Algebra 1 B Semester Exam Review

Name _____

The problems in this review are numbered consecutively and grouped by expectation:

Expectation 1.1 (Problems 1-17): The student will analyze a wide variety of patterns and functional relationships using the language of mathematics and appropriate technology.

Indicators: The student will:

1.1.1 recognize, describe, and/or extend patterns and functional relationships that are expressed numerically, algebraically, and geometrically.

1.1.1.2 recognize and describe exponential functions that are expressed numerically, algebraically, and/or graphically.

1.1.1.3 recognize and describe quadratic functions that are expressed numerically, algebraically, and/or graphically.

1.1.2 represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expression.

1.1.2.3 describe the effect of a change in the parameters *a* and *b* on the graph of $f(x) = a(b)^x$.

1.1.2.4 represent exponential functions numerically, algebraically, and/or graphically.

1.1.2.5 describe the effect of a change in the parameters *a*, *h*, and *k* on the graph of $f(x) = a(x-h)^2 + k$.

1.1.2.6 represent quadratic functions numerically, algebraically, and/or graphically.

1.1.3 apply addition, subtraction, multiplication and/or division of algebraic expressions to mathematical and real-world problems.

1.1.3.1 simplify expressions using the laws of exponents.

1.1.3.2 write polynomials in standard form.

1.1.3.3 add and subtract polynomials

1.1.3.4 multiply polynomials.

1.1.3.5 divide a polynomial by a monomial.

1.1.3.6 represent a polynomial as a product of monomial and a polynomial.

1.1.3.7 represent a quadratic polynomial as a product of two linear factors.

1.1.4 describe the graph of a non-linear function and discuss its appearance in terms of the basic concepts of maxima and minima, zeros (roots), rate of change, domain and range, and continuity.

1.1.4.1 identify the properties of a quadratic function.

1.1.4.2 identify the properties of an exponential function.

1.1.4.3 solve a quadratic function using a graph, factors, or the quadratic formula.

1.1.4.4 compare and contrast the properties of the following functions: linear, exponential, quadratic, absolute value, and piece-wise.

Expectation 1.2: (Problems 18-21) The student will model and interpret real-world situations using the language of mathematics and appropriate technology.
Indicators: The student will:
1.2.4.1 solve a real-world problem involving inverse variation and discuss its properties.
1.2.4.2 solve a real-world problem involving an exponential function.
1.2.4.3 solve a real-world problem involving a quadratic function.
1.2.5 apply formulas and/or use matrices (arrays of numbers) to solve real-world problems.

Expectation 3.1: (Problems 22-32) The student will collect, organize, and present data.
Indicators: The student will:
3.1.1 design and/or conduct an investigation that uses statistical methods to analyze data and communicate results.
3.1.1.a design an investigation that may include simple random sampling, representative sampling, and/or probability simulations, describe how the data will be collected, and justify the method.
3.1.1.b decide and justify whether a sample is representative or biased.
3.1.1.c decide and justify whether a sampling method is simple random sampling.
3.1.2 use the measures of central tendency and/or variability to make informed conclusions.
3.1.2.a use the measures of central tendency and/or variability to draw informed conclusions.
3.1.2.1 evaluate inferences and predictions that are based on data analysis.
3.1.3 calculate theoretical probability or use simulations or statistical inference from data to estimate the probability of an event.
3.1.3.a calculate the theoretical probability of an event for a chance situation.
3.1.3.b determine the experimental probability of an event using data.

Expectation 3.2 (Problems 33-34) The student will apply the basic concepts of statistics and probability to predict possible outcomes of a real-world situation.
Indicators: The student will:
3.2.1 make informed decisions and predictions based upon the results of simulations and data from research.
3.2.3 communicate the uses and misuses of statistics

1. Look at the functions represented by the tables below.

a.

x	y
1	2
2	5
3	8
4	11

b.

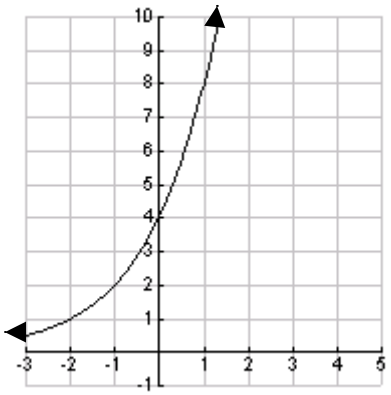
x	y
1	2
2	5
3	10
4	17

c.

x	y
1	2
2	4
3	8
4	16

Classify each function as exponential, quadratic or linear. Use mathematics to justify your answers.

2. Look at the function graphed below.



a. Complete the values for the function in the table below.

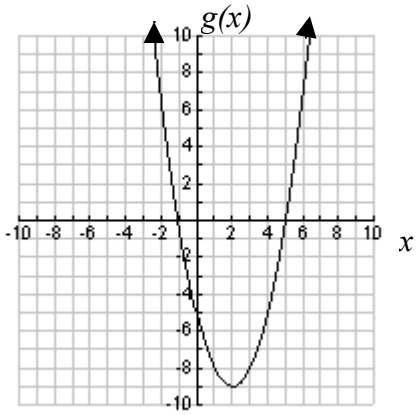
x	-2	-1	0	1	2
f(x)					

b. Classify the function represented by the graph.
c. Write the function rule for the graph.
d. Is the function increasing or decreasing?
e. Is the function continuous?
f. What is the domain of the function?
g. What is the range of the function?
h. What is the asymptote of the graph?

3. Let $f(x) = x^2 - 6x + 5$.

a. What is the vertex of the graph?
b. What is the y-intercept of the graph?
c. What are the x-intercepts of the graph?
d. Write this function in vertex form. You may choose to use your calculator or complete the square.

4. Look at the graph of the function *g(x)* below. It is a translation of the graph of the parent function, $f(x) = x^2$.



a. Describe the translation of the graph from the parent function, $f(x) = x^2$.
b. Write an equation for $g(x)$ in vertex form.
c. Write an equation for $g(x)$ in standard form.
d. What are the zeros of $g(x)$?
e. On what interval is *g(x)* increasing?

5. Look at the two functions below.

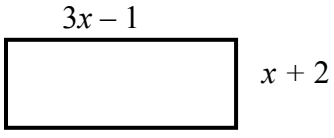
$f(x) = 4(3)^x$ $\qquad$ $g(x) = 5(7)^x$

Which of the following statements are true?

I. $f(x)$ is increasing at a faster rate than $g(x)$.
II. The *y*-intercept of $f(x)$ is less than the *y*-intercept of $g(x)$.
III. The graphs of both functions have the *x*-axis as its asymptote.

A I and II only **B** I and III only **C** II and III only **D** I, II, and III

6. Look at the rectangle below.

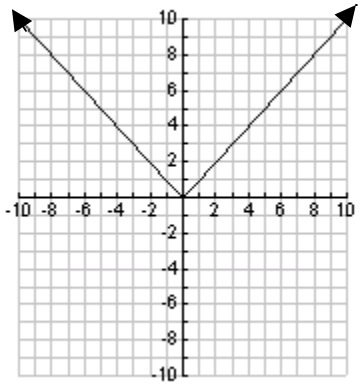


Which expression below could represent the perimeter of the rectangle?

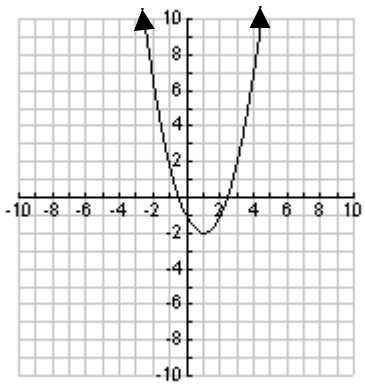
A $(3x-1)(x+2)$ **B** $2(3x-1)(x+2)$
C $2(3x-1)+2(x+2)$ **D** $(3x-1)+(x+2)$

Use the following graphs to answer questions 7 and 8.

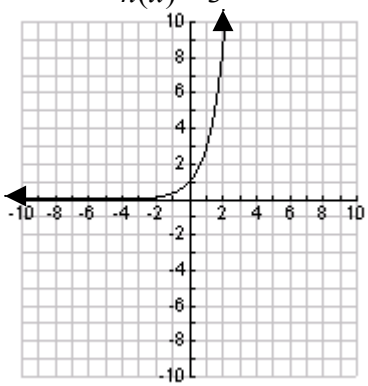
$f(x) = |x|$



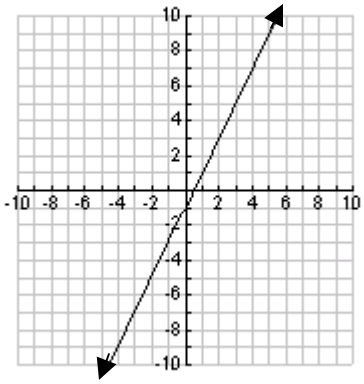
$g(x) = (x-1)^2 - 2$



$h(x) = 3^x$



$j(x) = 2x - 1$



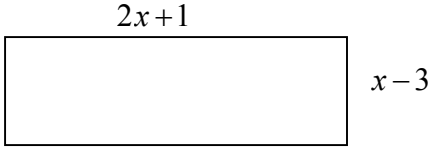
7. Complete the following:

   a. $f(x)$ is a(n) _____ function.
   b. $g(x)$ is a(n) _____ function.
   c. $h(x)$ is a(n) _____ function.
   d. $j(x)$ is a(n) _____ function.

8. Which of the functions $f(x), g(x), h(x),$ and/or $j(x)$:

   a. have a domain of all real numbers? _____
   b. have a range of all real numbers ? _____
   c. have a vertex? _____
   d. increase on some interval? _____
   e. increase on the entire domain? _____
   f. decrease on some interval? _____
   g. decrease on the entire interval $x < 1$? _____
   h. are continuous? _____
   i. have an axis of symmetry? _____

9. Look at the rectangle below.



Which expression below could represent the area of the rectangle?

A $(2x+1)(x-3)$ **B** $(2x+1)+(x-3)$

C $2(2x+1)+2(x-3)$ **D** $(2x+1)^2(x-3)^2$

10. Rewrite each polynomial in standard form.

a. $3x^2+x^3-4-9x$

b. $2+3x^2+5x^3+7x^4$

11. Simplify: Your final answer should have only positive exponents.

a. $(-3x^2y^3)^4$ b. $\left(2xy^3\right)\left(3x^2y\right)$ c. $\dfrac{15x^3y^{-2}}{3x^2y^3}$

12. Add or subtract as indicated.

a. $\left(-3x^2+4x-7\right)+\left(2x^2-7x+8\right)$

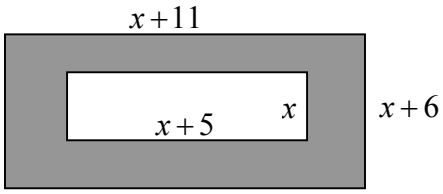
b. $\left(5m^2-6m+12\right)-\left(-m^2+2m-11\right)$

13. Multiply or divide as indicated.

a. $\left(2x-5\right)\left(4x+7\right)$ b. $(x-5)^2$

c. $(x-9)(x+9)$ d. $\dfrac{64x^3y^2+16x^2y^3+32x^5y^5}{8x^2y^2}$

14. Look at the figure below.



Write an expression in terms of x, for the area of the shaded region.

15. Which binomial below is a factor of x^2+x-12?

A $(x-4)$ **B** $(x-3)$ **C** $(x+3)$ **D** $(x+6)$

16. Factor each of the following.

a. $5x^3y^2 + 15x^2y^3$ b. $2x^2 + 9x - 5$

c. $x^2 - 64$ d. $a^2 - 14a + 49$

17. Solve.

a. $r^2 + 10r + 9 = 0$ b. $(2x - 5)(x - 1) = 0$ c. $x^2 - 5x = -1$

18. A catering company provides food for three family reunions on July 4th every year. The matrices below represent the number of hamburgers and hot dogs ordered by three families in 2001 and 2002.

Year 2001

Families	Hamburgers	Hot Dogs
Arnold	50	48
Baker	40	25
Carroll	15	20

Year 2002

Families	Hamburgers	Hot Dogs
Arnold	60	40
Baker	45	30
Carroll	40	40

a. Write a matrix that represents the total number of hamburgers and total number of hot dogs that each of the three families ordered for the years 2001 and 2002.

b. The catering company predicts that in 2010, each family will order five times as many hamburgers and hotdogs as they ordered in 2002. Based on this prediction, write a matrix that will represent the total number of hamburgers and total number of hot dogs each family will order in 2010.

19. Sheila had 2048 marbles. She gave marbles to her sister each day. The table below shows the number of marbles Sheila had left after each day.

BCR

# of Days ***d***	0	1	2	3	4
Number of marbles left ***N(d)***	2048	1024	512	256	128

- How many marbles will she have left after the 6th day?
- After what day will she have 2 marbles left? Explain how you determined your answer. Use words, symbols, or both on your explanation.

20. Jack kicked a football. The height, *h(t)*, in feet, of the ball after *t* seconds is given by the quadratic function. $h(t) = -16t^2 + 50t$.

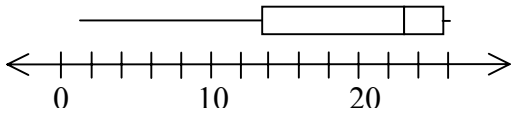
ECR

- Does the ball reach its maximum height at $t = 2$ seconds? Use mathematics to justify your answer.
- After how many seconds does the ball hit the ground? Explain how you determined your answer. Use words, symbols, or both on your explanation.

21. The amount of time it takes to complete a job varies inversely with the number of people on the job. If it takes 10 people a total of 15 hours to do a job, how long will it take 6 people to do the job?

22. ECR The table and box-and-whisker plot below show the number of hours Suchita worked each week at her summer job.

Number of Hours	Number of Weeks
1	1
7	2
20	2
22	1
24	2
25	1
26	3
	Total : 12



Hours worked by Suchita each week

- Jeff looked at the box-and-whisker plot and concluded the number of weeks Suchita worked 19 hours or less was greater than the number of weeks she worked 23 hours or more. Is Jeff's conclusion correct? Use mathematics to justify your answer.
- Use the frequency table to find each measure of central tendency (mean/median/mode). Which measure best represents Suchita's typical work week? Use mathematics to justify your answer.

23. Stephan bowled 160, 180, and 215 in his first three games.

BCR
- What score would Stephan have to bowl in his fourth game for his 4-game average to be 180? Explain how you determined your answer. Use words, symbols, or both in your explanation.

24. Nathan is conducting a simulation concerning seniors who discuss their studies at home. He chooses to use a random number table with digits 0-9, where 0, 1, 2, 3 represent a senior who discusses studies at home and 4, 5, 6, 7, 8, 9 represents a senior who does not discuss studies. Based on this digit assignment, what is the probability that a senior discusses studies at home?

A 6% **B** 30% **C** 40% **D** 60%

25. A bubble gum machine has 50 gumballs inside. There are 22 red, 14 blue, 9 green, and 5 white gumballs. A child chooses one gumball at random.

a. What is the probability that the gumball chosen is white?

b. What is the probability that the gumball chosen is NOT green?

26. Describe a model you could use to simulate a probability that 25% of all students go to the movies each week.

27. Which of the following sampling methods would provide a simple random sample of 50 college students?

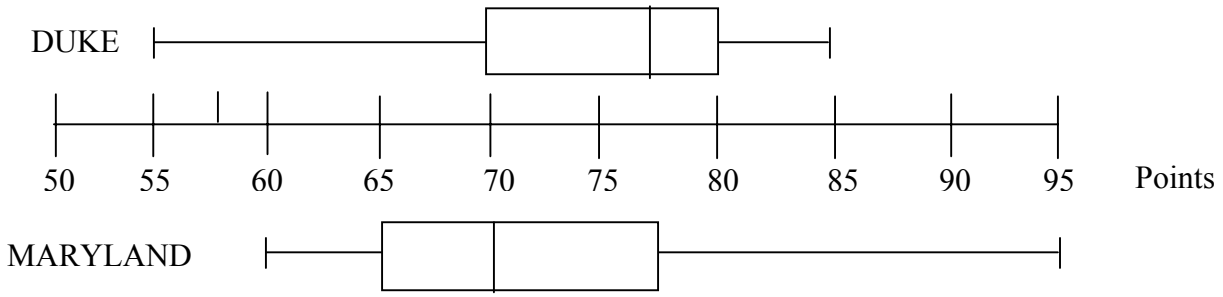
BCR

- Survey the first 50 students to enter the math building in the morning.
- Obtain a list of alphabetized student names, and then select every 5th student on the list until there are 50 students selected.
- Place the name of each student in a hat, and then draw 50 names.

Use the criteria for simple random sampling to justify your answer.

28. The box and whisker plot shows the points scored by two basketball teams over the course of a season.

BCR



Derek looked at the plots and stated that he thought that Maryland was the higher scoring team during the season. Is this a valid conclusion? Use mathematics to justify your answer. Give more than one reason.

29. Jose drives through three traffic lights each day. Each traffic light operates independently. Jose conducts a simulation to estimate the probability that two of the traffic lights will be red. Here are the results of the simulation.

Number of Red Traffic Lights	Frequency
0	5
1	7
2	3
3	0

Based on the results of the simulation, what is the probability that exactly two of the traffic lights will be red?

30. Jack and Jill surveyed students in their school to estimate how many students eat at a fast-food restaurant. Jack's sample was the first 50 students that arrive at school in the morning. Jill's sample was chosen by selecting students randomly from a list of all students in the school.

BCR

- Are Jack's and Jill's samples representative? Use mathematics to justify your answer.

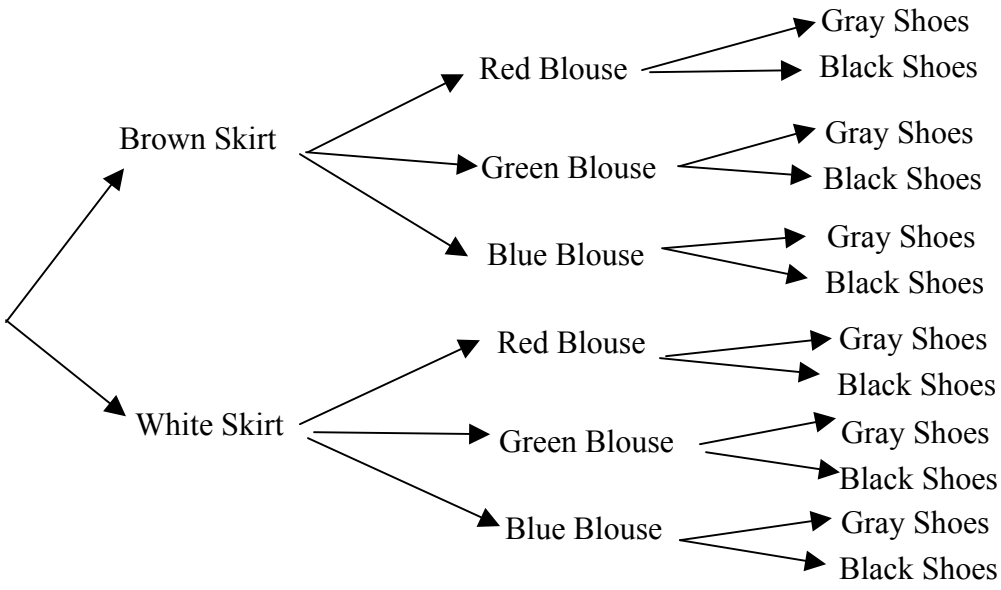
31. The table below shows the results of a survey.

BCR

Number of Students Who Listen to Classical Music	Number of Students Who Do Not Listen To Classical Music
10	40

- Based on the results of the survey, if a student is chosen at random, what is the probability that a student listens to classical music?
- Based on the results of the survey, if there are 800 students in her school, predict how many students listen to classical music.

32. The tree diagram below shows the ways that Jane can get dressed.



a. How many different outfits of a skirt, blouse, and shoes can Jane wear?

b. What is the probability that Jane will wear a white skirt, green blouse, and black shoes?

33. Bill recorded the color of the traffic light in front of his school when he arrived. The table below shows the results.

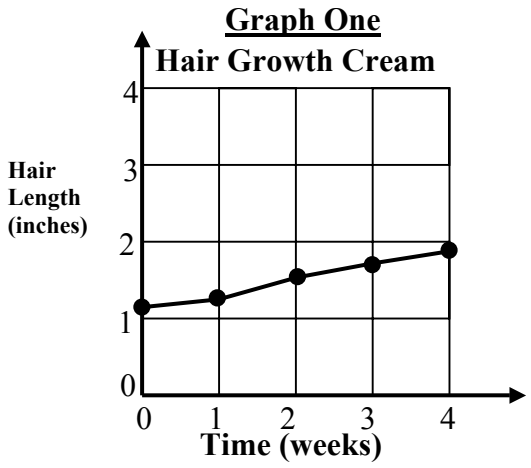
Color	Frequency
Red	12
Yellow	3
Green	5

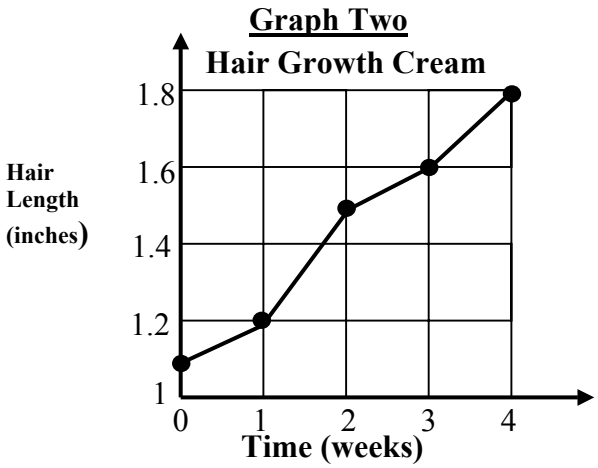
a. Based on the results in the table, what is the probability that the light will be red when Bill arrives?
b. Bill goes to school 180 days in a school year. Based on the results in the table, how many days will the light be red when he arrives?

34. Mr. VanDorn states that there is a 30% chance that a student is tardy to his class. Which of the following model(s) can be used to simulate this probability?

A A random number table with digits 0 – 9 where 0, 1, 2, 3, 4, 5, 6 represent a student that is tardy and 7, 8, 9 represent a student who is not tardy.
B A random number table with digits 0 – 9 where 0, 1, 2, 3, 4, 5 represent a student that is tardy and 6, 7, 8, 9 represent a student who is not tardy.
C A random number table with digits where 7, 8, 9 represent a student that is tardy and 0, 1, 2, 3, 4, 5, 6 represent a student who is not tardy.
D A six-sided die where 3 represents a student that is tardy.

35. Hairless in Seattle, Inc. is marketing its hair growth cream. The two graphs below are being considered for use in magazine ads.





- The two graphs represent the same information. Why do the two graphs not appear to represent the same information?