



7th
Basic

8th
Advanced

Helping With Math

USA
GRADES

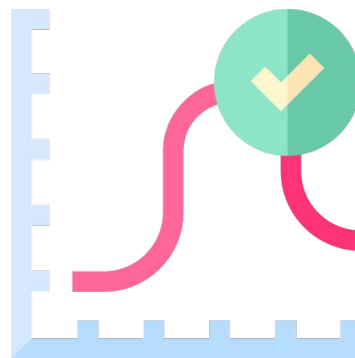
Measures of Skewness

Suitable for students
aged 11-13



This pack is suitable for learners aged 11-13 years old or 7th to 8th graders (USA). The content covers fact files and relevant basic and advanced activities involving measures of skewness..

Skewness is a measure of symmetry or the degree of asymmetry from the symmetry of a distribution. It measures the deviation of the distribution of a random variable from the a distribution which is normal and symmetrical on both sides.



Symmetric Distribution

- identical on both sides if divided into two at the center.

Skewed Distribution

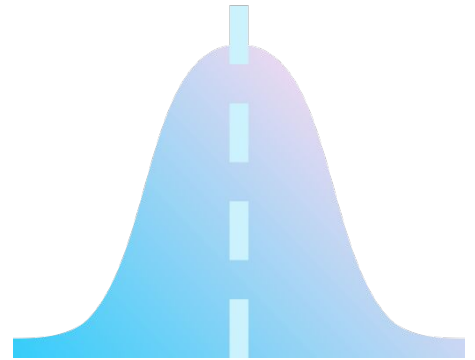
- not identical on both sides if divided into two at the center.



TYPES OF DISTRIBUTION

Symmetric Distribution

In a symmetrical distribution, the mean, median, and mode coincide with each other or are all equal.



Asymmetric or Skewed Distribution

It is also known as a non-symmetric or non-normal distribution. In an asymmetrical distribution, the mean, median, and mode occur at different points.

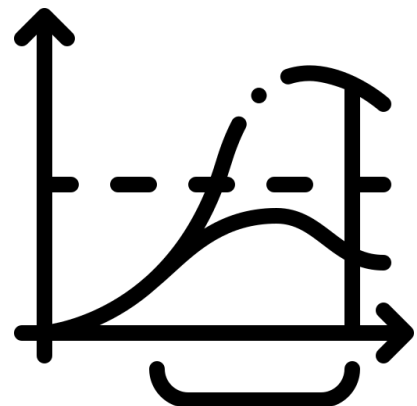
TYPES OF SKEWED DISTRIBUTION

Positively Skewed Distribution

The distribution is positively skewed if its tail shifts towards the right. The mean and median are greater than the mode. It is also called the right skewed distribution.

Negatively Skewed Distribution

The distribution is negatively skewed if its tail shifts towards the left. The mean and median are less than the mode. It is also called the left skewed distribution.



HOW DO YOU READ SKEWNESS?

1. If the skewness is less than -1 or greater than +1, the distribution is highly skewed.
2. If skewness is between -1 and -0.5 or between +0.5 and +1, the distribution is moderately skewed.
3. If skewness is between -0.5 and +0.5, the distribution is approximately symmetric.

PEARSON'S COEFFICIENT OF SKEWNESS

$$\text{Skewness} = \frac{3(\text{mean} - \text{median})}{\text{standard deviation}} \quad \text{or} \quad \text{Skewness} = \frac{\sum (X_i - \bar{X})^3}{(n - 1)s^3}$$

EXAMPLE

1. Find the value of skewness given a mean of 5.4, a median of 6.5 and a standard deviation of 2.3.

$$\text{Skewness} = \frac{3(\text{mean} - \text{median})}{\text{standard deviation}} = \frac{3(5.4 - 6.5)}{2.3} = -1.43$$

Interpretation:

The distribution is negatively skewed and highly skewed because the value is less than -1. Hence, the concentration of data is more on the left side.



EXAMPLE

The data of items made during the production is given below.

No. of products per machine	21 - 25	26 - 30	31 - 35	36 - 40	41 - 45	46 - 50
No. of machines	2	5	18	32	6	2

Class	Class Mark (x)	f	xf	$(x - \bar{x})$	$f(x - \bar{x})^2$	$f(x - \bar{x})^3$
21 - 25	23	2	46	-13.15	345.85	-4547.86
26 - 30	28	5	140	-8.15	332.11	-2706.7
31 - 35	33	18	594	-3.15	178.61	-562.68
36 - 40	38	32	1216	1.85	109.52	202.56
41 - 45	43	6	258	6.85	281.54	1928.52
46 - 50	48	2	96	11.85	280.85	3328.02

$$\text{Mean} = \frac{\sum (xf)}{N} = \frac{2350}{65} = 36.15$$

$$s = \sqrt{\frac{f(x - \bar{x})^2}{N - 1}} = \frac{1528.48}{64} = 4.89$$

$$Sk = \frac{\sum (X_i - \bar{X})^3}{(n - 1)s^3}$$

$$Sk = \frac{-2358.14}{(64)(4.89)^3}$$

The distribution is negatively skewed. Therefore, the concentration of the products/machines is more on the left side.

$$Sk = -0.32$$



TABLE OF ACTIVITIES

Ages 11-12 (Basic)		7th Grade
1	A Business Meeting	
2	Business Minded	
3	See The Sales	
4	Business Math	
5	How Skewed Is It?	
Ages 12-13 (Advanced)		8th Grade
6	Graph Interpretation	
7	Understand Your Competitors	
8	Business Partners	
9	Problem Solver	
10	Having The Right Idea	



A BUSINESS MEETING

G7
Basic

Ms. Johnson is about to leave her house for a business meeting. But she needs to tell first which of the statements are correct by writing true and replacing the underlined word/s if false.

1. Measures of skewness is also called as the measures of shape.



2. Data with a negative skew has tails in the right direction.

3. A box plot can be used to display the skew of data.

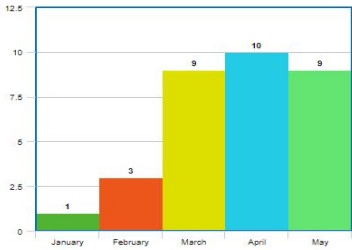
4. A positive number means negative skew.

5. A symmetrical distribution means a normal curve.

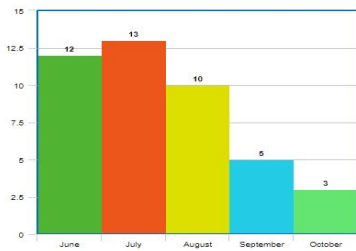
6. In a right skewed distribution, the mean and median are less than the mode.



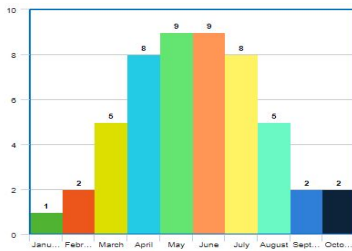
As a businesswoman, Ms. Johnson wants to make sure that her business makes profit by looking and interpreting the graphs below.



1. The data in the graph show the sales of Ms. Johnson from January to May. The data is:
- A. negatively skewed
 - B. positively skewed
 - C. right skewed
 - D. symmetrical

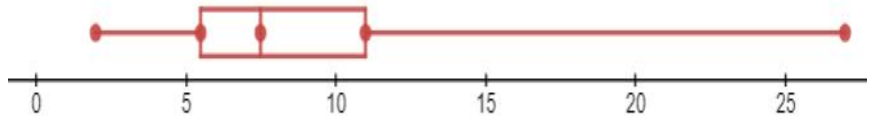


2. The data in the graph show the sales of Ms. Johnson from June to October. The data is:
- A. negatively skewed
 - B. right skewed
 - C. left skewed
 - D. symmetrical



3. The data in the graph show the sales of Ms. Johnson last year from January to October. The data is:
- A. negatively skewed
 - B. right skewed
 - C. left skewed
 - D. symmetrical

4. The data in the graph show the sales of Ms. Johnson per hour in a day. The data is:
- A. negatively skewed
 - B. right skewed
 - C. left skewed
 - D. symmetrical



1.	3.
2.	4.



SEE THE SALES

G7
Basic

In the world of business, every sale is being recorded. Help Ms. Johnson to make a visual representation of her sales by creating a stem and leaf plot and histogram.

Bag of chocolate balls sold per day:

60 53 120 50 78 40 75 115 60 40 86
49 72 65 60 55 65 45 115 104 54 83

Stem and Leaf Plot

Frequency Table

Class	Count
40 - 54	
55 - 69	
70 - 84	
85 - 99	
100 - 114	
115 - 129	

Histogram



Ms. Johnson wants to find out if she can use the mean, median, and mode to interpret the skewness of the data sales. Help her to figure it out!

1. Number of toys sold in a week

21 18 19 25 21 21 22

Mean

Median

Mode

What is the shape of the distribution based on your obtained mean, median, and mode? Explain.

2. Number of candies sold in a week

36 48 52 30 32 52 58

Mean

Median

Mode

What is the shape of the distribution based on your obtained mean, median, and mode? Explain.



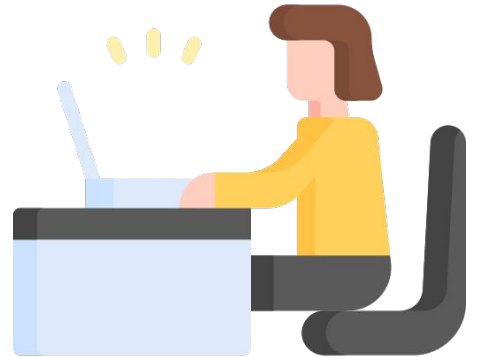
HOW SKEWED IS IT?

G7
Basic

After Ms. Johnson has computed the necessary values and knew the shape of the graph, she wants to know how skewed the graph is by computing the skewness of the data.

1. Number of doughnuts sold per month
Mean = 43 Median = 55
Standard Deviation = 6.2

Skewness



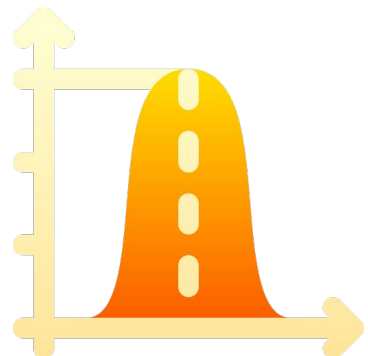
2. Amount of sales per month
Mean = \$12 452 Median = \$10 309
Standard Deviation = 9.4



Skewness

3. Amount of profit per month
Mean = \$435 Median = \$435
Standard Deviation = 5.3

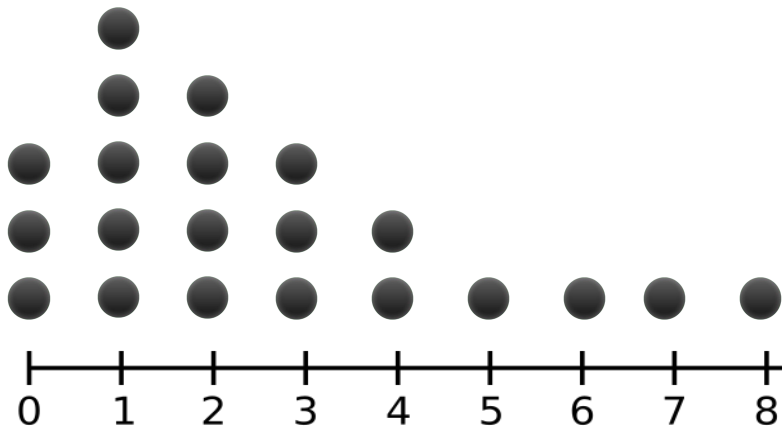
Skewness



GRAPH INTERPRETATION

G8
Basic

Businessmen should have an appropriate knowledge of their business. Without it, they cannot make a good business plan and make correct decisions. One of those is to make an interpretation of the product sales. If you are a businessman, which of the statements are true and if false, how will you make it correct?



1. The peak occurs at 1.
2. The graph is symmetric.
3. The graph is right skewed.
4. The mean is 4.
5. The median is 3.
6. The mode is 1.

1.

2.

3.

4.

5.

6.

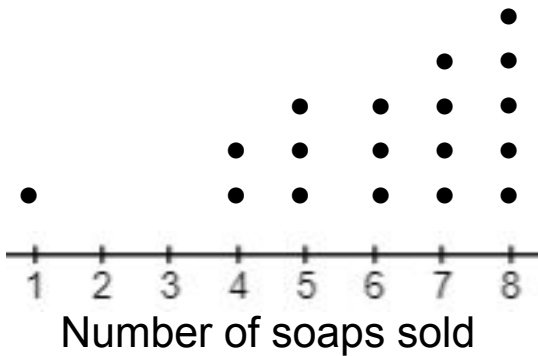


UNDERSTAND YOUR COMPETITORS

G8
Basic

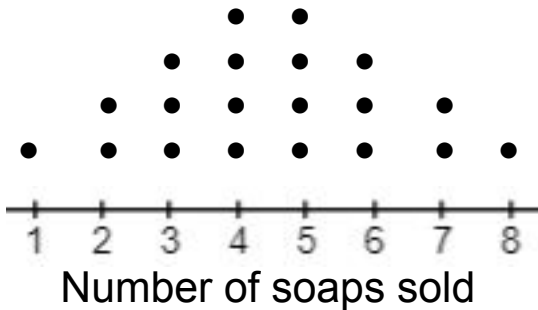
In business, thinking critically is very important and getting motivation from your competitors may help you be more innovative and creative. The line plots below represent the number of soaps sold in 15 days. Each day is represented by one circle. Describe each of the graphs by answering the questions..

Store A



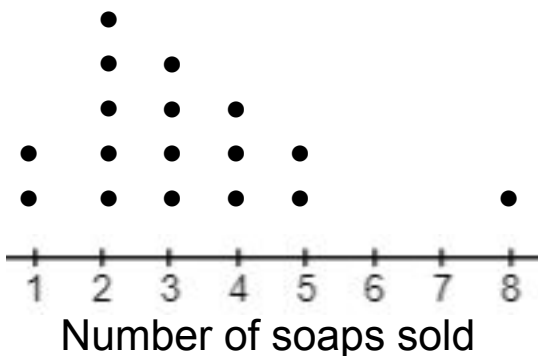
1. Describe the shape of the graph of store A.

Store B

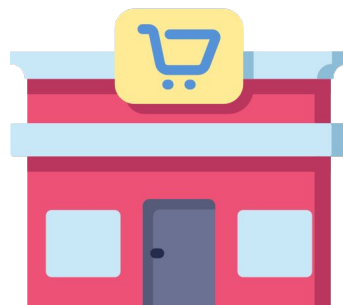


2. Compare the graphs of store A and store B.

Store C



3. Which of the graphs has/have outliers?



BUSINESS PARTNERS

G8
Basic

One of the people present in the business meeting asked Ms. Johnson if she could help him answer and interpret the data of his sales. These are given below.

The data on the profits (in dollars) earned by 40 companies is as follows:

Profits	1 - 100	101 - 200	201 - 300	301 - 400	401 - 500	501 - 600
No. of companies	2	6	10	12	7	3

Frequency Table

Class	Class Mark (x)	f	xf	$(x - \bar{x})$	$f(x - \bar{x})^2$	$f(x - \bar{x})^3$

Mean

Standard Deviation

Skewness

Interpretation

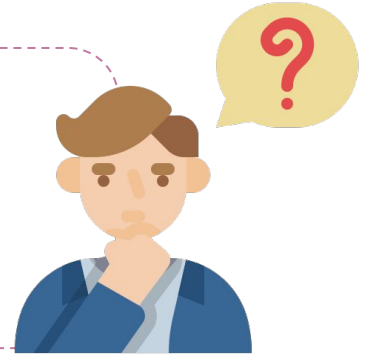


PROBLEM SOLVER

G8
Basic

One of the qualities of a businessman is to give solutions to the problems. If you are a businessman, create a problem where you need to collect and graph the data. The data should be skewed.

Problem



Data Table

Graph



HAVING THE RIGHT IDEA

G8
Basic

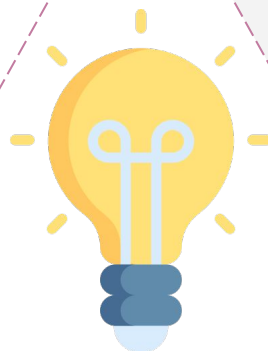
Deciding on what business you should be in must be different from what is already in the market. As a businessman, you should have a decision that serves the people for a long period of time. Since businessmen have full of ideas, they should also know how to decide on these questions.

Why is skewness important?

What is the most common type of skewness appearing in a set of data?

What is the difference between skewness and kurtosis?

What problems might encounter if the data is skewed?
How will it be solved?



ANSWER GUIDE

Activity 1

1. True
2. left
3. True
4. Positive
5. True
6. greater

Activity 2

1. A
2. B
3. D
4. B

Activity 3

Stem and Leaf Plot

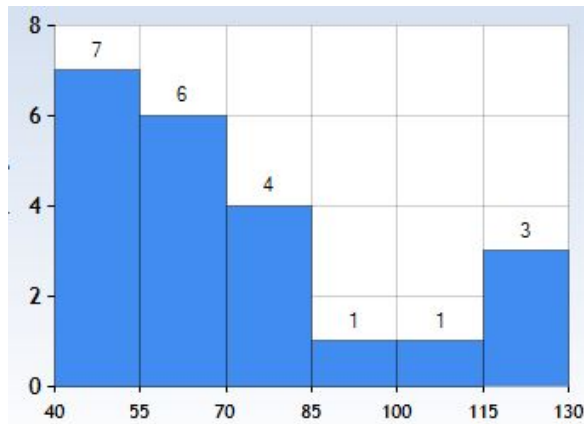
Stem	Leaf
4	0 0 5 9
5	0 3 4 5
6	0 0 0 5 5
7	2 5 8
8	3 6
9	
10	4
11	5 5
12	0

Frequency Table

Class	Count
40 - 54	6
55 - 69	7
70 - 84	4
85 - 99	1
100 - 114	1
115 - 129	3



ANSWER GUIDE



Activity 4

1. Mean = 21 Median = 21 Mode = 21
Symmetrical, because the mean, median and mode are equal.
2. Mean = 44 Median = 48 Mode = 52
Negatively skewed or left skewed distribution, because the mean and the median are less than the mode.

Activity 5

1. -5.81
2. 683.94
3. 0

Activity 6

1. True
2. The graph is positively skewed.
3. True.
4. The mean is 2.67.
5. The median is 2.
6. True

Activity 7

1. Store A is negatively skewed.
2. Store A is negatively skewed while store B is symmetrical.
3. Store A and B.



ANSWER GUIDE

Activity 8

Class	x	f	xf	$(x - \bar{x})$	$f(x - \bar{x})^2$	$f(x - \bar{x})^3$
1-100	50.5	2	101	-262.5	137812.5	-36175781.25
101-200	150.5	6	903	-162.5	158437.5	-25746093.75
201-300	250.5	10	2505	-62.5	39062.5	-2441406.25
301-400	350.5	12	4206	37.5	16875	632812.5
401-500	450.5	7	3153.5	137.5	132343.75	18197265.63
501-600	550.5	3	1651.5	237.5	169218.75	40189453.13

Mean = 313

Standard Deviation = 129.47

Skewness = -0.08

Interpretation may vary.

Activity 9

Answers may vary.

Activity 10

Answers may vary.



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