The Village School 's
AP Statistics Summer Math Packet

Please complete and turn in the following pages
on the first day of school in August.

AP Statistics Summer 2021 Mathematics Packet

Welcome to AP Statistics at The Village School. This packet consists of important concepts necessary for success in AP Statistics. Completion of this packet is mandatory for all AP Statistics students. As you complete this packet, show all steps used to arrive at your final answer. There are two parts to this packet: Part 1, mathematical practice problems to keep your math skills sharp, and Part 2, STEAM activity for you to explore.

Show your work on separate paper. For multiple choice questions, circle the correct response.

Part 1: Mathematical practice problems to keep your math skills sharp.

PERCENTS, DECIMALS, PROPORTIONS:

(A) Let's see if you can convert between decimals and percentages...

1) The percentage 3% is equivalent to what decimal:

(A) 300 (B) 30 (C) 3 (D) 0.3 (E) 0.03 (F) 0.003

2) The decimal 0.5 is equivalent to what percentage:

(A) 5% (B) 50% (C) 500% (D) 0.5% (E) 0.05% (F) 0.005%

3) "16%" is equivalent to which of the following:

(A) 16 (B) 0.16% (C) 0.016% (D) 0.16 (E) 0.016 (F) 0.0016

(B) Let's see if you can convert between proportions and percentages...

4) Statistics students sometimes reason as follows: "Since $\frac{1}{10}$ is 10%, it must be true that $\frac{1}{4}$ is 4%."

Is this reasoning correct?

(A) No, because $\frac{1}{10}$ is not 10%.

(B) No, because, although $\frac{1}{10}$ is 10%, this only works with the number 10.

(C) Yes, this works with 4, although there may be other numbers it won't work with.

(D) Yes, and this will work with any number.

(C) Let's see if you can compare decimals.

5) Choose the correct words to complete the following sentence:

0.04 is _____ 0.01

(less than equal to greater than)

6) Choose the correct words to complete the following sentence:

0.008 is _____ 0.05

(less than equal to greater than)

7) Choose the correct words to complete the following sentence:

0 is _____ 0.01

(less than equal to greater than)

(D) Let's see if you can interpret "proportion" terminology:

Suppose there are 50 people in the room, of which 13 are male.
Suppose 7 males in the room are wearing a baseball hat.

8) The proportion of males in the room is:

(A) $\frac{1}{13}$ (B) $\frac{13}{50}$ (C) $\frac{50}{13}$ (D) $\frac{13}{100}$ (E) $\frac{6}{50}$ (F) 13

9) The proportion of males that are wearing a baseball hat is:

(A) $\frac{1}{7}$ (B) $\frac{13}{7}$ (C) $\frac{7}{13}$ (D) $\frac{7}{50}$ (E) $\frac{7}{100}$ (F) 7

10) Out of the whole room, the proportion of baseball-hat-wearing males is:

(A) $\frac{1}{7}$ (B) $\frac{13}{7}$ (C) $\frac{7}{13}$ (D) $\frac{7}{50}$ (E) $\frac{7}{100}$ (F) 7

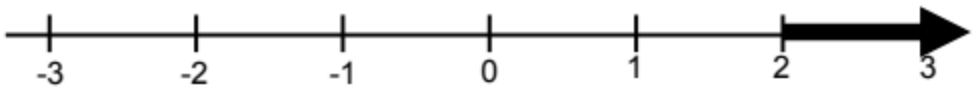
ALGEBRAIC NOTATION:

(A) Let's see if you can read inequality notation:

11) The expression "X < 4" means:

(A) X is greater than 4.
(B) X is at least 4.
(C) X is less than 4.
(D) X is no more than 4.
(E) X is equal to 4.

12) The set of X values represented by the darkened portion of the number line shown below is symbolized by what expression:



(A) X < 2 (B) X > 2 (C) X = 3

13) The expression "0 < X < 1" means:

(A) X can be any number.
(B) X must be greater than 1.
(C) X must be negative.
(D) X can be greater than 1, or negative.
(E) X must be between 0 and 1.
(F) X is either 0 or 1.
(G) Nothing – the expression has no meaning.

(B) Let's see if you can read functional notation:

14) If P(x) is a function, then the expression "P(x) = y" is properly interpreted to mean:

(A) x represents the input and y represents the output.
(B) x represents the output and y represents the input.
(C) x is multiplied by P to get y.

15) If P(x) is a function, then the expression "P(3) = 0.01" is shorthand for:

(A) When the input is 3, the output is 0.01.
(B) When the input is 0.01, the output is 3.
(C) x can equal 3 or 0.01.

(C) Let's see if you can interpret summation notation:

16) The expression $\sum_{k=1}^{5}\left(\frac{k}{9}\right)$ is shorthand for:

(A) The following sum of two terms: $\frac{1}{9}+\frac{5}{9}$
(B) The following sum of five terms: $\frac{1}{9}+\frac{1}{9}+\frac{1}{9}+\frac{1}{9}+\frac{1}{9}$

(C) The following sum of five terms: $\frac{1}{9} + \frac{2}{9} + \frac{3}{9} + \frac{4}{9} + \frac{5}{9}$

(D) The following sum of five terms: $\frac{5}{9} + \frac{5}{9} + \frac{5}{9} + \frac{5}{9} + \frac{5}{9}$

PROBABILITY:

17) Supposing that: $x_1 = 6, x_2 = 8, x_3 = 15, x_4 = 7,$ then the expression $\sum_{i=1}^{4} (x_i - 9)$ is shorthand for:

(A) The following quantity: (1 + 2 + 3 + 4) - 9
(B) The following quantity: (6 + 8 + 15 + 7) - 9
(C) The following quantity: (1 – 9) + (2 – 9) + (3 – 9) + (4 – 9)
(D) The following quantity: (6 – 9) + (8 – 9) + (15 – 9) + (7 – 9)
(E) The following quantity: (x – 9) + (x – 9) + (x – 9) + (x – 9)
(F) Either (6 – 9) or (7 – 9)

18) Supposing that: $x_1 = 6, x_2 = 8, x_3 = 15, x_4 = 7,$ then the expression $\sum_{i=1}^{4} (x_i)^2$ is shorthand for:

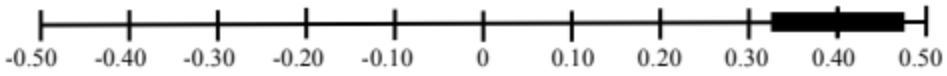
(A) The following quantity: $(1 + 2 + 3 + 4)^2$
(B) The following quantity: $(6 + 8 + 15 + 7)^2$
(C) The following quantity: $(1)^2 + (2)^2 + (3)^2 + (4)^2$
(D) The following quantity: $(6)^2 + (8)^2 + (15)^2 + (7)^2$
(E) Since (A) and (D) represent the same quantity, they are both correct.
(F) Since (B) and (E) represent the same quantity, they are both correct.

(D) Let's see if you understand "plus-minus" notation:

19) Suppose there is an interval on the x-axis. If the expression 0.40 ± 0.07 expresses the interval's endpoints, then the interval is:

(A) The interval whose left-hand endpoint is at negative 0.47 and whose right-hand endpoint is at positive 0.47, as represented in the following figure:

(B) The interval whose left-hand endpoint is at positive 0.33 and whose right-hand endpoint is at positive 0.47, as represented in the following figure:



(C) The interval whose left-hand endpoint is at negative 0.33 and whose right-hand endpoint is at positive 0.33, as represented in the following figure:

ALGEBRA MANIPULATIONS AND UNDERSTANDING:

(A) Let's see if you can perform basic algebraic manipulations:

20) Solve for the variable b in the following equation:

$$a = \frac{b-c}{d}$$

21) Solve for the variable d in the following equation:

$$a = b * \frac{c}{\sqrt{d}}$$

22) Suppose the number of people, y, on a bus, as a function of time, x, (in minutes), is given the equation y = 4 + 2x. The number of people on the bus after 20 minutes would be obtained by:

(A) Substituting 20 for y, and thus find x = 44 (people).
(B) Substituting 20 for y, and thus find x = 8 (people).
(C) Substituting 20 for x, and thus find y = 44 (people).
(D) Substituting 20 for x, and thus find y = 8 (people).
(E) No substitution is needed; the answer would be 20.

(B) Let's see if you understand order-of-operations on a calculator:

23) Suppose I want to use a calculator to evaluate the expression $\frac{150-100}{25}$.
If I type "$150 - 100/25$", will I get the intended answer? Why or why not? If not, how should I have entered the expression?

24) Suppose I want to use a calculator to evaluate the expression (.37)(1-.37). If I type "$.37 * 1 -.37$", will I get the intended answer? Why or why not? If not, how should I have entered the expression?

25) Suppose I want to use a calculator to evaluate the expression $\frac{2}{\frac{5}{10}}$. If I type: "2/5/10", will I get the intended answer? Why or why not? If not, how should I have entered the expression?

26) Suppose the following shape is perfectly symmetric, left-to-right, and suppose the total area of the entire shape is 100 units^2. If the thin, left-side shaded portion labeled "P" in the following picture is 5 units^2, which of the following gives the area of just the thin right-side portion labeled "Q"?

(A) Q = 100 + 5
(B) Q = 100 – 5
(C) Q = 50 – 5
(D) Q = 2(100 – 5)
(E) Q = 200 – 5
(F) Q = 5

(B) Let's see if you remember the coordinate system:

27) In the standard 2-dimensional coordinate system, which of the following is typically true?
(A) The horizontal axis is "x", and the vertical axis is "y".
(B) The vertical axis is "x", and the horizontal axis is "y".
(C) Both axes (horizontal and vertical) are "x".
(D) Both axes (horizontal and vertical) are "y".

28) In the standard 2-dimensional coordinate system, which of the following is generally true?
(A) The horizontal variable is the "output", and the vertical variable is the "input".
(B) The vertical variable is the "output", and the horizontal variable is the "input".
(C) Both variables (horizontal and vertical) are "output".

29) In the standard 2-dimensional coordinate system, the point notation "(2, 5)" would represent:
(A) A single point 2 units to the right and 5 units above the origin.
(B) A single point 5 units to the right and 2 units above the origin.
(C) Two points, one 2 units to the right of the origin and the other 5 units above the origin.
(D) Two points, one 5 units to the right of the origin and the other 2 units above the origin.

STRAIGHT LINES:

(A) Let's see if you understand slope, graphically:

30) A straight line whose graph *rises* from left to right:
(A) Must have a negative slope.
(B) Must have a positive slope.
(C) Must have a slope of zero.

31) A straight line whose graph *falls* from left to right:
(A) Must have a negative slope.
(B) Must have a positive slope.
(C) Must have a slope of zero.

32) There are two lines, the first having slope of 20, and the second having slope of 0.02. Then:
(A) The graph of the first line *rises* from left to right, but the graph of the second line *falls*.
(B) The graph of both lines rise from left to right, but the first line is steeper than the second.
(C) The graph of both lines rise from left to right, but the second line is steeper than the first.

(B) Let's see if you understand slope, conceptually:

33) Suppose I record the number of people in a bus over several minutes, so that the output, y, "number of people" is a linear function of the input, x, "time" (in minutes); and suppose the slope of the line is positive.

(A) As each minute goes by, the number of people decreases.

(B) As each minute goes by, the number of people increases.

(C) As each minute goes by, the number of people does not change.

34) Suppose I place books on a scale, so that the output, y, "weight" (in pounds) is a linear function of the input, x, "number of books"; and suppose the slope of the line is 0.1. Then:

(A) As each one book is added, the weight *increases* by ten pounds.

(B) As each one book is added, the weight *increases* by only a tenth of a pound.

(C) As each one book is added, the weight *increases* by one pound.

(D) As more books are added, the weight *decreases*.

35) Suppose I place books on a scale, so that the output, y, "weight" (in pounds) is a linear function of the input, x, "number of books"; and suppose the slope of the line is 10. Then:

(A) As each one book is added, the weight *increases* by ten pounds.

(B) For every ten books that are added, the weight *increases* by only one pound.

(C) For every ten books that are added, the weight *increases* by ten pounds.

(D) As more books are added, the weight *decreases*.

36) Suppose I record the number of people in a bus over several minutes, so that the output, y, "number of people" is a linear function of the input, x, "time" (in minutes); and suppose the slope of the line is zero. Then:

(A) As each minute goes by, the number of people on the bus *increases*.

(B) As each minute goes by, the number of people on the bus *decreases*.

(C) As each minute goes by, the number of people on the bus remains constant.

(D) As each minute goes by, the number of people on the bus goes to zero.

(C) Let's see if you understand y-intercept, graphically:

37) A straight line with y-intercept of 5:

(A) Passes through the point where x=0 and y=0.

(B) Passes through the point where x=5 and y=0.

(C) Passes through the point where x=0 and y=5.

(D) Passes through the point where x=5 and y=5.

(E) Passes through the point where x=-5 and y=5.

38) A straight line with y-intercept of 4:

(A) Must cross the horizontal axis 4 units to the left of the origin.

(B) Must cross the horizontal axis 4 units to the right of the origin.

(C) Must cross the vertical axis 4 units above the origin.

(D) Must cross the vertical axis 4 units below the origin.

(E) Must pass through the origin.

(D) Let's see if you understand y-intercept, conceptually:

39) Suppose I record the number of people in a bus over several minutes, so that the output, y, "number of people" is a linear function of the input, x, "time" (in minutes). If the y-intercept is 5, this means:

(A) When I began, my watch read "5 minutes".

(B) When I began, there were 5 people on the bus.

(C) As each minute goes by, the number of people increases by 5.

(D) As each minute goes by, the number of people decreases by 5.

40) Suppose I place books on a scale, so that the output, y, "weight" (in pounds) is a linear function of the input, x, "number of books". If the y-intercept is 3, this means:

(A) As each book is added, the weight increases by 3 pounds.

(B) As each book is added, the weight decreases by 3 pounds.

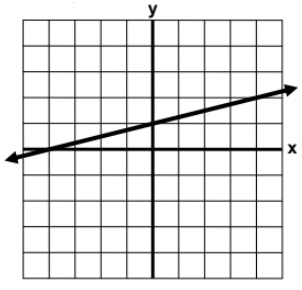
(C) With no books, the scale reads "3 pounds".

(D) With 3 books, the scale reads "0 pounds".

(E) Let's see if you understand straight line graphs:

For each of the following lines, find the slope and the y-intercept:

41)



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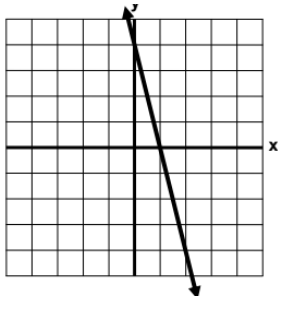

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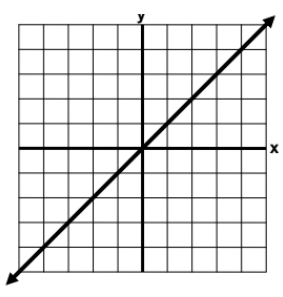

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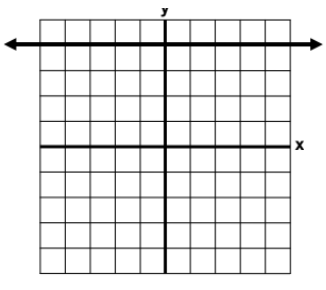

(F) Let's see if you understand straight line equations:

45) In algebra, straight lines are often written in the form "y = slope(x) + intercept". But in statistics, the x term is written last: "y = intercept + slope(x)". Using the statistics form, the equation of a line with slope 3 and y-intercept of 4 is:

(A) y = 3 + 4x (C) y = 4 + 3 (E) y = 3(4x)
(B) y = 3 + 4 (D) y = 4 + 3x

46) In algebra, straight lines are often written in the form "y = slope(x) + intercept". But in statistics, the x term is written last: "y = intercept + slope(x)". In the equation y = -2 + 0.75x, the slope

(A) -2 (B) 2 (C) 0.75 (D) x (E) y

47) Suppose I sell lollipops, so that the amount of money, y, that I have (in dollars) as a function of lollipops sold, x, is given by the linear equation y = -15 + 0.75x. The meaning of the 0.75 is:

(A) It is the y value when x is zero; i.e. the amount of money I started with.
(B) For every lollipop I sell, I make 75 cents.
(C) For every lollipop I sell, I lose 75 cents.
(D) It is how many lollipops I started with; i.e. I started with 75 lollipops.
(E) None of the above is entirely accurate.

48) Suppose I sell lollipops, so that the amount of money, y, that I have (in dollars) as a function of lollipops sold, x, is given by the linear equation y = -15 + 0.75x. The meaning of the -15 is:

(A) For every lollipop I sell, I lose 15 dollars.
(B) For every lollipop I sell, I earn 15 dollars.
(C) When I began (when I had sold no lollipops), I was 15 dollars in dept.
(D) When I began (when I had sold no lollipops), I had a profit of 15 dollar
(E) None of the above is entirely accurate.

49) Suppose I sell lollipops, so that the amount of money, y, that I have (in dollars) as a function of lollipops sold, x, is given by the linear equation y = -15 + 0.75x. The meaning of the x-intercept is:

(A) How much money I lose each time I sell a lollipop.
(B) How much money I earn each time I sell a lollipop.
(C) How much debt I was in before I started selling any lollipops.
(D) The number of lollipops I must sell in order to cancel my debt.
(E) None of the above is entirely accurate.

50) Suppose I sell lollipops, so that the amount of money, y, that I have (in dollars) as a function of lollipops sold, x, is given by the linear equation y = -15 + 0.75x. Find the x-intercept.

(A) x = 15 (B) x = 20 (C) x = 0.75 (D) x = 15 (E) x = 11.25

51) I think I got ___ out of 51 questions correct in this packet (this one included)…

(A) 0 – 19 (B) 20-39 (C) 40-43 (D) 44-47 (E) 48-51

Part 2: STEAM activity for you to explore

Mean, Median, Mode, and Range

Finding the mean, median, mode, and range of a small data set is fairly easy. When you are finding the mean, median, mode, and range of a larger set, you want to make use of technology. You should use technology, such as a graphing calculator, or software, like a spreadsheet (Excel or Google sheets), or an online calculator such as https://www.calculator.net/mean-median-mode-range-calculator.html?numberinputs=&x=77&y=28 or http://www.alcula.com/calculators/statistics/mean/. Graphing calculators are great, but numbers are entered one at a time. With a spreadsheet or online calculator, you may cut and paste the data that you need. While both online calculators are easy to use, they have difficulty reading numbers with commas, so ***I recommend using a spreadsheet.***

How to use google sheets functions:
https://support.google.com/docs/answer/46977?hl=en&ref_topic=1361471
Google sheets functions: https://support.google.com/docs/table/25273 narrow by "statistical"
The function for mean is "AVERAGE."

Do the following problems.

1. Find the mean, median, and range of the population of Florida counties.

2. Find the mean, median, and range of the area in square miles of Florida counties.

3. Find the mean, median, mode (if it applies), and range of another set of data. You may use any data set that has at least 30 items.

Go to https://www.florida-demographics.com/counties_by_population or http://worldpopulationreview.com/us-counties/fl/ to obtain the population data for each Florida county.

Go to http://www.usa.com/rank/florida-state--land-area--county-rank.htm or http://www.usa.com/rank/florida-state--land-area--county-rank.htm to obtain the area data for each Florida county.

This website https://en.wikipedia.org/wiki/List_of_counties_in_Florida has even more information.

1. Florida county population: Mean _____, Median _____, Range _____

2. Florida county area: Mean _____, Median _____, Range _____

3. Explain the data set that you chose. Why did you choose it?

   Mean _____, Median _____, Mode _____, Range _____