TEST NAME:**Math 1 Statistics and Probability Test**
TEST ID:**2093286**
GRADE:**09 - Ninth Grade**
SUBJECT:**Mathematics**
TEST CATEGORY:**My Classroom**

Student: _____

Class: _____

Date: _____

Read the passage - 'Wendy's Novel' - and answer the question below:

Wendy's Novel

Wendy's Novel

Wendy wrote her first novel. Patrick, a publisher, helped her edit and publish the book through online retailers.

Patrick developed equations designed to model the revenue that he would receive from the sales of the novel and the costs that he would incur. The publisher's share of the revenue, R dollars, is modeled by the equation $R = 5.5n$, where n is the number of novels sold. The cost for Patrick to print the novel and release it to the market, C dollars, is modeled by the equation $C = 2n + 2600$.

Patrick gave Wendy two payment options for her novel. If she chose Option 1, she would receive a $1,000 payment immediately, and then she would earn $0.65 for each book sold. If she chose Option 2, she would receive no initial payment, but she would earn $1.05 for each book sold.

When Wendy's book was released, the sales of the novel started off moderate, increased at a steady rate for the first week, and then decreased at a steady rate. The daily sales of Wendy's novel, s, are modeled by the equation $s = -40|x - 7| + 1000$, where x is the number of days since the book was released. For the first 21 days after the novel was released, Patrick's model was accurate to within 3% of the book's actual sales.

1. Read "Wendy's Novel" and answer the questions.

Rather than using an equation based on absolute value to model the daily sales of Wendy's novel, Patrick could have chosen to use a quadratic equation in the form of

$$y = ax^2 + bx + c$$

Part A

Find a quadratic equation that has a vertex at the same point as the maximum of Patrick's absolute value function, and the same y-intercept as the y-intercept of the absolute value function. Identify the coordinates for the vertex and y-intercept. Express the quadratic equation in standard form.

Part B

Identify and approximate the roots of the quadratic equation to the nearest hundredth. Which root predicts the day after which Wendy's novel will no longer generate sales? Show your work, and explain your reasoning.

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2. **Ian surveyed his friends about the number of televisions in their homes. Their responses are shown in the list. He will make a box-and-whisker plot of his data. To do so, he must first calculate the minimum, maximum, median, lower quartile, and upper quartile.**

   4, 3, 2, 4, 3, 7, 2, 1, 4, 4, 6, 2

   Select all of the following that are one of the 5 values needed to create the box-and-whisker plot.

   Pick up to 4 answers.

   A. 1
   B. 2
   C. 2.5
   D. 3.5
   E. 4

3. **A sample includes 600 bacteria. After a dose of an antibiotic, the number of bacteria decreases. Paula recorded the number of bacteria at 20-minute intervals following the dose of antibiotics. The relationship is given in the following table.**

Interval	# of Bacteria
0	600
1	319
2	162
3	70
4	38

Based on this observed data and a reasonably well-fitted function, which value is a good prediction of the number of bacteria remaining after 2 hours?

A. 9

B. 20

C. 70

D. 160

4. The table below shows the average retail price of televisions at a store based on the size of the screen.

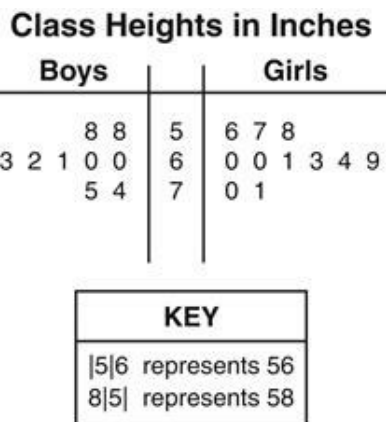| Size of Television Screen (inches)	Average Retail Price
19	$140
23	$180
24	$200
28	$210
32	$250
39	$290
40	$310
42	$450
48	$500
50	$630
60	$800

Which is an *approximate* equation of the line of best fit for the data?

A. $y = 15.61x + 214.91$

B. $y = 15.61x - 214.91$

C. $y = 16.10x + 165.85$

D. $y = 16.10x - 165.85$

5. **Write about a real-world situation that could be modeled with the scatterplot and line of best fit below.**
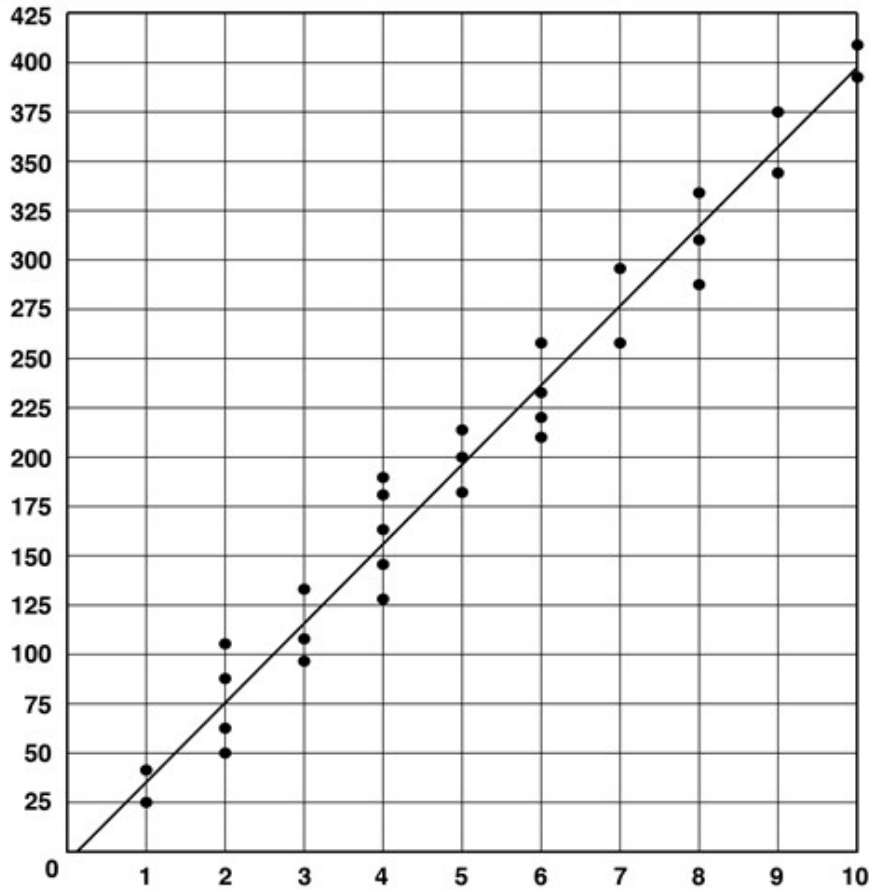
6. **Andy recorded the heights of the boys and girls in his class in the double stem-and-leaf plot.**

Class Heights in Inches

Boys		Girls
8 8	5	6 7 8
3 2 1 0 0	6	0 0 1 3 4 9
5 4	7	0 1

KEY
|5|6 represents 56
8|5| represents 58

What is the difference in height between the tallest boy and the tallest girl?

A. 2 inches

B. 4 inches

C. 13 inches

D. 19 inches

7. The table below shows the price of jeans sold at a store and the corresponding quantity sold.

Price of One Pair of Jeans (x)	Number of Jeans Sold (y)
$25	39
$35	27
$45	20
$55	11
$65	5

Which table shows the residual values?

A.

Jeans Sold	Residual Value
39	⁻14
27	8
20	25
11	44
5	60

B.

Jeans Sold	Residual Value
39	⁻1.8
27	1.8
20	0.4
11	1.0
5	⁻1.4

C.

Jeans Sold	Residual Value
39	1.8
27	⁻1.8
20	⁻0.4
11	⁻1.0
5	1.4

D.

Jeans Sold	Residual Value

39	14
27	⁻8
20	⁻25
11	⁻44
5	⁻60

8. **The data in the table can be used to determine and plot the residuals of a linear regression model.**

x	y
–2	4
–1	1
0	0
1	1
2	4
3	9
4	16
5	25
6	36
7	49

Which statement about the residuals is true?

A. The mean of the residuals is zero.

B. The plot of the residuals forms a pattern.

C. The plot of the residuals indicates the line is the curve of best fit.

D. The plot of the residuals does not yield useful information about the curve of best fit.

9. **Ben wants to compare the scores of this year's basketball games to the scores of last year's games. He made the following double stem-and-leaf plot to make his comparison.**

Comparison of Basketball Scores Between the Last Two Years		
Last Year	Stem	This Year
995	0	
97753	1	999
6654	2	7889
9	3	456778
	4	233
	5	2

What is the difference between the median score this year and the median score last year?

A. 16

B. 17

C. 18

D. 20

10. Xavier read that bamboo belongs to the grass family of plants. Unlike normal grass, some bamboo species can grow almost a foot per day, with most of them growing from about half an inch to a few inches in a given day.

Since he did not quite believe that bamboo could grow 12 inches in one day, he decided to check for himself and conduct a series of 10 measurements on the bamboo in his mother's garden.

He made the first measurement when a new sprout was just 3 inches tall and after that measured every 6 hours. The results of his data collection are shown in the table below.

Using a graphing utility, enter Xavier's data into a list. Based on the data and the resulting graph, calculate the line of best fit and correlation coefficient for a linear equation.

Explain what the slope of the line represents.

Explain whether or not you think there is a high level of correlation between elapsed time and growth.

BAMBOO GROWTH

Hours	Height (in.)
0	3.0
6	7.5
12	11.0
18	16.0
24	21.0
30	25.0
36	30.0
42	34.0
48	38.5
54	43.5

11. **The data in the table represent the relative distance, in miles, between a car and a particular mile marker on a highway over time.**

Car Travel

Elapsed Time, x (hr)	Relative Distance, y (miles)
0	–20
0.5	12
1	45
1.5	74
2	104

What does the slope of the linear equation that models the data indicate?

A. The car traveled at 62 miles per hour.

B. The car traveled 59 miles the second hour.

C. The car started out 19 miles from the mile marker.

D. The car traveled away from the marker at 19 miles per hour.

12. The table below shows the results of an experiment where the effect of caffeine on heart rate, brain function, and GPA were studied. To study the effects of caffeine on heart rate and brain function, an experiment was conducted. In this experiment, the heart rate, in beats per minute, of 15 college students were measured, then each individual was administered a certain dosage of caffeine, in milligrams, and then the heart rate and brain function or cerebral blood flow, in milliliters per minute, were remeasured. To study the effects of caffeine on GPA, the same 15 individuals were surveyed regarding their normal caffeine intake and their current GPA.

Participant	Caffeine Dose (in milligrams)	Change in Heart Rate (in beats per minute)	Cerebral Blood Flow (in milliliters per minute)	Number of Caffeinated Beverages Consumed per Day	Current GPA
1	0	−1	500	0	3.2
2	0	5	660	3	1.8
3	0	0	700	2	4
4	100	19	630	4	3.9
5	100	15	690	1	3.7
6	100	23	610	2	2.2
7	200	20	545	5	2.9
8	200	27	575	2	2.1
9	200	26	730	3	2.5
10	300	31	510	7	3
11	300	26	600	0	3.9
12	300	29	570	5	3.8
13	400	37	670	2	3.1
14	400	30	350	4	3.8
15	400	34	400	0	1.9

Part A. What is the correlation coefficient of the data that represents the effect of caffeine on heart rate? Round your answer to the nearest hundredth. What does this correlation coefficient tell you about the effect caffeine has on heart rate?

Part B. What is the correlation coefficient of the data that represents the effect of caffeine on brain function? Round your answer to the nearest hundredth. What does this correlation coefficient tell you about the effect caffeine has on brain function?

Part C. What is the correlation coefficient of the data that represents the effect of caffeine on GPA? Round your answer to the nearest hundredth. What does this correlation coefficient tell you about the effect caffeine has on a student's GPA?

Part D. If linear models were constructed to represent each of these relationships, which linear model would most accurately represent the data? Which linear model would least accurately represent the data? Explain.

13. Which correlation coefficient would have the strongest correlation between variables?

   A. 0.8

   B. 0.3

   C. ⁻0.2

   D. ⁻0.9

14. A person's wingspan is the distance from the fingertips of one hand to the fingertips of the other hand when the person's arms are outstretched. Jacob is interested in seeing whether there is a relationship between a person's height and wingspan. He recorded the height (in inches) and the wingspan (in inches) of twelve high school students and created a scatter plot. In which of these scatter plots is the line of best fit **correctly** drawn?
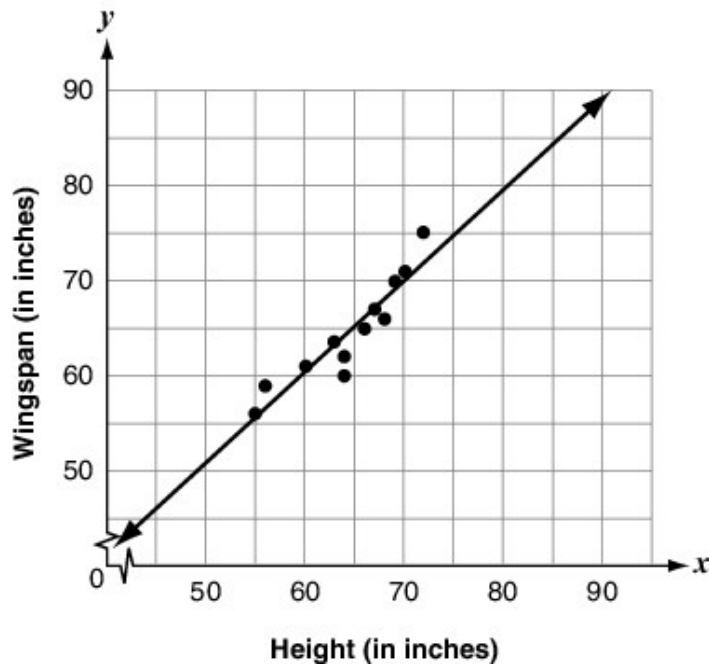
A.

B.

Height (in inches)

C.

Height (in inches)

D.

Wingspan (in inches)

90

80

70

60

50

0   50   60   70   80   90

Height (in inches)
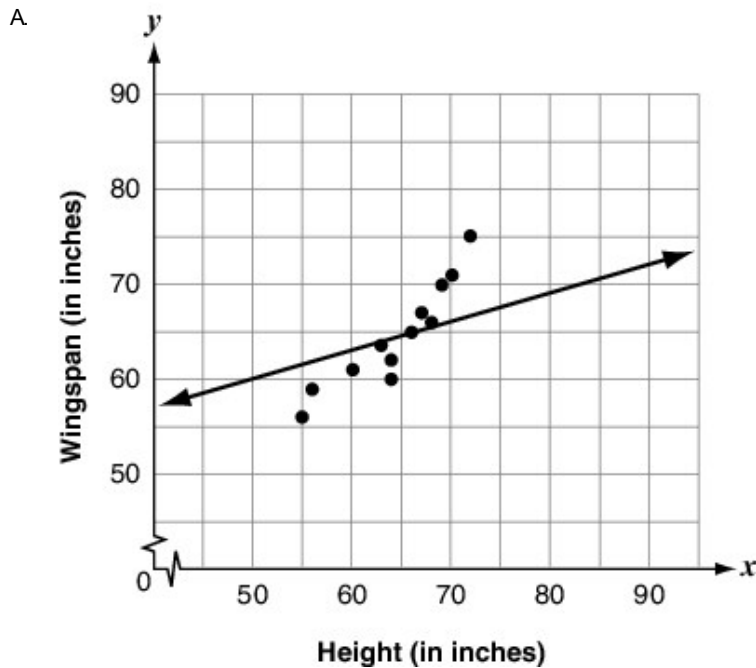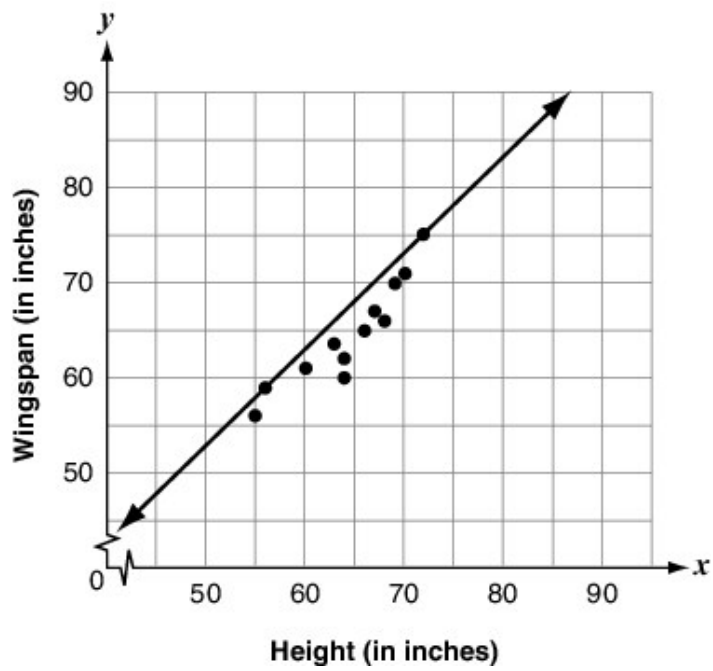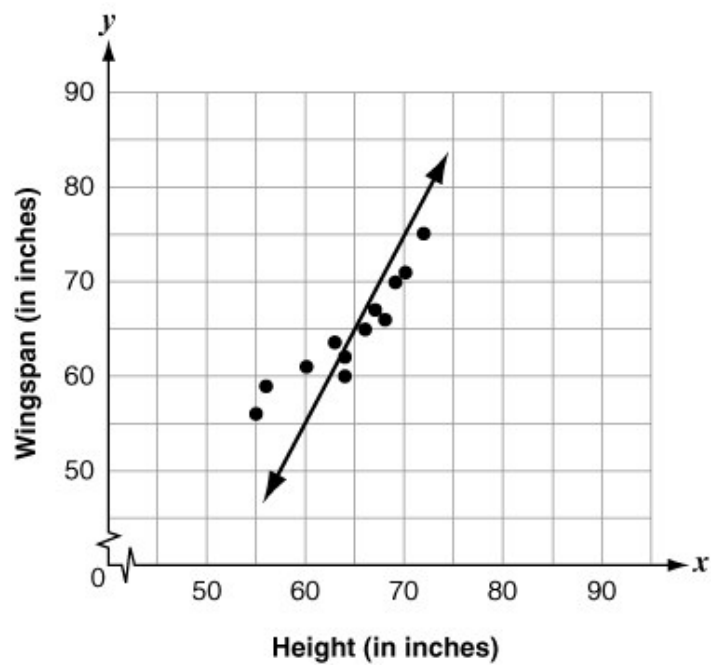
15. At what points do the graphs of $y = 2x + 1$ and $y = -(x - 1)^2 + 3$ intersect?

A. $(-3, 5)$ and $(1, 3)$

B. $(-2, -6)$ and $(2, 2)$

C. $(-1, -1)$ and $(1, 3)$

D. $(1, 3)$ and $(3, 7)$

16. **Which statement is the BEST hypothesis to be tested for a causal relationship?**

A. Students drink more bottles of water based on the time of day.
B. Students drink more bottles of water when they are exercising.
C. Students drink more bottles of water when the price is lower.
D. Students drink more bottles of water after a major test.

17. Given the data set below:

15, 56, 58, 60, 63, 75, 80, 80, 85

How does the outlier affect the distribution of the data?

A. The outlier skews the distribution to the left.

B. The outlier skews the distribution to the right.

C. The outlier makes the distribution more symmetrical.

D. The outlier has no effect on the distribution.

18. **The population of bacteria present in a sample is shown in the following table.**

Population of Bacteria

Time (hours)	Population
0	500
1	607
2	738
3	897
4	1091
5	1325
6	1611
7	1958
8	2379
9	2892
10	3515

- **Represent these data on the grid provided.**
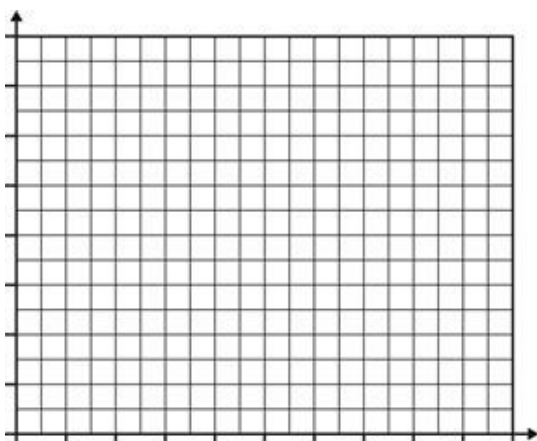
- **Identify which type of equation most accurately represents these data.**

- **Write an equation of "best fit" that most accurately represents these data. Identify what each variable represents.**

- **Based on the representative equation, what will the population of bacteria be after 24 hours?**

19. A charity tracked the number of donations given each day at one of its drop-off points. The data is given below.
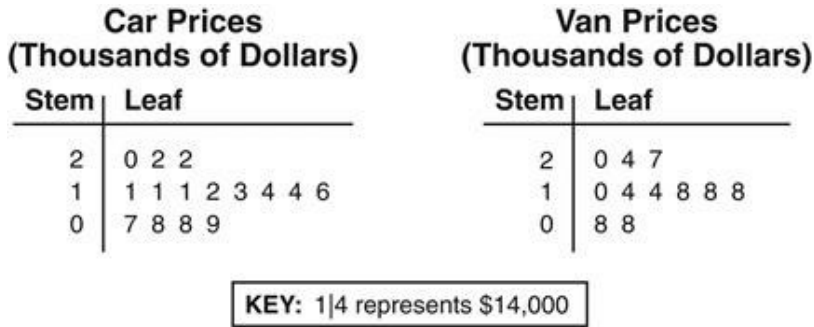
$$5, 10, 2, 5, 10, 7, 7, 5, 2, 3, 4, 2, 2, 3$$

Which box plot displays the donations?

A.

B.

C.

D.
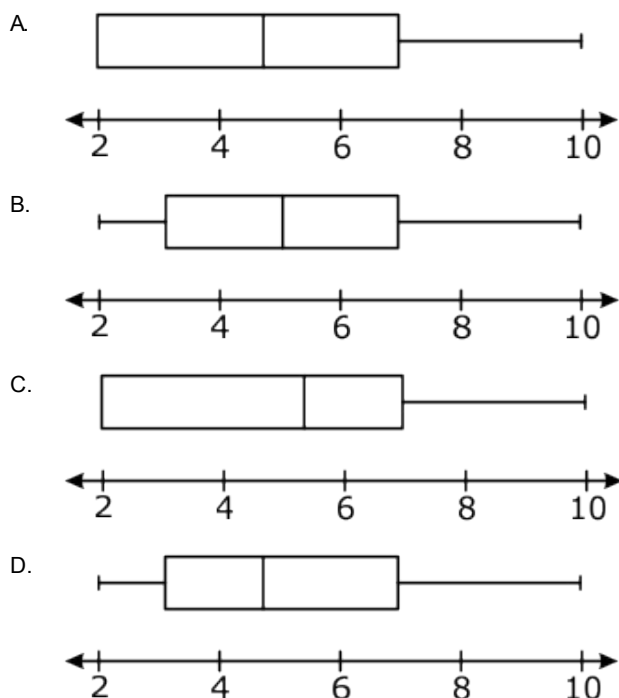
20. Which statement **must** be true about polynomial functions?

A. Functions that have different degrees have different end behavior as x approaches infinity.

B. Functions that have the same degree have the same end behavior as x approaches negative infinity.

C. Functions that have leading coefficients of different signs have different end behavior as x approaches infinity.

D. Functions that have leading coefficients with the same sign have the same end behavior as x approaches negative infinity.

21. **The stem-and-leaf plots below show the prices of cars and vans at a dealership, in thousands of dollars.**

Car Prices
(Thousands of Dollars)

Stem	Leaf
2	0 2 2
1	1 1 1 2 3 4 4 6
0	7 8 8 9

Van Prices
(Thousands of Dollars)

Stem	Leaf
2	0 4 7
1	0 4 4 8 8 8
0	8 8

KEY: 1|4 represents $14,000

What is the difference between the range of the van prices and the range of the car prices?

A. $4,000

B. $5,000

C. $6,000

D. $7,000

22. Jim and Carol recorded gas prices at five stations for their own towns in the table below.

Gas Prices

Name	Station 1	Station 2	Station 3	Station 4	Station 5
Jim	$3.45	$3.54	$3.71	$3.62	$3.49
Carol	$3.89	$3.65	$3.39	$3.48	$3.49

Which person's town had the lower mean for gas prices and by *about* how much?

A. Jim, by $0.02

B. Carol, by $0.02

C. Jim, by $0.06

D. Carol, by $0.06

23. A teacher looks at a set of data points, and determines whether extreme points are defined as outliers using the following method:

1. Identify the interquartile range (IQR) by finding the difference between the high quartile, Q_3, and the low quartile, Q_1.
2. Measure the distance from the extreme point to the nearest quartile.
3. If the distance is greater than 1.5 times the IQR, the point is considered an outlier.

The teacher records the first 37 test scores for a group of students. The low quartile is 80 and the high quartile is 90. The IQR is 10.

The teacher checks to see if the extreme points 62, 58, 57, and 30 are outliers, as shown below.

$Q_1 - 1.5(Q_3 - Q_1) = 80 - 1.5(90 - 80) = 80 - 15 = 65$, so these four scores are outliers.

The teacher then checks to see if extreme point 99 is an outlier. Since 99 is less than $Q_3 + 1.5(Q_3 - Q_1)$, 99 is not considered an outlier.

The teacher records the second test scores for the same group of students and also identifies 4 unique outliers, all below Q_1. The teacher decides to remove the 4 unique outliers and evaluate the data. Which of the following statements may be true about the result of removing these outliers?

A. It will not affect the IQR.

B. It will not affect the higher quartile.

C. It may create new outliers in the data set.

D. It may create a new mode in the data set.

24. **The box-and-whisker plots below represent the scores for pre- and post-written tests for applicants obtaining their driver's licenses. A passing score is 70%.**

Written Tests for Driver's License

First Test (pre-test)

Second Test (post-test)
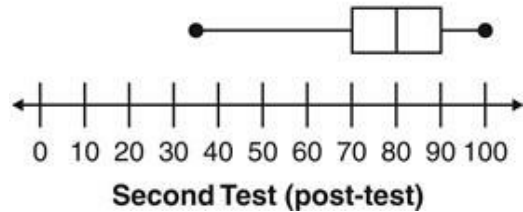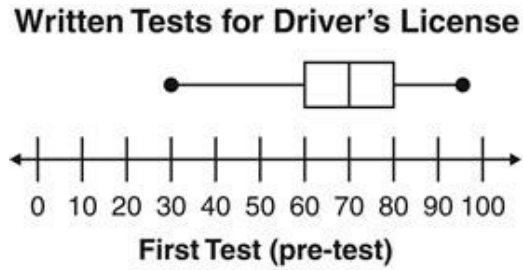
Which of the following is best supported by the information in the graphs?

A. Exactly 25% more applicants passed the post-test than the pre-test.

B. Exactly 50% more applicants scored below the passing score on the pre-test than on the post-test.

C. Of all the applicants that passed the pre-test, only 25% scored higher than a 90.

D. Of all the applicants that passed the post-test, only 50% scored between a 70 and an 80.

25. **A beauty shop owner collected data on various services provided to clients. The table below shows the number of haircuts and highlights that each hairstylist provided to clients last month.**

Beauty Shop Services

Hairstylist	Haircuts	Highlights
Anna	20	20
Cara	72	25
Darren	35	36
Joyce	42	21
Kiana	64	46
Layla	42	48
Millie	71	37
Niki	66	50
Ray	64	51
Reza	64	52
Steve	44	47
Tonya	46	46

The owner concluded that the median number of haircuts and the median number of highlights provided by the hairstylists was 46. What error did the owner make?

A. She confused the range and the median for each set of data.

B. She deleted repeating numbers when ordering the numbers.

C. She confused the mode for the median in the haircut data set.

D. She chose the number in the middle of the table as the median.

26. **Kara compared the number of text messages 100 students sent in one day and the grade point average (GPA) of each student. The correlation coefficient among the data is –0.9 rounded to the nearest tenth. Based on this information, which statement is MOST likely true?**

A. There is correlation but not causation between GPA and the number of text messages.

B. There is causation but not correlation between GPA and the number of text messages.

C. There is both correlation and causation between GPA and the number of text messages.

D. There is neither correlation nor causation between GPA and the number of text messages.

27. A data set is shown below.

x	y
1	6.00
2	5.04
3	4.23
4	3.56
5	2.99
6	2.51
7	2.11

Using an exponential best-fit model, what is the predicted value of y when $x = 10$?

A. 1.78

B. 1.49

C. 1.25

D. 0.88

28. Mr. Lopez, the guidance counselor at a high school, wants to determine whether there is a relationship between a student's IQ score and the student's GPA. He takes the data of 14 of his students and finds that the linear model that **best** fits is $y = -3.56 + 0.06x$. Using residuals, explain the relationship between a student's IQ score and his or her GPA.

IQ Score	73	81	85	89	90	97	99	102	108	110	115	117	120	125
GPA	1.05	1.25	1.5	1.6	1.9	2.2	2.3	2.6	3	3.1	3.2	3.5	3.8	3.9
Residuals	0.23	–0.05	–0.04	–0.18	0.06	–0.06	–0.08	0.04	0.08	0.06	–0.14	0.04	0.16	–0.04

A. Since the residuals form a negative, linear association, there is a negative, linear relationship between IQ score and GPA as demonstrated by $y = -3.56 + 0.06x$.

B. Since the residuals form a positive, linear association, there is a positive, linear relationship between IQ score and GPA as demonstrated by $y = -3.56 + 0.06x$.

C. Since the residuals are scattered points, there is no relationship between IQ score and GPA as demonstrated by $y = -3.56 + 0.06x$.

D. Since the residuals form no pattern, there is a linear relationship between IQ score and GPA as demonstrated by $y = -3.56 + 0.06x$.

29. **The data in the table can be entered into a calculator to determine a linear equation of best fit where x represents the elapsed time in minutes and y represents the depth of water in a tub in inches.**

Water Depth in Tub

Elapsed Time, x (minutes)	Depth, y (inches)
3	10
3.5	9
4	8
4.5	7
5	6
5.5	5
6	4
6.5	3
7	2
7.5	1
8	0

What conclusion can be drawn from the correlation coefficient?

A. There is a weak positive correlation between the variables.

B. There is a weak negative correlation between the variables.

C. There is a strong positive correlation between the variables.

D. There is a strong negative correlation between the variables.

30. **Two different teams, composed of 6 team members, had a friendly competition to see how many times each player could hit the target with a softball. Each player had 7 chances. The table below shows the number of target hits each baseball player made compared to each softball player.**

Number of Successful Hits

Baseball Players	Softball Players
0	3
2	3
4	4
5	4
6	4
6	5

What can be concluded from the table above?

A. The baseball players are just as accurate as the softball players, when you look at the average of each group.

B. The baseball and softball players' spread of data are very close.

C. The mode of successful hits of the softball players' is the same as the baseball players'.

D. The softball players are more accurate throwers than the baseball players, when you look at the average of each group.

31. Danny and Dennis are siblings who both own car dealerships. They tracked the number of customers who visited their respective dealerships over seven days and recorded the data in the chart below.

Owner	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Danny	15	28	8	29	9	20	17
Dennis	19	2	26	27	17	23	29

What is the difference between the interquartile range for the two sets of data?

A. 8

B. 9

C. 10

D. 19

32. **Michala is growing her hair to donate to charity. She records her hair length for several months and graphs the results.**

Hair Growth
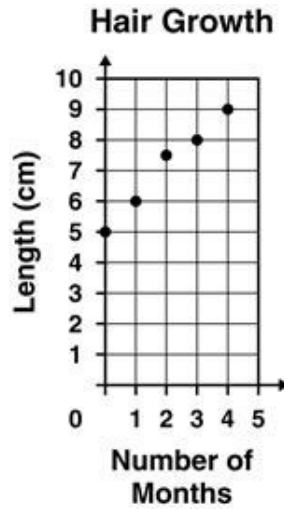
Because she needs to grow hair to a specific length to donate it, she fits a linear equation to the data so she can estimate when her hair will be long enough. Which equation BEST models the relationship between *g*, the length of her hair in centimeters, and *t*, the number of months she let her hair grow?

A. $g = 7.5$

B. $g = 6t$

C. $t = g + 5$

D. $g = t + 5$

33. **The table and scatterplot show the average heights of girls at different ages.**

Average Heights of Girls

Age (years)	Height (inches)
0	20.0
2	34.5
4	41.0
6	46.0
8	50.5
10	54.5

Average Heights of Girls
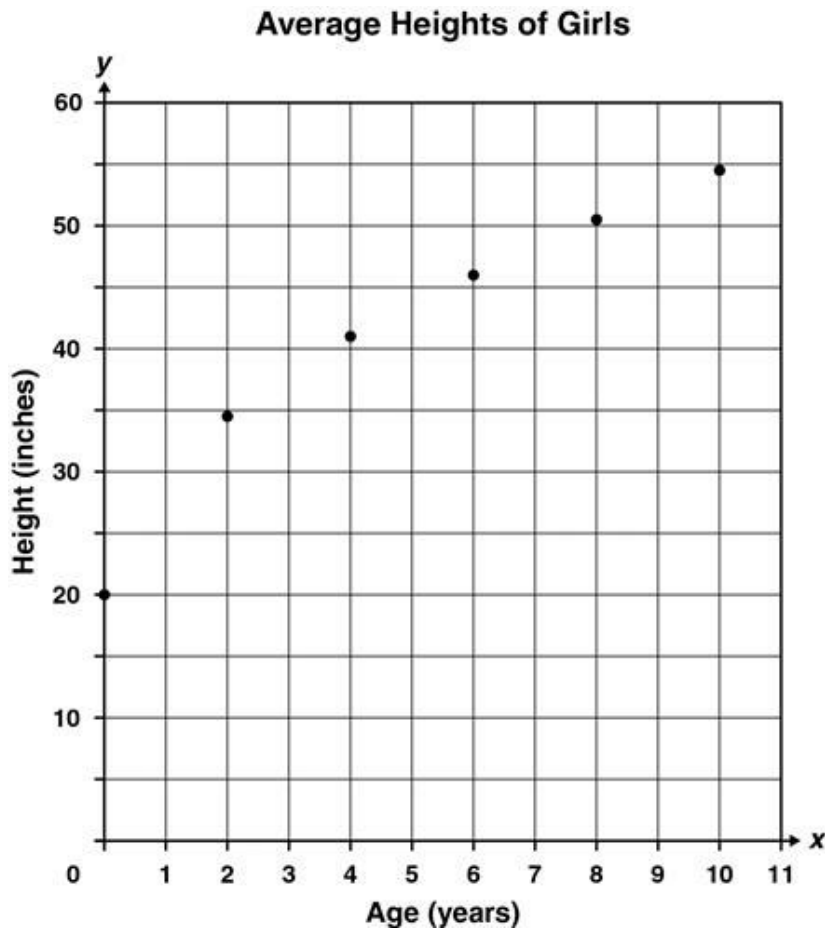
The variable x represents age, in years, and y represents height, in inches. According to the scatterplot, which equation BEST represents the relationship between age and height?

A. $y = 0.3x - 7$

B. $y = 0.4x - 12$

C. $y = 2.5x + 30$

D. $y = 3.2x + 25$

34. The scatter plot below relates the diameter of a particular species of tree, in inches, to its age, in years. The growth rate of a tree, in years per inch, is also known as the growth factor of the tree. The slope of the line of best fit in the scatter plot represents the growth rate, or factor, of the tree.
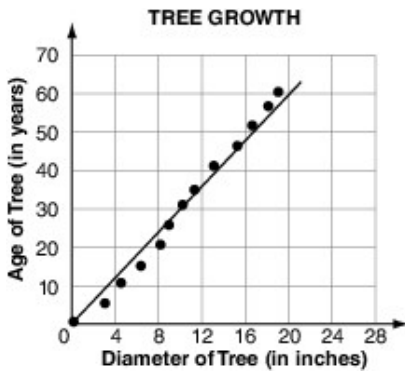
TREE GROWTH

The table below lists the growth factors of different species of trees.

Tree Species	Growth Factor
Cottonwood	2.0
Silver maple	3.0
Red oak	4.0
White pine	5.0

What species of tree is most likely represented by the scatter plot?

A. Cottonwood

B. Silver maple

C. Red oak

D. White pine

35. The table below shows the number of hours per week six students spend online and their current grades in math.

Hours Online (per week)	12	8	15	25	4	1	9
Current Math Grade	78	82	73	68	90	93	85

Using a line of best fit, which statement *best* describes the *y*-intercept of the equation?

A. the number of hours spent online if a student's grade were zero

B. the average change in the grade of a student per hour spent online

C. the grade a student should expect when no time is spent online

D. the point at which a student's grade is the lowest

36. **In an election, the median number of votes a candidate received in 6 towns was 300. Which statement MUST be true about this election?**

A. The candidate received at least 300 votes in half of the 6 towns.

B. The candidate received exactly 300 votes in at least two of the towns.

C. The total number of votes the candidate received in the election was 1800.

D. The total number of votes received by all the candidates in the election was 1800.

37. **Which relationship is an example of causation?**

A. The more education a person has, the more they read.

B. More time spent on homework results in higher grades.

C. More weight on one side of a balance scale will tip the scale in that direction.

D. Animals that consume higher than average amounts of feed per week gain weight.

38. The table below shows the number of miles a car has been driven and the number of times the oil has been changed in the car.

Miles (in thousands)	45	55	65	75	85
Number of oil changes	12	14	15	17	18

Which statement *best* represents the meaning of the slope of the line of best fit of the data?

A. The car averaged 1 oil change over 10,000 miles.

B. The car averaged 2 oil changes over 10,000 miles.

C. The car averaged 3 oil changes over 20,000 miles.

D. The car averaged 6 oil changes over 20,000 miles.

39. A scientist is conducting an experiment to study the question "How does air temperature affect water temperature?" The scientist is using a water tank that is in a sheltered location and is partially underground. The temperature of the water in the water tank and the surrounding air temperature were recorded in degrees Fahrenheit $(°F)$ for a week. The table below shows the air temperature (T_A) and water temperature (T_W) recorded during the week.

Air Temperature (in °F)	Water Temperature (in °F)
90	72
94	74
88	70
89	71
95	73
98	75
92	71

Part A. Construct the scatter plot for the above data with (T_A) on the *x*-axis and (T_W) on the *y*-axis.
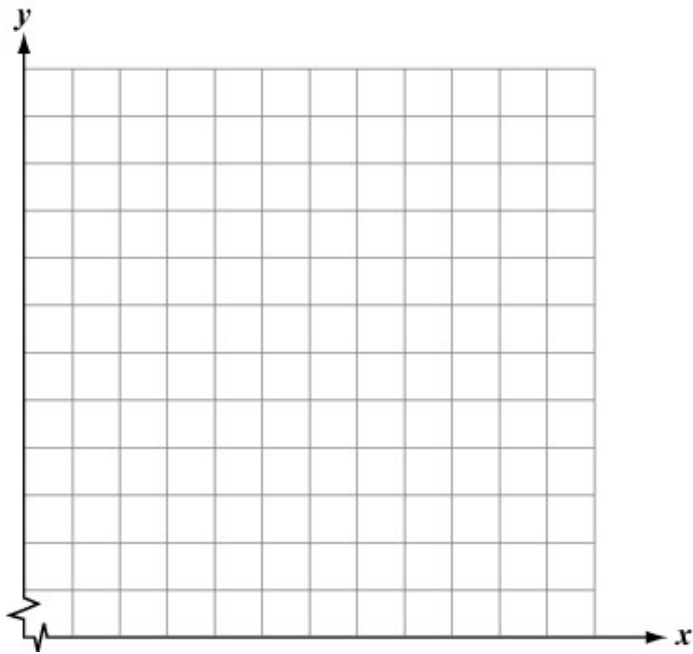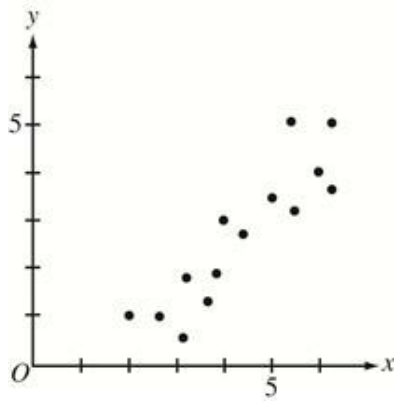
Part B. Determine the equation for the line of best fit of the given data. Round the slope and *y*-intercept to the nearest hundredth and draw the line of best fit on the scatter plot constructed above.

Part C. Based on the line of best fit, estimate the water temperature if the surrounding air temperature is 80°F. Round your answer to the nearest integer.

Part D. If the temperature of the water in the tank is 88°F, what could be its surrounding air temperature based on the line of best fit? Round your answer to the nearest integer.

Use words, numbers, and/or pictures to show your work.

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40. **Which of the following equations BEST models the data in the scatterplot below?**

A. $y = x + 2$

B. $y = x - 2$

C. $y = -x + 2$

D. $y = -x - 2$