

TEST NAME: **Math 1 Functions Test**  
TEST ID: **2093225**  
GRADE: **09 - Ninth Grade**  
SUBJECT: **Mathematics**  
TEST CATEGORY: **My Classroom**

Student: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

Read the passage - 'Kevin's Used Car' - and answer the question below:

### Kevin's Used Car

#### Kevin's Used Car

Kevin is planning to buy a used car. He searches online to find used cars that he can afford. Kevin has \$1,500 in savings and plans to borrow no more than \$6,000.

Next, Kevin investigates different loans that he could use to help him buy the car. In order to figure out how much money he needs to borrow, he needs to know the price of the car he plans to buy, as well as the cost of the title, the registration fees, and the taxes, all of which vary from one state or city to another. He will also need to decide the amount of money he will spend from his savings.

Kevin's local bank offers him a 4-year loan at 4.75% annual percentage rate (APR) with a \$90 application fee. He searches for a better auto loan rate online. Whatever rate Kevin can find, his monthly car payment,  $M$ , will be computed by the formula,

$$M = P \times \frac{\left(\frac{r}{12}\right)\left(1 + \frac{r}{12}\right)^n}{\left(1 + \frac{r}{12}\right)^n - 1}$$

where  $P$  is the amount of money he will borrow,  $r$  is the APR for the loan (expressed as a decimal rather than as a percent), and  $n$  is the number of months for the loan. (In this case,  $\left(\frac{r}{12}\right)$  is a close approximation of the loan's monthly interest rate.)

Kevin is uncomfortable paying for the car for the next four years, so he plans to make additional payments to pay the loan off faster. He hopes that this accelerated schedule will lower the total amount of interest he pays on the car loan by decreasing the outstanding principal (that is, the amount of the loan he still has to pay back). However, some car loans do not allow "prepayments." That is, if Kevin overpays a loan payment, the additional money will go toward his next payment.

1. Read "Kevin's Used Car" and answer the questions.

Part A

Kevin finds a car to purchase and needs to borrow \$3,400. Calculate Kevin's monthly payment for a 4-year loan with a 4.75% annual percentage rate. Show your work.

Part B

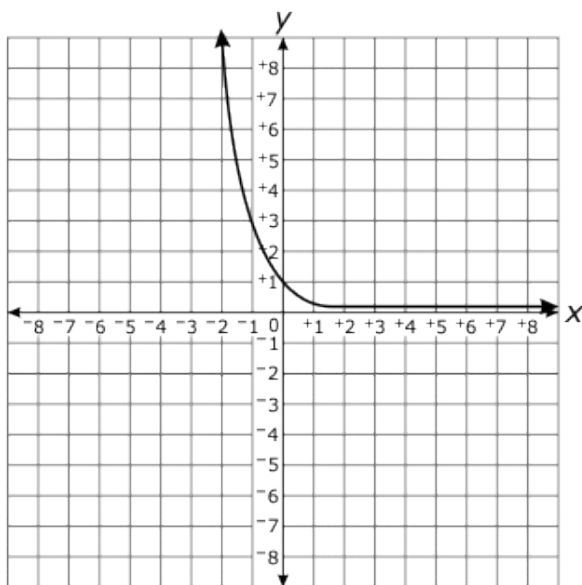
How much more would Kevin's car payment be if he pays back the \$3,400 in even payments over 3 years instead of 4 years at the same annual percentage rate? Show your work.

Part C

How much will Kevin save if he pays back the money over 3 years instead of 4 years?

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2. The function  $f(t) = 500(0.8)^t$  models the the size of a population of rats in an area  $t$  years after 2005. What does 0.8 represent in this function?
    - A. a decay rate of 80% each year
    - B. a growth rate of 80% each year
    - C. a decay rate of 20% each year
    - D. a growth rate of 20% each year

3. Which function is graphed below?



- A.  $y = 3^x$
- B.  $y = -3^{(-x)}$
- C.  $y = \left(\frac{1}{3}\right)^x$
- D.  $y = -\left(\frac{1}{3}\right)^{(-x)}$

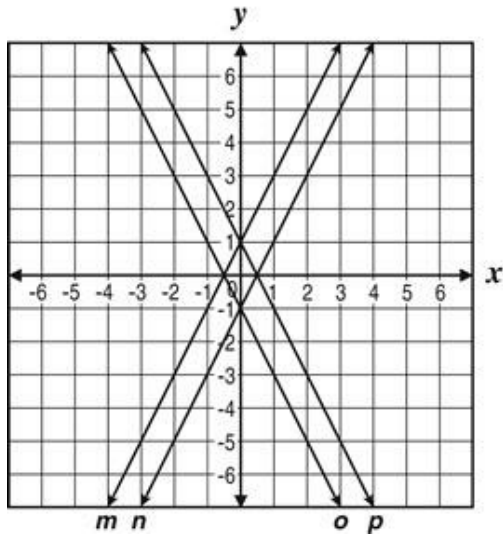
4. If  $\frac{1}{x^2+bx+c}$  can be rewritten as  $\frac{1}{(x+6)(x-6)}$ , where  $x \neq 6$  and  $-6$ , what are the values of  $b$  and  $c$ ?

- A.  $b = 0, c = 36$
- B.  $b = 0, c = -36$
- C.  $b = 12, c = 36$
- D.  $b = -12, c = -36$

5. Which statement about the graphs of  $f(x) = 3x - 4$  and  $g(x) = 3x + 4$  is true?

- A. The graphs of  $f$  and  $g$  have the same  $x$ -intercept.
- B. The graphs of  $f$  and  $g$  have the same  $y$ -intercept.
- C. The graphs of  $f$  and  $g$  are perpendicular.
- D. The graphs of  $f$  and  $g$  are parallel.

6. Lines  $m$ ,  $n$ ,  $o$ , and  $p$  are graphed on the coordinate grid below. A table of values for one of the lines, represented by the equation  $y = 2x + 1$ , is also provided.

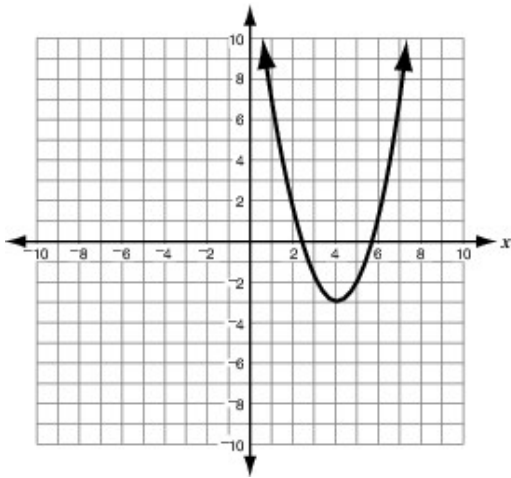


$x$	$y$
0	1
1	3
-1	-1
2	5
-2	-3

Which line BEST represents the equation  $y = 2x + 1$ ?

- A.  $m$
  - B.  $n$
  - C.  $o$
  - D.  $p$
7. The function  $f(x) = 110(1.004)^x$  models the population of rabbits, in thousands, in a state  $x$  years after 1990. What is the **approximate** population of the rabbits in 2012?
- A. 115,000
  - B. 120,000
  - C. 310,085,000
  - D. 338,550,000
8. Which scenario describes a process of exponential growth?
- A. A 14-foot tree grew by 10% in 2009 and then by 5% in 2010.
  - B. A software virus had infected 10,000 new computers on Monday and 20,000 more on Tuesday.
  - C. An insect population grew by 40% over the course of January and then grew by 40% again in February.
  - D. A pool of water loses 3 milliliters due to evaporation between noon and 1 p.m. and another 3 milliliters between 1 p.m. and 2 p.m.

9. The function  $B(t) = 17,550(0.88)^t$  models the value of a boat,  $t$  years after it was purchased. Which statement is true about the value of the boat?
- A. The value of the boat is increasing by 12% each year.
  - B. The value of the boat is increasing by 88% each year.
  - C. The value of the boat is decreasing by 12% each year.
  - D. The value of the boat is decreasing by 88% each year.
10. What is the average rate of change of the function below over the interval of  $x = 5$  to  $x = 7$ ?



- A.  $\frac{1}{4}$
- B.  $\frac{1}{2}$
- C. 2
- D. 4

11. Mr. Levy invested \$6,500 at a 4.5% annual interest rate. The function  $f(t) = 6,500(1.045)^t$  models the value of the investment after  $t$  years. What is the value of the investment after 18 months?
- A. \$6,872.56
  - B. \$6,943.65
  - C. \$11,349.20
  - D. \$14,355.11

12. Consider the two different families of functions below.

Family 1	Family 2
$f(x) = 2^x$	$j(x) = 2x + 3$
$g(x) = 3^x$	$k(x) = 3x - 2$
$h(x) = \left(\frac{1}{2}\right)^x$	$p(x) = \frac{1}{2}x$

Part A. Complete the chart below to determine the rate at which the output values change.

$x$	$f(x) = 2^x$	$g(x) = 3^x$	$h(x) = \left(\frac{1}{2}\right)^x$
0			
3			
6			
9			

Part B. What is the relationship between  $f(c)$  and  $f(c+3)$  for any real number  $c$ ? What is the relationship between  $h(c)$  and  $h(c+3)$ ?

Part C. Complete the chart below.

$x$	$j(x) = 2x + 3$	$k(x) = 3x - 2$	$p(x) = \frac{1}{2}x$
0			
3			
6			
9			

Part D. Suppose  $r(x) = mx + b$  for real numbers  $m$  and  $b$ . What is the relationship between  $r(c)$  and  $r(c+3)$ ? How does the rate of change for this family of functions compare with the rate of change for the first family of functions?

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



13. The table below shows the total number of computer parts Donavon can assemble during a 4-hour work shift.

Hours Worked	Parts Assembled
0	0
1	512
2	1,024
3	1,490
4	1,972

What is Donavon's average number of parts per hour for his entire 4-hour shift?

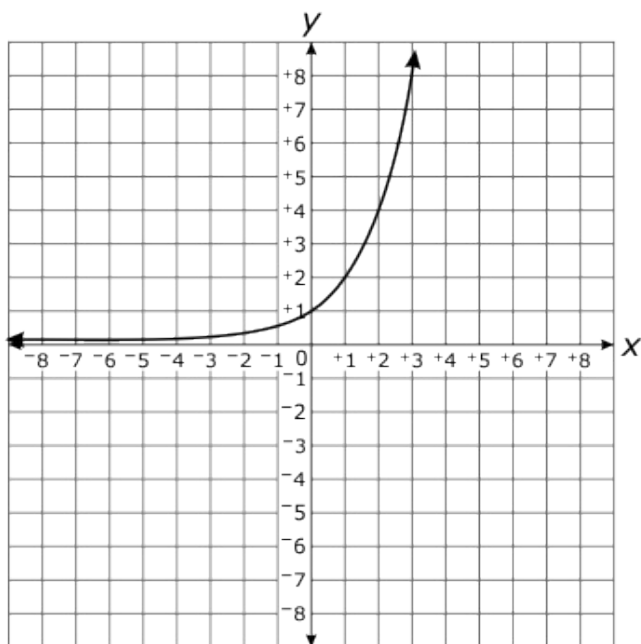
- A. 493 parts per hour
  - B. 512 parts per hour
  - C. 657 parts per hour
  - D. 1,972 parts per hour
14. Which is an equation of the linear function that passes through the points  $(0, -2)$  and  $(2, -\frac{2}{3})$ ?
- A.  $6x - 3y = 6$
  - B.  $2x - y = 6$
  - C.  $2x - 3y = 6$
  - D.  $2x - 3y = 2$
15. What is the  $x$ -intercept for the graph of  $y - 3x = -6$ ?
- A.  $-6$
  - B.  $-3$
  - C.  $1$
  - D.  $2$

16. The function  $P(x) = 10 + 2x$  models the amount of money Ryan earns selling ribbons at the fair each day, where  $P(x)$  is the amount Ryan earns and  $x$  is the number of ribbons sold. Which statement **best** explains Ryan's pay?
- A. He receives \$10 for the first ribbon he sells and \$2 more for every other ribbon he sells.
  - B. He receives \$2 for the first ribbon he sells and \$10 more for every other ribbon he sells.
  - C. He receives \$10 for each day he works, plus \$2 for each ribbon he sells.
  - D. He receives \$2 for each day he works, plus \$10 for each ribbon he sells.
17. Describe a real-world situation that could be modeled with the formula given below.

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18. What is the minimum value of the function  $f(x) = 2x^2 + 12x + 6$ ?
- A. -6
  - B. -10
  - C. -12
  - D. -16
19. What are the coordinates of the  $y$ -intercept of the graph of  $y = 3x - 6$ ?
- A. (2, 0)
  - B. (0, 2)
  - C. (-6, 0)
  - D. (0, -6)

20. An exponential function is graphed below.



What is the average rate of change for the function over the interval  $2 \leq x \leq 4$ ?

- A. 2
- B. 4
- C. 6
- D. 8

21. The table below shows the cost to rent a movie for different numbers of days at a movie rental store.

Days	Total Cost
3	\$6.00
5	\$8.50
6	\$9.75
9	\$13.50

What is the meaning of the rate of change for the data?

- A. The cost to rent a movie increases by \$1.25 for each additional day the movie is rented.
- B. The cost to rent a movie increases by \$2.00 for each additional day the movie is rented.
- C. The cost to rent a movie increases by \$2.50 for each additional day the movie is rented.
- D. The cost to rent a movie increases by \$2.75 for each additional day the movie is rented.
22. Maria began the school year with \$200 in her school lunch account.
- The amount of money in the account has decreased linearly.
  - After 3 months, she had \$155 in her account.
  - After 5 months, she had \$125 in her account.

Which function models the amount of money that Maria has in her account at the end of  $n$  months?

- A.  $f(n) = 200 - 30n$
- B.  $f(n) = 200 - 15n$
- C.  $f(n) = 30n - 200$
- D.  $f(n) = 15n - 200$

23. What is the value of  $f(-2)$  for the function  $f(x) = \frac{1}{3}x - 4$ ?

A.  $\frac{-17}{3}$

B.  $\frac{-14}{3}$

C.  $\frac{-10}{3}$

D.  $\frac{22}{3}$

24. The half-life of a substance is the time required for a quantity of a substance to decay to half its original value. The half-life of a radioactive isotope of Iodine-131 is eight days. Write an exponential equation that could be used to find out how many grams ( $g$ ) of a 200-gram sample of Iodine-131 will be left after 6 days.

25. The function  $f(x) = 3.89x$  models the cost for Jeff to fill his truck with  $x$  gallons of gas. Jeff's truck can hold a maximum of 21 gallons of gas. Jeff never lets his truck go below 2 gallons of gas. What is the **most** appropriate domain of the function?

A.  $2 \leq x \leq 23$

B.  $2 \leq x \leq 21$

C.  $0 \leq x \leq 19$

D.  $0 \leq x \leq 21$

26. Which polynomial has exactly 2 positive  $x$ -intercepts?

A.  $y = x^3 - 7x + 6$

B.  $y = x^3 - 7x - 6$

C.  $y = x^3 + 4x^2 + x - 6$

D.  $y = x^3 - 6x^2 + 11x - 6$

27. How many times does the graph of the quadratic function  $y = 3x^2 - 21x$  intersect the  $x$ -axis?
- A. 3
  - B. 2
  - C. 1
  - D. 0
28. For what domain is the function  $f(x) = 2^x - 4$  positive?
- A.  $x \geq 4$
  - B.  $x > 4$
  - C.  $x \geq 2$
  - D.  $x > 2$
29. What point is the  $y$ -intercept of the line represented by the equation  $10x + 7y = 70$ ?
- A. (10, 0)
  - B. (7, 0)
  - C. (0, 10)
  - D. (0, 7)
30. A man's shoe size is related to his foot length and can be modeled by the equation  $s = 1.7f - 7.2$ , where  $s$  is shoe size and  $f$  is foot length, in inches. What is the shoe size of a man whose foot measures 9 inches?
- A. 6
  - B. 8
  - C.  $9\frac{1}{2}$
  - D.  $10\frac{1}{2}$

31. The table below shows the distance Chris is located from his school at different times.

Time (minutes)	Distance (miles)
0	20
3	18
6	16
9	14
12	12
15	10

Assuming a linear relationship, how long will it take Chris to get to school?

- A. 20 minutes
- B. 24 minutes
- C. 27 minutes
- D. 30 minutes

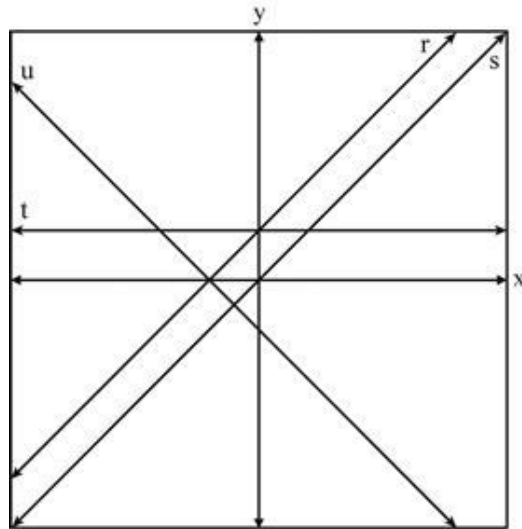
32. Two functions are shown below.

$$f(x) = x^2 + 6$$
$$g(x) = 3x^2 + 2x + 1$$

Kenneth added  $f(x)$  and  $g(x)$  resulting in  $h(x)$ . Is  $h(x)$  a function?

- A. Yes, each input of  $x$  results in a unique value for  $h(x)$ .
  - B. Yes, each value for  $h(x)$  has a unique value of  $x$  associated with it.
  - C. No, each input of  $x$  does not result in a unique value for  $h(x)$ .
  - D. No, each value for  $h(x)$  does not have a unique value of  $x$  associated with it.
33. What are the  $x$ - and  $y$ -intercepts of the graph of the equation  $3x - 4y = -1$ ?
- A.  $x$ -intercept:  $-\frac{1}{3}$ ;  $y$ -intercept:  $-1$
  - B.  $x$ -intercept:  $\frac{1}{4}$ ;  $y$ -intercept:  $-1$
  - C.  $x$ -intercept:  $-\frac{1}{3}$ ;  $y$ -intercept:  $\frac{1}{4}$
  - D.  $x$ -intercept:  $\frac{1}{4}$ ;  $y$ -intercept:  $-\frac{1}{3}$

34. Lines  $t$ ,  $u$ ,  $r$ , and  $s$  are shown on a coordinate plane below.



Which line BEST represents the graph of the equation  $y = x + 2$ ?

- A. Line  $r$
- B. Line  $s$
- C. Line  $t$
- D. Line  $u$

35. Which of the following describes the domain of  $y = \sqrt{4x + 5}$ ?

- A.  $x \geq -\frac{5}{4}$
- B.  $x \leq -\frac{5}{4}$
- C.  $x \leq -\frac{4}{5}$
- D.  $x \geq -\frac{4}{5}$

36. Which coordinate pair represents the  $y$ -intercept of the line  $6x + 3y = 12$  in the coordinate plane?

- A.  $(4, 0)$
- B.  $(2, 0)$
- C.  $(0, 4)$
- D.  $(0, 2)$



37. What is the average rate of change of  $f(x) = -5x + 1$  over the interval  $[-2, 3]$ ?
- A.  $-14$
  - B.  $-5$
  - C.  $-\frac{1}{5}$
  - D.  $11$
38. Lori graphed a linear function. The function had a positive  $x$ -intercept and a negative  $y$ -intercept. Which choice could be the function that Lori graphed?
- A.  $3y - 2x = 24$
  - B.  $3x - 2y = 24$
  - C.  $3y + 2x = -24$
  - D.  $3x - 2y = -24$
39. The function  $F(t) = 45(1.2)^t$  gives the approximate number of fish in a large pond after  $t$  years. Select all of the true statements.
- Pick up to 2 answers.
- A. There were originally 45 fish in the pond.
  - B. There were originally 54 fish in the pond.
  - C. The number of fish increases by 9 every year.
  - D. The number of fish doubles every year.
  - E. The number of fish increases by a factor of 1.2 every year.
40. The value of a new car after  $n$  years is modeled by the function  $f(n) = 21,500(0.95)^n$ . What does the number 21,500 represent in terms of the given context?