QUANTITATIVE REASONING

Tables and Graphs, Part 1

Tables and graphs are very common on the GRE, and your ability to correctly utilize them is fundamental to your success in the quantitative sections. The GRE's tables and graphs are not especially difficult to understand or interpret. The challenge is that they contain a lot of information, and you need to ensure you are consistently careful and correct in both your understanding of the task and your reading of these tables and graphs.

The numerical information presented in the tables and graphs will either be qualitative in nature (describing the characteristics of something, such as, for example, the weights or heights of various animals in a zoo), or they will give you information about frequency (e.g., the number of each type of animal in the zoo) or relative frequency (e.g., the same data about the number of animals at the zoo, but presented in terms of the percentage they represent of the total zoo population).

This information will most commonly be presented in the form of tables, bar graphs, segmented bar graphs, line graphs, or circle graphs. You will practice examples of each in this chapter. Information can also be presented in other, less common graphical ways; I'll cover those in the next chapter.

Questions will ask you to interpret the data or utilize it in some way: to perform simple computations, identify ratios or proportions, or solve for different types of statistics. You will practice examples of all these types of questions here as well.

To begin, let's look at a few sample situations and review the ways in which the same information can be presented in different tables and graphs.

Price of Item X and Price of Item Y Over Time

Imagine that you are given the following information about the price of two items, Item X and Item Y, and how they've changed over time. Here are three different ways in which the same information can be presented:

Year	Price of Item X	Price of Item Y
1990	\$1.25	\$1.00
2000	\$1.50	\$1.75
2010	\$1.75	\$2.00
2020	\$2.00	\$2.50



Here is the same information, presented in both bar and line graphs in which the x-axis represents the year, and the y-axis represents the price of each item. Please note that on the real exam, you won't be presented with multiple views of the same information as you are here, and the questions will vary depending on how the information is presented.

Now let's look at some examples of the types of questions that you might be asked regarding this information.

1. How much more would it have cost to purchase 20 of item Y in 2020 than 20 of item Y in 1990?	Solution
 (A) \$10 (B) \$20 (C) \$30 (D) \$40 (E) \$50 	In 2020, it would have cost \$2.50 per item times 20 items = \$50 to purchase 20 of item <i>Y</i> . In 1990, it would have cost \$1.00 per item times 20 items = \$20 to purchase 20 of item <i>Y</i> . The difference between those prices is $50 - 20 = 30$, so (C) is the correct answer .

2. The price of item *X* increased by what percent between 1990 and 2010?

- A 20%
- B 25%
- © 37.5%
- D 40%
- E 60%

<u>Solution</u>

In 1990, the price of item *X* was \$1.25. In 2010, the price of item *X* was \$1.75. The price increased 0.50, which represents $\frac{0.50}{1.25} = 0.4$, or a 40% increase. (**D**) is the correct answer.

3. How much greater is the increase in price for item *Y* between 1990 and 2010 than the increase in price for item *X* between 1990 and 2020?

- A \$0.25
- B \$0.50
- © \$0.65
- D \$0.75
- E \$1.00

Solution

Item *Y* increased from \$1.00 in 1990 to \$2.00 in 2010, a difference of \$1.00. Item *X* increased from \$1.25 in 1990 to \$2.00 in 2020, a difference of \$0.75. Therefore, the increase in price for item *Y* between 1990 and 2010 was \$0.25 greater than the increase in price for item *X* between 1990 and 2020. **(A) is the correct answer**.

4. The ratio of the price of item *X* in 1990 to the price of item *X* in 2020 is greater than which of the following ratios?

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

- A Price of item X in 1990 to the price of item Y in 2010
- **B** Price of item *Y* in 1990 to the price of item *Y* in 2010
- \bigcirc Price of item *Y* in 1990 to the price of item *X* in 2010
- \square Price of item *X* in 2000 to the price of item *Y* in 2010
- **E** Price of item *Y* in 2000 to the price of item *Y* in 2020

<u>Solution</u>

The price of item *X* in 1990 is \$1.25, and the price of item *X* in 2020 is \$2.00, so the ratio of the two is $\frac{1.25}{2} = \frac{5}{8}$.

For [A], the ratio is $\frac{1.25}{2} = \frac{5}{8}$. This is not greater than the initial ratio.

For [B], the ratio is $\frac{1}{2}$. This is not greater than the initial ratio.

For [C], the ratio is $\frac{1}{1.75} = \frac{4}{7}$. This is not greater than the initial ratio.

For [D], the ratio is $\frac{1.5}{2} = \frac{3}{4}$. This is greater than the initial ratio.

Finally, for [E], the ratio is $\frac{1.75}{2.5} = \frac{7}{10}$. This is greater than the initial ratio.

Thus, answer choices [D] and [E] are correct.

Weekend Shop Sales

A certain shop is open for two weekend days, Saturday and Sunday, and it sells exactly five types of items: appetizers, sandwiches, soups, desserts, and drinks. The following table and graphs show the number of each type of item sold on each day.

Item	Saturday	Sunday
appetizers	43	41
sandwiches	82	86
soups	42	48
desserts	62	33
drinks	75	82





A segmented bar graph helps you see how components add up to a total.

1. Which of the following accurately represents the ratio of the total number of appetizers sold over the weekend to the total number of sandwiches sold over the weekend?

A 1:4

B 10:22

- © 1:2
- D 11:21
- E 41:74

Solution

There were a total number of 43 + 41 = 84 appetizers sold over the weekend and a total of 82 + 86 = 168sandwiches sold over the weekend. The ratio of appetiz-

ers sold to sandwiches sold is, therefore, $\frac{84}{168} = \frac{1}{2}$. The correct answer is (C).

2. For which of the following types of items was the total number of sales the least over the entire weekend?

- (A) Appetizers
- B Sandwiches
- © Soups
- D Desserts
- (E) Drinks

Solution

You can fairly quickly see that sandwiches and drinks are out of the running. Comparing appetizers to soups, you can see that the store sold fewer appetizers (1 more appetizer on Saturday but 7 fewer on Sunday). Comparing appetizers to desserts, there were a lot more desserts sold on Saturday, and some more appetizers sold on Sunday, but overall there were fewer appetizers sold than desserts (appetizers = 43 + 41 = 84; desserts = 62+ 33 = 95). Therefore, **(A) is the correct answer**. 3. If the store earned a net profit of \$2.25 per sandwich sold, how much more profit did it earn from the sale of sandwiches on Sunday than it earned from the sale of sandwiches on Saturday?

\$

<u>Solution</u>

The store sold 4 more sandwiches on Sunday than it did on Saturday (86 - 82 = 4). Therefore, it earned (4)(\$2.25) = \$9.00 more in profit off sandwiches sold on Sunday than on Saturday.

4. Appetizers represent approximately what percentage of all items sold on Sunday?

A 10%

B 15%

- © 20%
- D 25%
- E) 30%

Solution

There were 41 appetizers sold on Sunday, and a total of 41 + 86 + 48 + 33 + 82 = 290 items were sold. $\frac{41}{290} = 0.141$, which is closest to 15%. **(B) is the correct answer**.

Acme Co.

Total revenue in 2010: \$500,000; Total revenue in 2020: \$725,000



PERCENTAGE OF INCOME PER INCOME STREAM

1. How much more total revenue did Acme Co. earn through retail sales in 2020 than in 2010?

44%

A \$24,500

10%

- B \$36,250
- © \$47,550
- D \$58,750
- E \$225,000

<u>Solution</u>

33%

42%

Acme Co. earned (0.15)(\$725,000) = \$108,750 through retail sales in 2020 and (0.10)(\$500,000) = \$50,000through retail sales in 2010. Therefore, Acme Co. earned \$108,750 - \$50,000 = \$58,750 more in retail sales revenue in 2020 than it did in 2010. **The correct answer is (D)**.

Institutional

Wholesale Other

Retail

2. Which income streams had a greater total revenue in 2010 than in 2020?

Indicate <u>all</u> such income streams.

- A Online
- B Wholesale
- C Retail
- D Institutional
- E Other

Solution

For online and retail sales, the total revenue of the company and their portion of that total revenue both went up between 2010 and 2020, so you know that their revenue was greater in 2020 than it was in 2010.

For wholesale, in 2010 revenue was (0.44)(\$500,000) = \$220,000. In 2020, wholesale revenue was (0.33)(\$725,000) = \$239,250. Therefore, total revenue from wholesale was greater in 2020.

For institutional, in 2010 revenue was (0.12)(\$500,000) = \$60,000. In 2020, institutional revenue was (0.07)(\$725,000) = \$50,750. Therefore, total revenue from institutional was greater in 2010.

For other, in 2010, the revenue was (0.10)(\$500,000) = \$50,000. In 2020, other revenue was (0.03)(\$725,000) = \$21,750. Therefore, total revenue from other was greater in 2010.

Therefore, the two departments that had greater total revenue in 2010 were [D] institutional and [E] other.

3. Which income stream has the greatest ratio of total revenue earned in 2020 to total revenue earned in 2010?

- (A) Online
- ^(B) Wholesale
- © Retail
- D Institutional
- (E) Other

<u>Solution</u>

You are looking for the stream whose revenue grew the most, proportionally speaking, between 2020 and 2010; this stream will have the highest ratio of revenue earned in 2020 to that earned in 2010. The only two likely streams are online and retail sales, since both grew as a percentage of overall sales while the other streams did not.

For online sales, the ratio of revenue earned in 2020 to 2010 is:

 $\frac{(0.42)(725,000)}{(0.24)(500,000)}, \text{ or } \frac{304,500}{120,000} \approx \frac{2.5}{1}$

For retail sales, the ratio of revenue earned in 2020 to 2010 is:

 $\frac{(0.15)(725,000)}{(0.10)(500,000)}, \text{ or } \frac{108,750}{50,000} \approx \frac{2.2}{1}.$

So, the ratio of total revenue earned from online sales is greatest, and (A) is the correct answer.

4. Which of the following represents the total range of revenue earned from each of the different income streams in 2010?

- (A) \$50,000(B) \$70,000
- © \$122,000
- D \$170,000
- E \$220,000

<u>Solution</u>

In 2010, Acme Co. earned the most total revenue through wholesale sales, which accounted for 44% of \$500,000 = \$220,000 in total revenue. It earned the least through retail and other sales, which each accounted for 10% of \$500,000 = \$50,000 in total revenue.

The range of revenue for the different income streams was therefore 220,000 - 50,000 = 170,000, and (D) is the correct answer.

Suggested Strategies

Compared to their counterparts, quantitative questions that involve the use of tables and charts tend to be fairly straightforward. Even at the highest adaptive levels, they typically don't require clever inferences, understanding of advanced math rules, or efficient answer choice strategies.

Instead, success on these questions typically requires the following:

1. Comfort and familiarity. The last thing you want to do is run into an unfamiliar type of graph during your official timed exam. A key to success is to have previous experience working with all the different types of tables and graphs that you might encounter on test day.

2. Exactness. For these questions, you're typically provided with a lot more information than you are for other types of questions, so it's easier than usual to either misread or lose sight of the task, misinterpret the given information, or mismatch the two. **Therefore, you want to practice not rushing and being attentive to detail to avoid careless errors**.

3. Mastery of underlying math rules. Nearly every question you'll see related to tables and graphs will test either your ability to read the information correctly or your ability to utilize the given information to solve for ratios, proportions, or various statistics.

On the pages to come are three sample sets of table and graph questions. The first set includes four questions that focus on **reading correctly**, the second set includes four examples of **ratio and proportion** questions, and the final set includes four examples of **statistics** questions. By the time you're done, you should have a good sense of what to expect from table and graph questions and how to be successful with them.

Study Regimen

A certain student has decided to follow a strict study regimen that includes 3 daily study sessions: 1 in the morning, 1 in the afternoon, and 1 in the evening. At each study session, the student will devote a certain percentage of time to learning, a certain percentage of time to practice, and a certain percentage to review. The student will go through 3 stages of studying, during which she plans to change the time spent studying at each study session, as well as the allocation of that time to each priority, in the following manner:



Practice Questions

1. The study regimen recommends what percentage increase in daily study time between stage 1 and stage 3?

- (A) 25%
- B 50%
- © 75%
- D 100%
- E 175%

2. Assuming that the regimen's recommendations for the percentage of time spent on learning, practice, and review apply to each study session of each day, how much time is recommended for practice in the afternoon session during stage 3?

- (A) 12 minutes
- B 20 minutes
- © 24 minutes
- D 30 minutes
- (E) 36 minutes

3. How many more minutes per day will the student spend reviewing during stage 2 than they will during stage 1?



4. Assuming that the study regimen's recommendations for percentage of time allocated to learning, practice, and review apply to each study session of each day, for which of the following study sessions are the greatest number of minutes allocated to learning?

- A morning in stage 1
- (B) An evening in stage 1
- © An afternoon in stage 2
- D A morning in stage 3
- (E) An evening in stage 3

Practice Question Solutions

1. The study regimen recommends what percentage increase in daily study time between stage 1 and stage 3?

- A 25%
- B 50%
- © 75%
- D 100%
- E 175%

Solution

In stage 1, the total daily recommended study time was 30 + 60 + 30 = 120. In stage 3, the total jumps to 60 + 60 + 90 = 210.

The difference is 210 - 120 = 90.

$$\frac{90}{120} = \frac{3}{4} = 75\%$$
 increase.

(C) is the correct answer.

2. Assuming that the regimen's recommendations for the percentage of time spent on learning, practice, and review apply to each study session of each day, how much time is recommended for practice in the afternoon session during stage 3?

- (A) 12 minutes
- B 20 minutes
- © 24 minutes
- D 30 minutes
- E 36 minutes

<u>Solution</u>

From the circle graph, you know that it is recommended that the student spend 60% of their study time during stage 3 on practice. If an afternoon session is 60 minutes long, the student would spend. (6)60 = 36 minutes of that on practice, so **(E) is the correct answer**.

3. How many more minutes per day will the student spend reviewing during stage 2 than they will during stage 1?



<u>Solution</u>

During stage 1, the student studies a total of 120 minutes per day, 10% of which they spend reviewing, which equates to 12 minutes per day.

During stage 2, the student studies a total of 180 minutes per day, 20% of which they spend reviewing, which equates to 36 minutes per day.

Thus, the student will spend 24 minutes more per day reviewing during stage 2 than they did during stage 1.

4. Assuming that the study regimen's recommendations for percentage of time allocated to learning, practice, and review apply to each study session of each day, for which of the following study sessions are the greatest number of minutes allocated to learning?

- A morning in stage 1
- B An evening in stage 1
- C An afternoon in stage 2
- D A morning in stage 3
- (E) An evening in stage 3

<u>Solution</u>

In stage 1, the regimen recommends spending 70% of one's studying time on learning. In stage 1, the morning and evening sessions are both 30 minutes, so for both (A) and (B), the portion devoted to learning = (0.7)(30) = 21 minutes.

For afternoon in stage 2, learning = (0.4)(60) = 24 minutes.

For morning in stage 3, learning = (0.1)(60) = 6 minutes.

For evening in stage 3, learning = (0.1)(90) = 9 minutes.

(C) is the greatest and the correct answer.

Districts

A certain city comprises 4 districts: A, B, C, and D. The following table lists the population of each of the 4 districts in the city both in 2015 and in 2020.

District	2015	2020
Α	3,201	3,992
В	5,422	5,664
С	5,640	5,286
D	6,043	6,120

Practice Questions

1. Approximately what percentage of the city's population lived in District D in 2020?

(A) 25%

(B) 29%

C) 32%

D 34%

E) 36%

3. The increase in population in District B represents approximately what percent of the total increase in population for the entire city between 2015 and 2020?

(A)	18%
B	32%
\bigcirc	42%
\bigcirc	64%

(E) 71%

2. Which of the following is closest to the ratio of the population of District A in 2015 to the population of District *A* in 2020?

(A) 2:3

(B) 3:4

© 32:39

D 4:5

(E) 16:19

4. If the ratio of the population in District A to the population in District C had stayed roughly consistent between 2015 and 2020, and if District A had a population of 3,992 in 2020, what population is expected in District *C* in 2020?

(A)	4,890
B	6,440
\bigcirc	7,030
\bigcirc	7,260
E	8,340

Practice Question Solutions

1. Approximately what percentage of the city's population lived in District *D* in 2020?

B 29%

© 32% D 34%

(E) 36%

L J0%

Solution

There were a total of 3,992 + 5,664 + 5,286 + 6,120 = 21,062 residents in the city in 2020, and 6,120 of them live in District D. $\frac{6,120}{21,062} \approx 29\%$, and **(B) is the correct answer**.

2. Which of the following is closest to the ratio of the population of District A in 2015 to the population of District A in 2020?

A 2:3

B 3:4

© 31:39

D 4:5

E 16:19

Solution

The ratio of the population of District *A* in 2015 to 2020 is 3,201:3,992, which is roughly equivalent to 32:40. You can simplify this by dividing both parts of the ratio by 8, which gives you 4:5. Alternatively, you could have used a calculator to see that $\frac{3,201}{3,992} \approx 80.2\%$, which, again, is closest to the ratio 4:5. **The correct answer is (D)**.

3. The increase in population in District *B* represents approximately what percent of the total increase in population for the entire city between 2015 and 2020?

(A)	18%
B	32%
\bigcirc	42%
\bigcirc	64%
E	71%

<u>Solution</u>

District *B* increased by 5664 – 5422 = 242.

Meanwhile, in 2015, the total population for the city was 3,201 + 5,422 + 5,640 + 6,043 = 20,306.

In 2020, it was 3,992 + 5,664 + 5,286 + 6,120 = 21,062.

21,062 - 20,306 = 756.

 $\frac{242}{756} \approx 32\%$

(B) is the correct answer.

4. If the ratio of the population in District *A* to the population in District *C* had stayed roughly consistent between 2015 and 2020, and if District *A* had a population of 3,992 in 2020, what population is expected in District *C* in 2020?

- A 4,890
- B 6,440
- © 7,030
- D 7,260
- E 8,340

Solutions Continued

<u>Solution</u>

The ratio of the population of District *A* to the population of District *C* in 2015 is $\frac{3,201}{5,640}$.

If District A has a population of 3,992 in 2020 and the two districts continue to have the same ratio, you can use the following proportional equation to solve for the population of District C in 2020:

 $\frac{3,201}{5,640} = \frac{3,992}{x}$

3,201x = (3,992)(5,640)

 $x = \frac{(3,992)(5,640)}{3,201}$

x = 7,033.7, which is closest to 7,030 in answer choice (C).

Grades



Practice Questions

1. Which of the following represents the average (arithmetic mean) number of students per period who received either an A or a B?

3. For which periods is the range of grades greater than 35%?

- A 8
- B 13
- © 17
- D 19
- E 22

2. Which of the following could be the median percent grade for the first period?

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

Α	76%
В	78%
С	81%
D	89%
Е	92%

(A) First

- B Second
- © Third
- \bigcirc First and second only
- $\textcircled{\mbox{\sc E}}$ It cannot be determined.
- 4. Which of the following must be true?

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

- A The range of grades was greater in the first period than in the second period.
- B The range of grades was greater in the second period than in the third period.
- C The range of grades was greater in the first period than in the third period.

Sample Question Solutions

1. Which of the following represents the average (arithmetic mean) number of students per period who received either an A or a B?

- A 8
 B 13
 C 17
 D 19
- (E) 22

Solution

In the first period, 6 + 8 = 14 students received either an A or a B. In the second period, 12 + 8 = 20 students received an A or a B. Finally, in the third period, 5 + 12 = 17 students received either an A or a B. Thus, a total of 14 + 20 + 17 = 51 students received either an A or a B, for an average of $\frac{51}{3} = 17$ such students per

period. (C) is the correct answer.

2. Which of the following could be the median percent grade for the first period?

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



<u>Solution</u>

There are 6 + 8 + 6 + 2 + 2 = 24 total grades given out in the first period, and you know the median percent grade must be the average of the 12th and 13th highest grades. Per what you know about the grades for this period, you can infer that the 12th and 13th highest grades must have been B's, which you are told are between 80 and 89%. **Thus, both [C] and [D] could represent the median percent grade for the period**. 3. For which periods is the range of grades greater than 35%?

- (A) First
- (B) Second
- © Third
- D First and second only

(E) It cannot be determined.

<u>Solution</u>

If a class has students with A's and F's, the range can be as great as 100 or as small as 90 - 59 = 31. Therefore, you cannot determine if any ranges are greater than 35%, and **(E) is the correct answer**.

4. Which of the following must be true?

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

- A The range of grades was greater in the first period than in the second period.
- B The range of grades was greater in the second period than in the third period.
- C The range of grades was greater in the first period than in the third period.

<u>Solution</u>

The range of grades for the first period could be as great as 100 - 0 = 100 or as small as 90 - 59 = 31%.

The range of grades for the second period could be as great as 100 - 60 = 40 or as small as 90 - 69 = 21%.

The range of grades for the third period could be as great as 100 - 70 = 30 or as small as 90 - 79 = 11%.

Thus, the only statement that must be true is [C], so **[C]** is the correct answer.