: $12x$: $4x$: $36x$, with x as the unknown multiplier. To make 9 cupcakes, set $36x$ equal to 9 and solve for x.

$$36x = 9$$
$$x = \frac{1}{4}$$

In words, for a batch of 9 cupcakes, Maria would make $\frac{1}{4}$ of the original recipe.

Now plug this value into the expression for cups of milk: $12x = (12)\left(\frac{1}{4}\right) = 3$. Maria would need 3 cups of milk.

10. **(D).** Since 7 members of the orchestra play the viola and four times as many play the violin, then (7)(4) = 28 people must play the violin. Altogether, 7 + 28 = 35 musicians in the orchestra play either the viola or the violin.

The ratio of *either* to *neither* is 5 : 9, or $5x$: $9x$ using the unknown multiplier. Since 35 people play either instrument, set $5x$ equal to 35 and solve for x.

$$5x = 35$$
$$x = 7$$

Now plug this value into the expression for *neither*: $9x = 9(7) = 63$. There are 63 people in the orchestra who play neither instrument.

11. **(C).** You can rewrite ratios as fractions and then multiply or divide top and bottom by the same number, keeping the ratio (or fraction) the same.

First, multiply top and bottom by 10, to remove the decimal: $\frac{0.4}{5} = \frac{0.4 \times 10}{5 \times 10} = \frac{4}{50}$

Next, cancel the common factor of 2: $\frac{4}{50} = \frac{2 \times 2}{25 \times 2} = \frac{2}{25}$

Finally, the fraction $\frac{2}{25}$ is the same as the ratio of 2 to 25, which is therefore equivalent to the original ratio of 0.4 to 5.

12. **(B).** The ratio of giraffes to zebras is 37 : 43. Introduce the unknown multiplier x: the number of giraffes is $37x$, and the number of zebras is $43x$, where x is a positive integer.

Now translate the second sentence of the problem into algebra. "There are 300 more zebras than giraffes" becomes Zebras – Giraffes = 300, or $43x - 37x = 300$. Solve for x:

$$\begin{aligned} 43x - 37x &= 300 \\ 6x &= 300 \\ x &= 50 \end{aligned}$$

Finally, substitute into the expression for the number of giraffes: $37x = 37(50) = 1{,}850$. There are 1,850 giraffes.

Alternatively, the right answer must be a multiple of 37, because the giraffe number in the ratio is 37, and there must be a positive whole number of giraffes. Test the answer choices in the calculator to find that only 1,850 is divisible by 37. This shortcut doesn't always work this well, of course!

13. **(B).** The ratio of male to female employees is 3 : 4. Introduce the unknown multiplier x, making the number of males $3x$ and the number of females $4x$, where x is a positive integer.

Now translate the second sentence of the problem into algebra. "There are 5 more female employees than male employees" becomes Females – Males = 5, or $4x - 3x = 5$. Solve for x:

$$\begin{aligned} 4x - 3x &= 5 \\ x &= 5 \end{aligned}$$

Finally, substitute into the expression for the number of male employees: $3x = 3(5) = 15$. There are 15 male employees.

14. **(D).** Call the number of girls who joined the class x, so the new number of girls in the class is $8 + x$. Twice as many boys left the class, so the number of boys who left the class is $2x$, and the new number of boys in the class is $20 - 2x$.

The resulting ratio of boys to girls is 7 to 4. Since there is already a variable in the problem, don't use an unknown multiplier. Rather, set up a proportion and solve for x:

$$\frac{\text{Girls}}{\text{Boys}} = \frac{8+x}{20-2x} = \frac{7}{4}$$

$4(8 + x) = 7(20 – 2x)$
$32 + 4x = 140 – 14x$
$18x = 108$
$x = 6$

Finally, the question asks for the number of boys who left the class. This is $2x = 2(6) = 12$ boys.

Check: There were 8 girls in the class, then 6 joined for a total of 14 girls. There were 20 boys in the class until 12 left the class, leaving 8 boys in the class. The resulting ratio of girls to boys is $\frac{14}{8} = \frac{7\times2}{4\times2} = \frac{7}{4}$, as given.

15. **(E).** Since 14 daks = 1 jin, a length measured in daks is 14 times the same length measured in jins. In other words, the ratio of the length in daks to the length in jins is 14 to 1.

Write this relationship as a fraction: $\frac{14 \text{ daks}}{1 \text{ jin}}$. You can also write $\frac{1 \text{ jin}}{14 \text{ daks}}$. You can convert a measurement from one unit to the other by multiplying by one of these unit conversion factors.

Side of big square: $(2 \text{ jins})\left(\frac{14 \text{ daks}}{1 \text{ jin}}\right) = 28$ daks. Since the small square has a side length of 2 daks, the number of small sides that will fit along a big side is $28 \div 2 = 14$.

However, 14 is not the right answer; 14 is the number of small squares that will fit along *one wall* of the big square, in one row. There will be 14 rows, so in all there will be $(14)(14) = 196$ small squares that fit inside the big square.

16. **(A).** Write two different Part : Part : Whole relationships. In each relationship, the two parts sum to the whole.

Women : Men : Total = 5 : 6 : 11, so Women : Total = 5 : 11.

Left-handed : Right-handed : Total = 7 : 9 : 16, so Left-handed : Total = 7 : 16.

In other words, women account for $\frac{5}{11} = 45.\overline{45}\%$ of the group, left-handed people for $\frac{7}{16} = 43.75\%$ of the group.

Since the total number of people is the same (it's the same group, whether divided by gender or

handedness), the percents can be compared directly. There must be more women than left-handed people in the group. Quantity A is greater.

17. **(B).** Be careful—don't just add the "parts" from the different mixtures, because the parts will generally not be the same size! Start by writing Part : Part : Whole relationships for each glass. In each relationship, the whole is the sum of the parts:

For Party Cranberry, *Cranberry* : *Seltzer* : *Whole* = 3 : 1 : 4

For Fancy Lemonade, *Lemon* : *Seltzer* : *Whole* = 1 : 2 : 3

Since the two amounts that are mixed are the same size, choose a smart number to represent the total volume for both Party Cranberry and Fancy Lemonade. This number should be a multiple of both 4 and 3, according to the ratios above, so it is convenient to say that the amount of each is 12 ounces. Multiply the Party Cranberry ratio by 3 and the Fancy Lemonade ratio by 4, in both cases to get 12 total ounces:

For Party Cranberry, *Cranberry* : *Seltzer* : *Whole* = 9 : 3 : 12

For Fancy Lemonade, *Lemon* : *Seltzer* : *Whole* = 4 : 8 : 12

Finally, when the two glasses are mixed, the resulting total is 24 ounces, of which 9 ounces are cranberry juice but 3 + 8 = 11 ounces are seltzer. There is more seltzer in the resulting mix, so its fraction of the mix is greater than cranberry juice's fraction of the mix. Quantity B is greater.

18. **(D).** Write the ratios as fractions and set them equal to each other:

$$\frac{16}{g} = \frac{g}{49}$$

Cross-multiply to get $16 \times 49 = g^2$.

Remember that when "unsquaring" an equation with a squared variable, you must account for the negative possibility. The value of g could be *either* $4 \times 7 = 28$ *or negative* 28. Nothing in the problem indicates that g must be positive. Since Quantity A might equal Quantity B *or* be less than Quantity B, the relationship cannot be determined from the information given.

19. **(D).** Since vehicles must be counted with whole numbers and $\frac{1}{3}$ of the cars are black, the total number of cars must be divisible by 3. Otherwise, $\frac{1}{3}$ of the total would not be a whole number. The answer must be (B) or (D).

The remainder of the cars is $1 - \frac{1}{3} = \frac{2}{3}$ of the total. Of these, $\frac{1}{5}$ are white, so $\frac{1}{5}$ of $\frac{2}{3}$, or $\frac{2}{15}$ of the total number of vehicles are white. Again, because the white cars must be countable with whole numbers, $\frac{2}{15}$ of the total must be an integer. You can write the equation using fractions:

$$\left(\frac{2}{15}\right)(\text{Total}) = \text{Integer}$$

To get an integer outcome, the total must be divisible by 15. Of the answer choices, only (D) is divisible by 15.

20. **(E).** Since the ratio of ingredients is 3 : 2 : 1 in the recipe, imagine that Larry works in cups. Then a recipe makes 3 + 2 + 1 = 6 cups of dressing. To figure out the "limiting factor," take each available amount of ingredient and figure out how many times he could make the recipe, permitting fractions, if he had more than enough of the other ingredients.

Oil: 8 cups available ÷ 3 cups needed per recipe = $\frac{8}{3}$ recipes (in other words, $2\frac{2}{3}$ times the recipe). There is no need to round down, because fractional cups of ingredients are allowed.

Vinegar: 7 cups available ÷ 2 cups needed per recipe = $\frac{7}{2}$ recipes (in other words, $3\frac{1}{2}$ times through the recipe).

Water availability is not limited, so ignore it.

Oil is the limiting factor, because Larry can make the fewest recipes with it. Thus, he can only make $\frac{8}{3}$ recipes. To find the total cups of salad dressing, multiply this fraction by the total number of cups that a recipe makes:

$$\frac{8}{3} \text{ recipe} \times 6 \text{ cups per recipe} = 16 \text{ cups}$$

21. **(D).** Create a unit conversion factor using the given ratio of oranges to dollars. The conversion factor will look like either $\frac{5 \text{ oranges}}{y \text{ dollars}}$ or $\frac{y \text{ dollars}}{5 \text{ oranges}}$. Which one to use depends on how you want to convert the units.

The question asks how many dollars, in terms of y, 25 oranges cost. Since the given is oranges and the question asks for dollars, choose the conversion unit that cancels oranges and leaves dollars on top: $\frac{y \text{ dollars}}{5 \text{ oranges}}$. Then multiply:

$$(25 \text{ oranges})\left(\frac{y \text{ dollars}}{5 \text{ oranges}}\right) = \frac{25y}{5} \text{ dollars} = 5y \text{ dollars}$$

Intuitively, a total of 25 oranges is the same as 5 sets of 5 oranges each. Each set costs y dollars. Therefore, the total cost for 5 sets of oranges is $5 \times y = 5y$.

22. **(A).** The total amount of money left over after paying rent and buying food is $40. From this number, you can find the woman's total weekly salary by determining what fraction this is of her total salary.

Since the woman spent $\frac{5}{8}$ of her salary on rent, she had $1 - \frac{5}{8} = \frac{3}{8}$ of her salary remaining. Of the

remainder, she spent $\frac{1}{3}$ on food and had $\frac{2}{3}$ left over. So, $\frac{2}{3}$ of $\frac{3}{8}$ of her total weekly salary was left over for other expenses:

$$\left(\frac{2}{3}\right)\left(\frac{3}{8}\right)=\frac{2}{8}=\frac{1}{4}$$

One-quarter of her salary was the \$40 left over. Now you can find *T*, her total weekly salary:

$$\left(\frac{1}{4}\right)T=\$40$$

$$T=\$160$$

23. **(E).** Rewrite the given ratio using the unknown multiplier x, so that the length of the rectangle is $3x$, while the width is $2x$. Now express the area of the rectangle in these terms, set it equal to 150 square centimeters, then solve for x:

$$\begin{aligned}
\text{Area} &= (\text{Length})(\text{Width}) \\
150 &= (3x)(2x) \\
150 &= 6x^2 \\
25 &= x^2 \\
5 \text{ cm} &= x
\end{aligned}$$

In this case, you don't need to worry about the negative possibility for the square root, since lengths cannot be less than zero. The length is $3x = 15$ centimeters, while the width is $2x = 10$ centimeters.

Finally, the perimeter of a rectangle is twice the length, plus twice the width:

$$\begin{aligned}
\text{Perimeter} &= 2 \times \text{length} + 2 \times \text{width} \\
\text{Perimeter} &= 2 \times 10 \text{ cm} + 2 \times 15 \text{ cm} \\
\text{Perimeter} &= 20 \text{ cm} + 30 \text{ cm} \\
\text{Perimeter} &= 50 \text{ cm}
\end{aligned}$$

24. **(B).** One way to approach this problem is to pick a smart number for the number of students, which shows up in both ratios. In the first ratio, students are represented by 8, so you want the smart number of students to be a multiple of 8. Likewise, in the second ratio, students are represented by 5, so you want the smart number of students to be a multiple of 5 as well. So pick 40 for the number of students.

From here, solve for the number of professors:

$$\frac{\text{Students}}{\text{Professors}} = \frac{40}{\text{Professors}} = \frac{8}{1}$$

$$\begin{aligned}
40 &= 8 \times \text{Professors} \\
5 &= \text{Professors}
\end{aligned}$$

Likewise, solve for the number of administrators:

$$\frac{\text{Students}}{\text{Administrators}} = \frac{40}{\text{Administrators}} = \frac{5}{2}$$

$$\begin{aligned}
40 \times 2 &= 5 \times \text{Administrators} \\
16 &= \text{Administrators}
\end{aligned}$$

Therefore, the ratio of professors to administrators is 5 : 16. In fractional ratio form, this is $\frac{5}{16}$.

Comparing the two quantities, both have the same numerator, but the denominator of Quantity A is greater, making it the smaller value. In fact, Quantity B is exactly twice as great as Quantity A.

25. **(E).** The question requires converting an amount of money in "lemuws" to "rubels." Conceptually, there are two steps: first convert lemuws to schillings, then convert schillings to rubels. The fast way to do this two-step conversion is to multiply the money by the right conversion factors, which express identities (such as 8 rubels = 1 schilling) in the form of ratios: $\frac{8 \text{ rubels}}{1 \text{ schilling}}$ or $\frac{1 \text{ schilling}}{8 \text{ rubels}}$. If you make sure that the units cancel correctly, then you can always be sure under pressure whether to multiply or divide by 8.

Here is the conversion, done all in one line:

$$(6 \text{ lemuws})\left(\frac{5 \text{ schillings}}{1 \text{ lemuw}}\right)\left(\frac{8 \text{ rubels}}{1 \text{ schilling}}\right) = 240 \text{ rubels}$$

Both lemuws and schillings cancel on the left, leaving rubels. 6 lemuws are worth 240 rubels.

26. **(B).** To solve this ratios problem, choose smart numbers for the money collected for each team and the number of students on each team. Choose multiples of the ratios given, such as the following:

Money collected by team A = \$10
Money collected by team B = \$12
Number of students in team A = 2
Number of students in team B = 3

Then compute the money per student:

Money per student in team A = \$10 ÷ 2 = \$5 per student
Money per student in team B = \$12 ÷ 3 = \$4 per student

Thus, the ratio of money per student in team A to money per student in team B is 5 : 4.

27. **(C).** To find how much vinegar Jarod needs, think about how many multiples of his original recipe Jarod wants to make. The original recipe makes 2 cups of sushi rice, so 7 cups of rice is $\frac{7}{2}$ times his original recipe.

Since Jarod is scaling proportionally, to make $\frac{7}{2}$ times the usual amount of rice, he must also use $\frac{7}{2}$ times as much vinegar. Therefore, Jarod must use:

$$\left(\frac{7}{2}\right)\left(\frac{2}{3}\text{ ounces}\right)=\frac{7}{3}\text{ ounces of vinegar}$$

Alternatively, you can start with 7 cups of rice and multiply by the recipe's ratio of vinegar to rice, canceling cups of rice and producing ounces of vinegar:

$$(7 \text{ cups of rice})\left(\frac{\frac{2}{3} \text{ ounces of vinegar}}{2 \text{ cups of rice}}\right) = \frac{7}{3} \text{ ounces of vinegar}$$

28. **(B).** Solve for the cost of a papaya by translating the information given into mathematical statements. The first sentence states that 3 bananas, 2 apples, and 1 mango cost $3.50. Letting *B* represent the cost of a banana, *A* the cost of an apple, and *M* the cost of a mango, set up an equation:

$$3B + 2A + M = \$3.50$$

Similarly, for the second sentence, you get the following equation:

$$3B + 2A + P = \$4.20 \text{ (where } P \text{ is the cost of a papaya)}$$

The problem requires finding the cost of a papaya and provides the ratio of the costs of a mango and papaya. To use this information, remove bananas and apples from the list of unknowns. Here's how: try elimination. Specifically, subtract the first equation from the second:

$$\begin{array}{r} 3B + 2A + P = \$4.20 \\ -(3B + 2A + M = \$3.50) \\ \hline P - M = \$0.70 \end{array}$$

Now, since the ratio of the cost of a mango to a papaya is 3 : 5, write a proportion:

$\frac{M}{P} = \frac{3}{5}$, which becomes $M = \frac{3}{5} P$ if you isolate *M*. Now substitute back into the equation above, to eliminate *M* and solve for *P:*

$$\begin{aligned} P - M &= \$0.70 \\ P - \frac{3}{5} P &= \$0.70 \\ \frac{5}{5} P - \frac{3}{5} P &= \$0.70 \\ \frac{2}{5} P &= \$0.70 \end{aligned}$$

$$P = \frac{5}{2}(\$0.70) = \$1.75$$

Quantity B is greater.

29. **(C).** To solve for the number of unemployed females, first compute the total number of people who are unemployed. You need to represent the total number of people in the town. Call this number x. Since $\frac{2}{5}$ of the town is employed, a total of 40,000 people, write the ratio:

$$\frac{\text{Employed}}{\text{Total population}} = \frac{40{,}000}{x} = \frac{2}{5}$$

Cross-multiply and solve for x:

$$\begin{aligned} 5(40{,}000) &= 2x \\ 200{,}000 &= 2x \\ 100{,}000 &= x \end{aligned}$$

If 40,000 people in the town are employed, then 100,000 – 40,000 = 60,000 people are unemployed.

Finally, the ratio of unemployed males to females is 5 : 7. In other words, out of every 5 + 7 = 12 unemployed people, there are 7 unemployed females. Therefore, the fraction of unemployed females in the total unemployed population is 7 out of 12, or $\frac{7}{12}$. Set y as the number of unemployed females:

$$\frac{\text{Unemployed females}}{\text{Total unemployed}} = \frac{y}{60{,}000} = \frac{7}{12}$$

To get the number of unemployed females, solve for y: $y = \frac{7 \times 60{,}000}{12} = 7 \times 5{,}000 = 35{,}000$

30. **(E).** According to the problem, $\frac{3}{5}$ of an inch on the map is equivalent to 400 miles of actual distance. So you can set up a ratio of these two measurements to use as a conversion factor:

$\frac{3/5 \text{ inch}}{400 \text{ miles}}$ or $\frac{400 \text{ miles}}{3/5 \text{ inch}}$. Which one you use depends on which way you're converting: from miles to inches or vice versa.

The question states that Oklahoma City is separated from Detroit by approximately $\frac{3}{2}$ inches on the map, and asks how many real miles, approximately, lie between the two cities. To go from inches to

miles, multiply the given measurement $\left(\frac{3}{2}\text{ inches}\right)$ by the conversion factor that will cancel out inches and leave miles:

$$\left(\frac{3}{2}\text{ inches}\right)\left(\frac{400\text{ miles}}{\frac{3}{5}\text{ inch}}\right)=\left(\frac{3}{2}\right)(400)\left(\frac{5}{3}\right)\text{miles}=1{,}000\text{ miles}$$

31. **(C).** First, figure out how many boxes worth of cans the machine produced in the 2 hours that it was on. The first step is to find the number of cans produced in 2 hours. Use the formula Work = Rate × Time. The question tells you 20 cans per hour is the rate and 2 hours is the time:

Work = (20 cans per hour) × (2 hours) = 40 cans

Now, since there are 10 cans per box, compute the number of boxes:

$$\text{Number of boxes} = 40 \text{ cans} \times \left(\frac{1 \text{ box}}{10 \text{ cans}}\right) = 4 \text{ boxes}$$

So Maria must pack 4 whole boxes to accommodate all the cans that the machine had made.

One more time, use the formula Work = Rate × Time. Maria's rate is 3 boxes per hour, while the total work as 4 boxes. Rearrange and plug in:

$$\text{Time} = \frac{\text{Work}}{\text{Rate}} = \frac{4 \text{ boxes}}{3 \text{ boxes per hour}} = \frac{4}{3} \text{ hours}$$

Finally, convert from hours to minutes as the question requires:

$$\text{Time} = \frac{4}{3} \text{ hours} \times \left(\frac{60 \text{ minutes}}{1 \text{ hour}}\right) = 80 \text{ minutes}$$

32. **$54 and $72 only.** If Beth has $\frac{1}{4}$ more money than Ari, their money is in a ratio of 5 : 4 (because 5 is $\frac{1}{4}$ more than 4). Another way to see this result is with algebra:

$B = A + \frac{1}{4}A = \frac{5}{4}A$, so $\frac{B}{A} = \frac{5}{4}$.

As a result, for every $9 total, Beth has $5 and Ari has $4. To keep both Ari and Beth in integer dollar values, the answer needs to be a multiple of 9. Among the answer choices, only 54 and 72 are multiples of 9.

33. **47 and 235 only.** Since salesperson A sold 35% more motorcycles than salesperson B, their sales are in a ratio of 135 : 100. You can reduce this ratio to 27 : 20 by canceling a common factor of 5.

As a result, for every 47 motorcycles sold, salesperson A sold 27 and salesperson B sold 20. The number of motorcycles sold must be integer multiples of these numbers (because you can't sell partial motorcycles—not legally anyway), so the total needs to be a multiple of 47. Among the answer choices, only 47 and 235 are multiples of 47.

34. **22, 55, and 121 only.** First, figure out which animal there are fewest of. "Twice as many zebras as lions" means Zebras > Lions and "four times as many monkeys as zebras" means Monkeys > Zebras. So lions are found at the zoo in smallest numbers. To make the calculation straightforward, pick 1 lion as a smart number. Since there are twice as many zebras, there are 2 zebras. Finally, there are four

times as many monkeys as zebras, so there are $4 \times 2 = 8$ monkeys. Putting all of that together:

Lions : Zebras : Monkeys = 1 : 2 : 8

So, for every 11 animals (1 + 2 + 8), there are 1 lion, 2 zebras, and 8 monkeys. To preserve integer numbers of lions, zebras, and monkeys, the total number of animals could only be a multiple of 11. Among the answer choices, only 22, 55, and 121 fit the bill.

35. **(E).** To tackle this question, rewrite all these ridiculously named currencies in terms of just one currency, ideally a real currency. Use whatever real currency you like, but here's an example with dollars.

Say that 1 murb is worth \$1.

A galok is worth 40% more than a murb, or 40% more than \$1. A galok is worth \$1.40.

Since 10 terble coins equal 1 galok, then 10 terble coins are worth a total of \$1.40. Each terble coin therefore, is worth \$1.40 ÷ 10 = \$0.14, or 14 cents.

Since 6 barbar coins equal 1 murb, then 6 barbar coins equal \$1. Each barbar coin is worth $\$\frac{1}{6}$ or $\frac{100}{6}$ cents.

The ratio of the value of 1 terble coin to the value of 1 barbar coin:

$$\frac{1 \text{ terble}}{1 \text{ barbar}} = \frac{14 \text{ cents}}{100/6 \text{ cents}} = 14 \times \frac{6}{100} = \frac{21}{25}$$

36. **(A).** Manipulate the given ratios to create one ratio that includes all three colors. You might use a table:

R	B	O
1	2	
6		1

The problem here is the red car: that column contains both a 1 and a 6. In order to fix this issue, create a common term. Multiply the entire first ratio (the first row) by 6:

R	B	O
6	12	
6		1

Now that the same number is in both rows of the red column, you can combine the two rows into a single ratio:

R : B : O = 6 : 12 : 1

For every 19 cars (6 + 12 + 1), there are 6 red cars, 12 blue cars, and 1 orange car. To maintain whole numbers of cars in each color, the correct answer has to be a multiple of 19. Only 38 is a

multiple of 19.