

Looking at raw data consisting of mind-boggling numbers will surely give a headache to anyone.

For this reason, people who constantly organize and arrange data create visual representations called **graphs** to summarize them.

Graphs are indispensable tools for those who generate information and insights from their data. Statisticians, scientists, economists, teachers, and even political analysts use graphs for their studies as well as to share their expert opinions with the public.

However, you don't need to be a professional to analyze a graph. Graphs are created so that people can easily grasp information extracted from a data set.

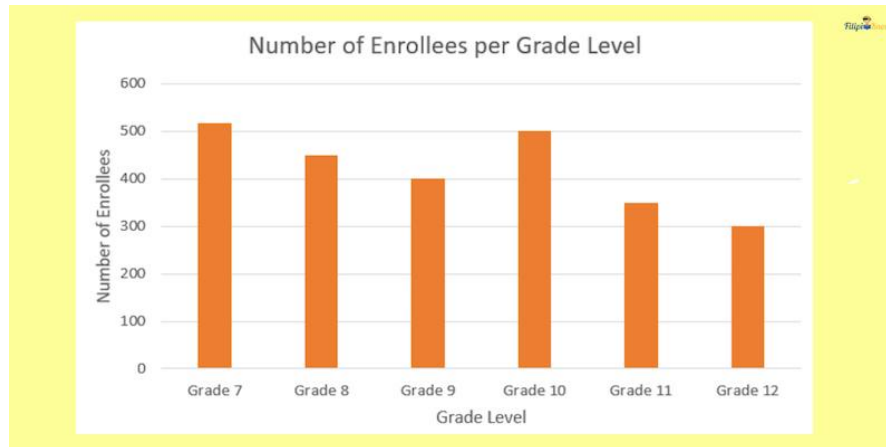
In this reviewer, you're going to learn how to analyze graphs and use them to create meaningful interpretations and conclusions.

What Are Graphs?

Graphs are visual diagrams used to present quantitative data. The goal of a graph is to make the presentation of data more concise and organized so that people can derive accurate information and insights from them in the shortest possible time.

Suppose there are 850 students in a certain national high school. These students belong to different grade levels. If the school administration just relies on the individual enrollment forms of the students, it will take them a lot of time to analyze the distribution of students in different grade levels.

To easily identify how many students are enrolled in each grade level, the school administrators may use graphs to represent the data derived from the enrollment forms. Below is a bar graph presenting the number of students enrolled per grade level in the said national high school.



The bar graph above allows us to quickly identify which grade level has the lowest or highest number of students. If we are going to rely on raw data, it will take too much time before we can create any conclusion.

What Are the Different Types of Graphs?

1. Bar Graphs

Bar graphs represent the amount or magnitude of a specific category. A bar graph can either be horizontal or vertical.

There are two axes in a bar graph. In a vertical bar graph, the horizontal axis indicates the categories, while the vertical axis indicates the magnitude or quantity of each category. On the other hand, in the horizontal bar graph, the horizontal axis indicates the quantity or magnitude of each category, while the vertical axis indicates the categories included in the graph.



Shown above are horizontal and vertical bar graphs presenting the monthly sales of a company from January 2018 to June 2018.

Notice that in a vertical bar graph, the horizontal axis indicates the category or the months being presented. Meanwhile, the vertical axis indicates the number of sales for each month. For the vertical bar graph, the designation of the axes is reversed.

When Is a Bar Graph Used?

A bar graph is best used when comparing quantities of different categories.

Consider our previous example showing the monthly sales of a company from January 2018 to June 2018.

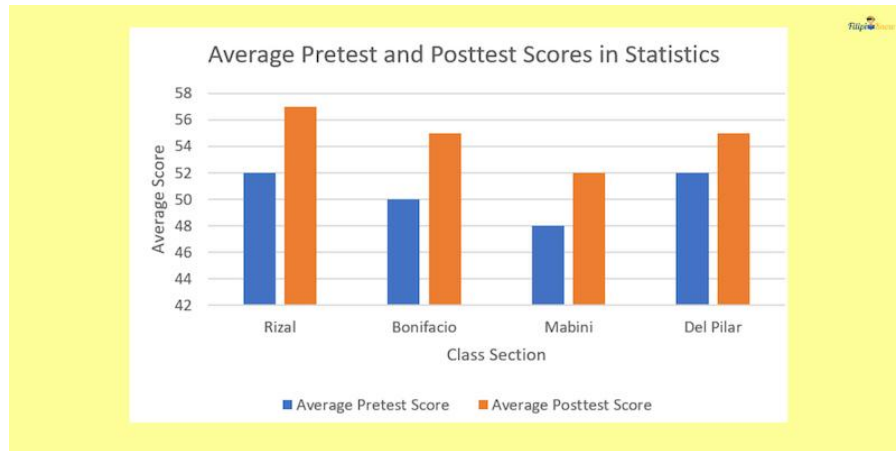


For instance, we can easily state that the monthly sales of the company during April 2018 are higher than in May 2018. We can also conclude that the month with the highest sales is March 2018. Similarly, the month with the lowest sales is May 2018.

Multiple Bar Graph

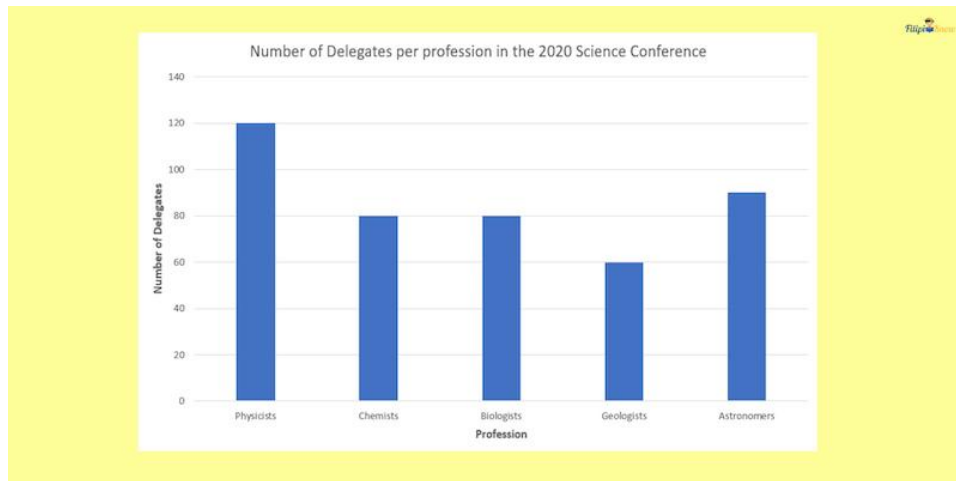
Multiple bar graphs indicate multiple information for each category. They come with a legend to indicate what information each rectangle represents.

Below is an example of a multiple bar graph for the average pretest and posttest scores of different Grade 10 sections in their Statistics class.



Note that for each category, there are two rectangles presented. Blue rectangles represent the average pretest score while orange rectangles represent the average post-test score (refer to the legend below the multiple bar graph).

Sample Problem: Shown below is a bar graph that represents the number of delegates per profession in a science conference.



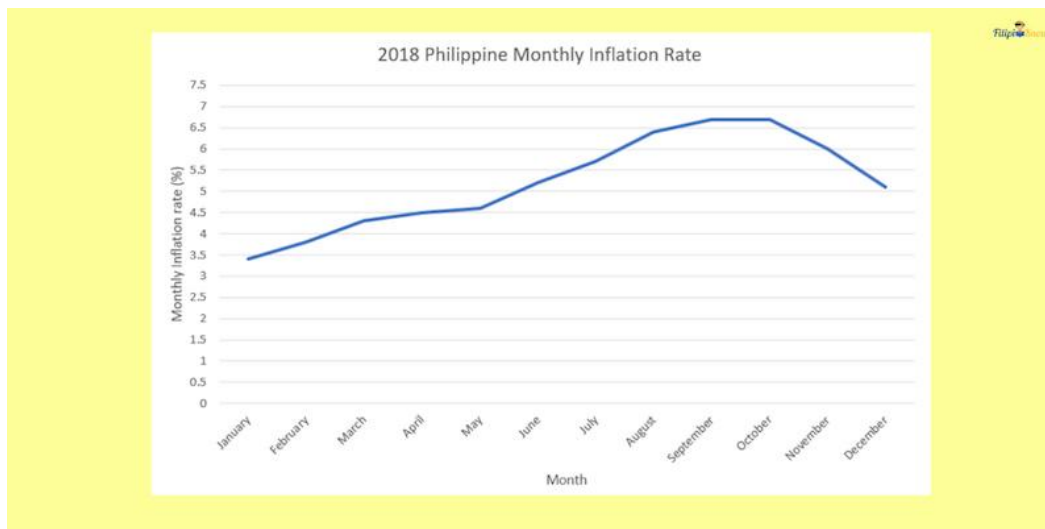
What is the difference between the number of physicists and geologists that joined the conference?

Solution: By looking at the graph, there are 120 physicists who joined the conference. Meanwhile, 60 geologists joined the conference. The difference between the two is $120 - 60 = 60$.

2. Line Graph

As the name suggests, a line graph is a graph that involves straight lines.

Below is an example of a line graph that presents the monthly inflation rate of the Philippines in 2018, based on the data obtained from the Philippine Statistics Authority (PSA).



Again, we have two axes in a line graph. The horizontal axis usually indicates the period in a line graph. In our example below, the horizontal axis indicates the months in 2018. On the other hand, the vertical axis indicates the quantity being presented by the line graph. In our example, the vertical axis indicates the monthly inflation rate.

When Is a Line Graph Used?

A line graph is best used to show how data changes over time. It provides us with information on the trend or behavior of the numerical data as time progresses.

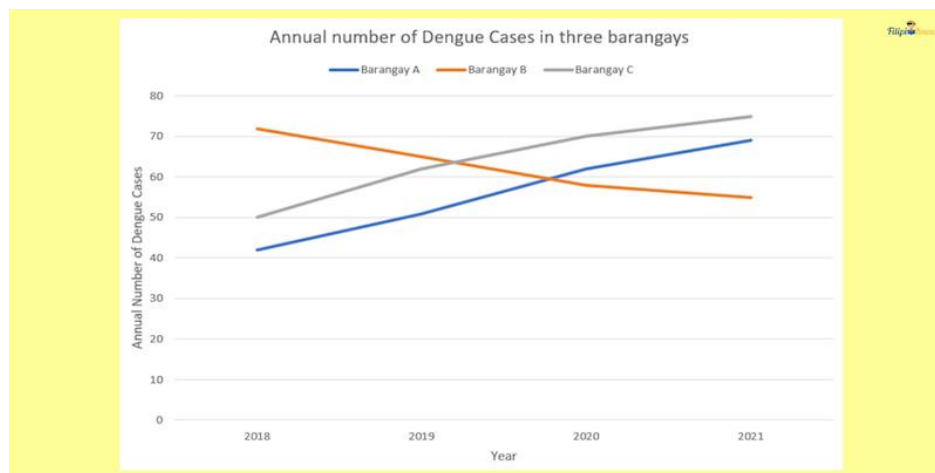
Refer again to the line graph of the monthly inflation rate of the Philippines in 2018. The graph above shows how the monthly inflation rate changes from January to its succeeding months. We can deduce from the line graph that the inflation rate continuously climbed from January 2018 until October 2018. Afterward, the inflation rate started to go down from November 2018 until December 2018.

This suggests that the increase in prices of goods and services in the Philippines during 2018 rose from January to October, which eventually declined in November.

Multiple Line Graphs

We also have multiple line graphs where more than one line graph is plotted. We use multiple line graphs to portray the difference in the rate of how certain variables change value over time. A multiple-line graph uses legends to indicate the variable represented by each line.

Shown below is an example of a multiple-line graph.



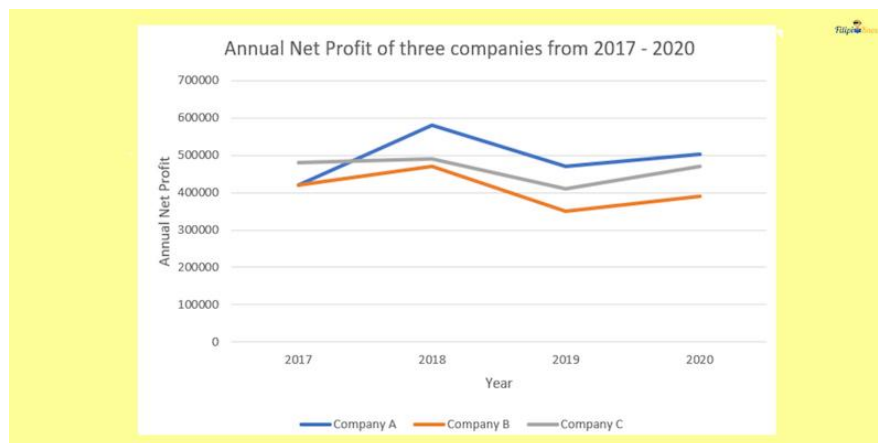
The multiple line graph above presents the annual number of dengue cases in Barangay A, Barangay B, and Barangay C from 2018 to 2021. Note that by referring to the legend in the upper part of the line graph, we can see that the blue line represents Barangay A, the orange line represents Barangay B, and the gray line represents Barangay C.

The multiple-line graph above enables us to compare the behavior of each barangay in terms of the number of dengue cases. As we can see, only Barangay B has a declining number of dengue cases within four years. This is illustrated by the downward trend of the orange line that represents Barangay B.

Furthermore, although both Barangay A and C have an increasing number of dengue cases from 2018 to 2021, we can see that Barangay C has higher Dengue cases per year than Barangay A. This is because the gray line that represents Barangay C is located above the blue line that represents Barangay A.

Sample Problem: Shown below is a multiple-line graph presenting the 2017 - 2020 annual net profit of three companies. Answer the questions below:

1. Which company has the highest net profit in 2017?
2. Provide an estimate of the annual net profit difference between Companies A and C in 2018.



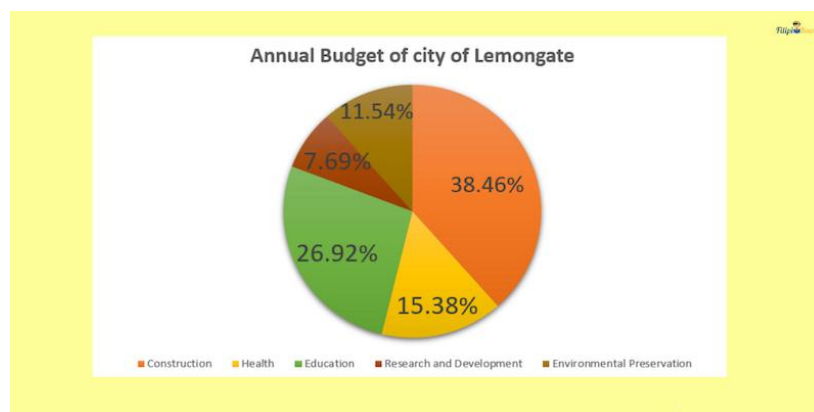
Solution:

1. The graph suggests that in 2017, Company C garnered the highest net profit. The gray line which represents Company C is plotted higher than other lines in the year 2017.
2. Let us look at the respective annual net profit of Companies A and C for the year 2018. Unfortunately, the graph cannot provide us with an exact value for the net profit of each company for this year. However, we can somehow estimate their net profits based on the graph. For instance, the net profit of Company A in 2018 is about ₱600,000 (this is just an estimate based on the graph and not the actual value). On the other hand, the net profit of Company C in 2018 is about ₱500,000 (again, this is just an estimate based on the graph and not the actual value). Thus, the estimated difference in their net profit would be $600,000 - 500,000 = ₱100,000$.

3. Pie Chart

A pie chart is a circular graph divided into “slices.” The entire pie chart represents the entire data set we are presenting. Meanwhile, each slice represents a portion of the data. The size of each slice is proportional to its numerical value.

Shown below is an example of a pie chart. This pie chart presents the annual budget of a small city.



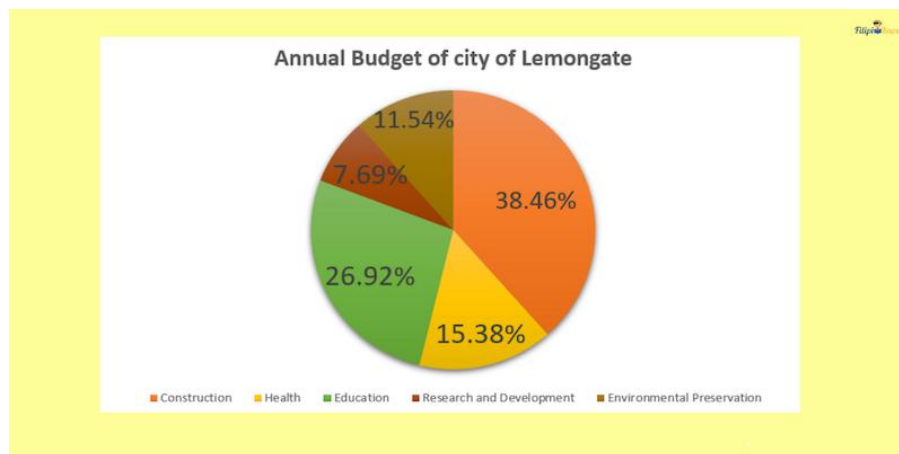
Look how the pie chart above shows us in which expenses the annual budget of the city was allocated. We can see that the budget is divided among “Construction,” “Health,” “Education,” “Research and Development,” and “Environmental Preservation.” The pie chart also tells us the percentage portion of each expense relative to the total budget. For instance, 38% of the total budget is allocated for construction.

When Is a Pie Chart Used?

A pie chart is used if we want to show a “part-to-whole” relationship in a given data. In other words, we use this diagram if we want to show the composition of the whole data. Going back to our previous example about the annual budget of the small city, we can present the composition of the entire budget by dividing it into different categories (e.g., Construction, Health, Education, etc.).

How To Interpret a Pie Chart?

Let’s go back to the annual budget of a small city presented as a pie chart.



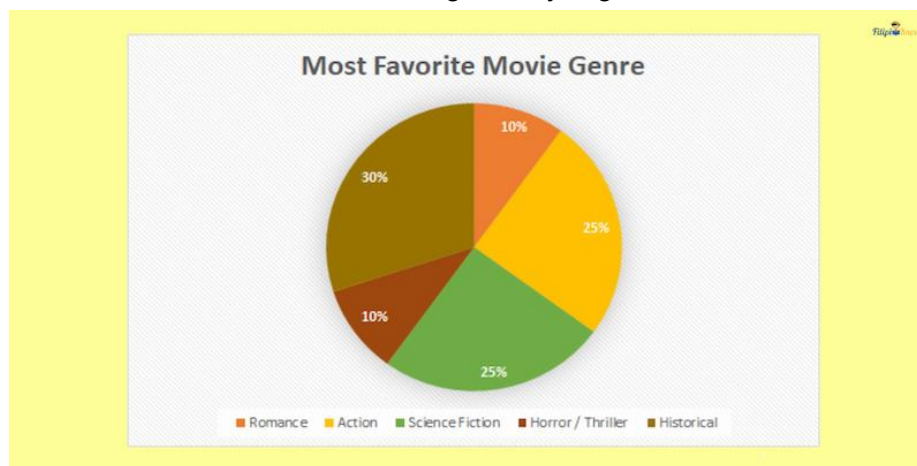
Suppose that the total budget of Lemongate City is ₱130,000,000. Let us figure out the allocated budget for construction based on the given pie chart.

According to the given pie chart, 38.46% is allocated for construction. To determine how much is allocated for this category, we simply multiply the total budget (which is ₱130,000,000) by the percentage allocation for construction (which is 38%):

$$130,000,000 \times 0.3846 = \text{₱}49,998,000$$

Therefore, out of the ₱130,000,000 annual budget of Lemongate City, ₱49,998,000 is allocated for construction.

Sample Problem: Shown below is a pie chart presenting the favorite movie genres of 200 students of Lemongate City High School.



Answer the following questions:

1. How many students have romance as their favorite movie genre?
2. How many students have science fiction as their favorite movie genre?
3. How many students have a favorite movie genre that is not action?

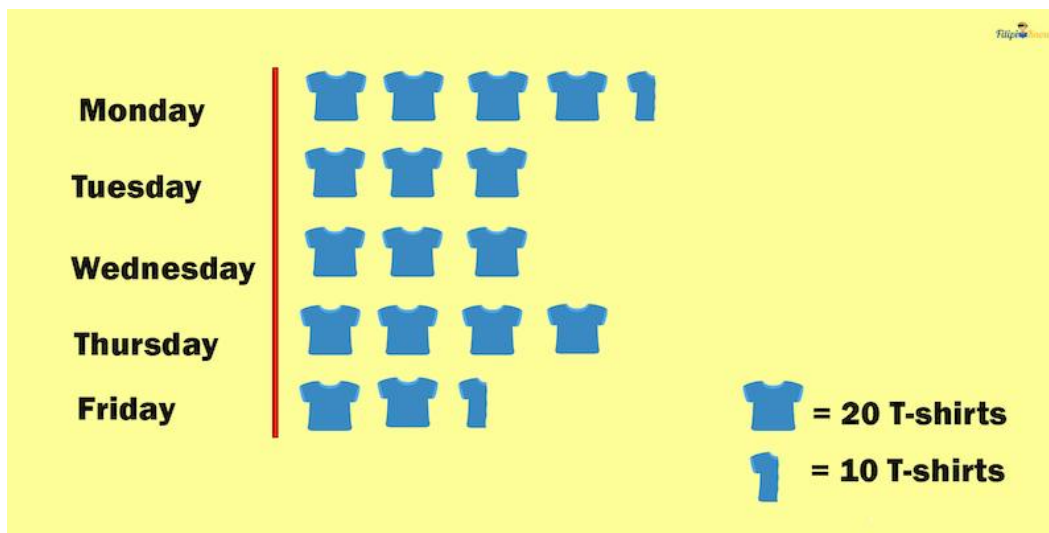
Solution:

1. According to the pie chart, 10% of 200 students have romance as their favorite movie genre. Thus, $0.10 \times 200 = 20$ students have romance as their favorite movie genre.
2. According to the pie chart, 25% of 200 students have science fiction as their favorite movie genre. Thus, $0.25 \times 200 = 50$ students have science fiction as their favorite movie genre.
3. According to the pie chart, 25% of 200 students have action as their favorite movie genre. This implies that $100\% - 25\% = 75\%$ of students have a favorite movie genre that is not action. Thus, we have $0.75 \times 200 = 150$ students.

4. Pictograph

From the portion of the word itself, “picto,” we can quickly guess that this type of graph involves images. That’s exactly what a pictograph is; it is a graph that uses images or illustrations to present data.

Below is an example of a pictograph illustrating the number of T-shirts sold by Lemongate Fabrics in an entire week.



As you can see, each T-shirt icon is equivalent to 20 T-shirts sold, while the “half” T-shirt icon represents 10 T-shirts sold.

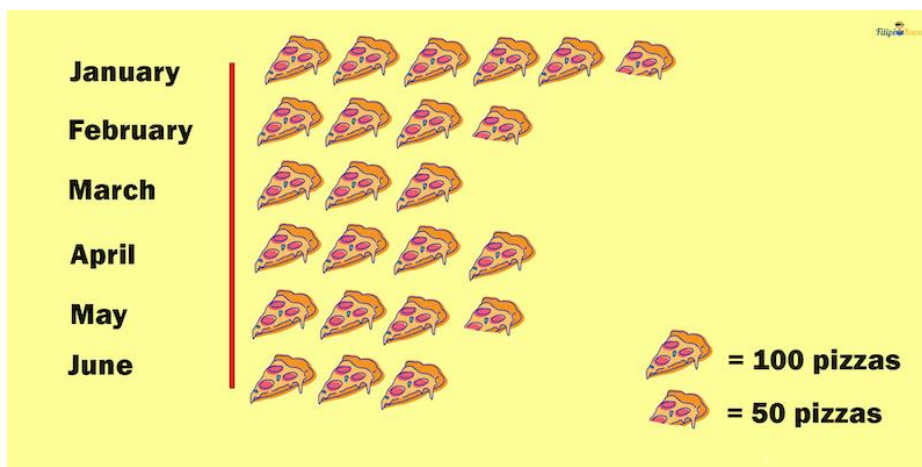
For instance, we can see that Lemongate Fabrics sold 90 T-shirts on Monday because it has four T-shirt icons that represent 80 T-shirts sold ($4 \times 20 = 80$). Furthermore, it has one “half” T-shirt icon, which represents 10 T-shirts sold ($1 \times 10 = 10$). Hence, the total number of T-shirts sold on Monday is $80 + 10 = 90$.

When Is a Pictograph Used?

Pictograph is best used to illustrate organized data engagingly. If done properly, a pictograph can be colorful and visually appealing, which can entice readers to analyze the data further.

However, pictographs can be misleading or confusing if the icons or images used are not well-defined. Hence, the images must be made properly to make data interpretation easier.

Sample Problem: Shown below is a pictograph presenting the number of pizzas sold by Lemongate Hut for the last six months.



1. How many pizzas are sold in March?
2. Which month has the highest number of pizzas sold?



Mathematics Reviewer

Graph Analysis

Solution:

1. There are three “whole” pizza icons illustrated for March. Hence, the total pizzas sold that month is $3 \times 100 = 300$.
2. It's clear that January has the highest number of pizzas sold because it has the most number of pizza icons presented in the pictograph.



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To God be the glory!