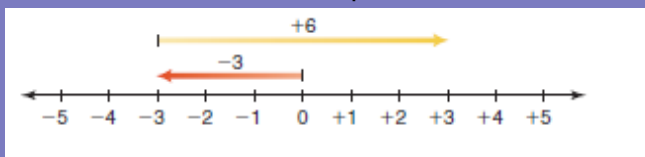


1) $(+1) + (-3) = -2$

2) What is the addition equation for the number line?



$(-3) + (+6)$

3) Represent the subtraction equation with counters:

$(-1) - (+2)$

4) $(+4) - (-3) = +7$

5) $49 \div 7$

6) $32 \times 0.5 = 16$

7) $424 \times 2 = 848$

8) What number is divisible by 4? a) 314 b) 118 c) 716

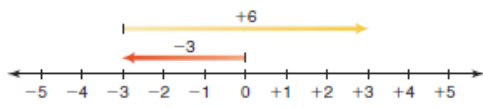
716

9) What number is divisible by 6? a) 104 b) 340 c) 606

606

10) $1/3$ of 33

11 ☺



Ready...find your pulse.



$\boxed{2}$, 25, 40, 44, 47, 52, 54, $\boxed{56, 66}$, 68, 70
~~71~~, ~~71~~, ~~83~~, ~~96~~, ~~97~~, ~~96~~, ~~66~~, ~~68~~, ~~70~~
~~47~~, ~~71~~, ~~52~~, ~~56~~, ~~83~~, ~~54~~
~~79~~, ~~40~~, ~~44~~, ~~25~~, ~~97~~
~~79~~, ~~40~~, ~~44~~, ~~25~~, ~~97~~

59.4
 59.37

mean
 median 61
 mode - no
 range - 97-2 = 95

16 heartbeats

7.3

The Effects of Outliers on Average

Focus Understand how mean, median, and mode are affected by outliers.

Connect

A number in a set of data that is significantly different from the other numbers is called an outlier.

An outlier is much greater than or much less than most of the numbers in the data set.

Outliers sometimes occur as a result of error in measurement or recording.

↖ In these cases, outliers should be ignored.

↖ Sometimes an outlier is an important piece of information that should not be ignored. For example, if one student does much better or much worse than the rest of the class on a test.

Outliers may not always be obvious.

Identifying outliers is then a matter of choice.

Example

Here are the marks out of 100 on an English test for students in a Grade 7 class:

21, 23, 24, 24, 27, 29, 29, 29, 32, 37, 37, 38, 39,

40, 50, 50, 51, 54, 56, 57, 58, 59, 61, 71, 80, 99

a) How many students were in the class? How do you know?

b) What is the outlier? Explain your choice.

b) There is only one number, 99, that is significantly different.

The outlier is 99.

The difference between the outlier and the nearest mark is $99 - 80 = 19$.

This difference is much greater than that between other pairs of adjacent marks.

c) Calculate the mean, median, and mode.

c) There are 26 marks. To find the mean mark, add the marks:

$$21 + 23 + 24 + 24 + 27 + 29 + 29 + 29 + 32 + 37 + 37 + 38 + 39 + \\ 40 + 50 + 50 + 51 + 54 + 56 + 57 + 58 + 59 + 61 + 71 + 80 + 99 = 1175$$

Divide the total by the number of marks, 26: $1175 \div 26 \doteq 45.2$

The answer is written to the nearest tenth.

The median mark is the mean of the 13th and 14th marks.

The 13th mark is 39. The 14th mark is 40.

So, the median is: $\frac{39 + 40}{2} = \frac{79}{2} = 39.5$

The mode is the mark that occurs most often. This is 29.

d) Calculate the mean, median, and mode without the outlier.
What do you notice?

d) Without the outlier, there are 25 marks and the sum of the marks is: $1175 - 99 = 1076$
The mean is: $1076 \div 25 = 43.04$
The median is the 13th mark: 39
The mode is 29.
When the outlier was removed, the mean and median decreased.
The mode remained the same.

e) Should the outlier be used when reporting the average test mark? Explain.

e) The outlier should be used when reporting the average test mark.

To understand how the class is performing, all test marks should be included.

Practice

1. This set of data represents the waiting time, in minutes, at a fast-food restaurant:

5, 5, 5, 6, 5, 7, 0, 5, 1, 7, 7, 5, 6, 5, 5, 5, 8, 5, 0, 5, 4, 5, 2, 7, 9

- Calculate the mean, median, and mode.
- Identify the outliers. Explain your choice.
- Calculate the mean, median, and mode without the outliers.

How is each average affected when the outliers are not included?

2. Bryan recorded the time he spent on the school bus each day for one month.

Here are the times, in minutes:

15, 21, 15, 15, 18, 19, 14, 20, 95, 18, 21, 14, 15, 20, 16, 14, 22, 21, 15, 19

- Calculate the mean, median, and mode times.
- Identify the outlier. How can you explain this time?
- Calculate the mean, median, and mode times without the outlier.

How is each average affected when the outlier is not included?

- A classmate asks Bryan, "What is the average time you spend on the bus each day?" How should Bryan answer? Give reasons.

Remember to arrange the data in order before finding the median.

Averages:
mean =
 mode
 median

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4. Here are the science test marks out of 100 for the Grade 7 students in a combined-grades class:

0, 66, 65, 72, 78, 93, 82, 68, 64, 90, 65, 68

- a) Calculate the mean, median, and mode marks.
- b) Identify the outlier. How might you explain this mark?
- c) Calculate the mean, median, and mode marks without the outlier. How is each average affected when the outlier is not included?
- d) Should the outlier be used when reporting the average test mark? Explain.



- 6. Assessment Focus** A Grade 7 class wanted to find out if a TV advertisement was true. The ad claimed that *Full of Raisins* cereal guaranteed an average of 23 raisins per cup of cereal. Each pair of students tested one box of cereal. Each box contained 20 cups of cereal. The number of raisins in each cup was counted.



- a) Assume the advertisement is true.
How many raisins should there be in 1 box of cereal?
- b) Here are the results for the numbers of raisins in 15 boxes of cereal:
473, 485, 441, 437, 489, 471, 400, 453, 465, 413, 499, 428, 419, 477, 467
- Calculate the mean, median, and mode numbers of raisins.
 - Identify the outliers. Explain your choice.
 - Calculate the mean, median, and mode without the outliers.
How do the outliers affect the mean?
 - Should the outliers be used when reporting the average number of raisins? Explain.
 - Was the advertisement true? Justify your answer.

