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Math Rules

Heart of Algebra (Algebra I) SAT Math Workshop

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Linear relationships

1. If $\frac{x-1}{3} = k$ and $k = 3$, what is the value of x?

A) 2
B) 4
C) 9
D) 10

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2. If $5x + 6 = 10$, what is the value of $10x + 3$?

A) 4
B) 9
C) 11
D) 20

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3. If $3r = 18$, what is the value of $6r + 3$?

A) 6
B) 27
C) 36
D) 39

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4. If $\frac{7}{9}x - \frac{4}{9}x = \frac{1}{4} + \frac{5}{12}$, what is the value of x?

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5. Which of the following expressions is equal to 0 for some value of x?

A) $|x-1| - 1$
B) $|x+1| + 1$
C) $|1-x| + 1$
D) $|x-1| + 6$.

Linear relationships, word problems

7. On Saturday afternoon, Armand sent m text messages each hour for 5 hours, and Tyrone sent p text messages each hour for 4 hours. Which of the following represents the total number of messages sent by Armand and Tyrone on Saturday afternoon?

A) $9mp$
B) $20mp$
C) $5m + 4p$
D) $4m + 5p$

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8. $b = 2.35 + 0.25x$

$c = 1.75 + 0.40x$

In the equations above, b and c represent the price per pound, in dollars, of beef and chicken, respectively, x weeks after July 1 during last summer. What was the price per pound of beef when it was equal to the price per pound of chicken?

A) $2.60
B) $2.85
C) $2.95
D) $3.35

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9. The sales manager of a company awarded a total of $3000 in bonuses to the most productive salespeople. The bonuses were awarded in amounts of $250 or $750. If at least one $250 bonus and at least one $750 bonus were awarded, what is one possible number of $250 bonuses awarded?

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10. A painter will paint n walls with the same size and shape in a building using a specific brand of paint. The painter's fee can be calculated by the expression $nKlh$, where n is the number of walls, K is a constant with units of dollars per square foot, l is the length of each wall in feet, and h is the height of each wall in feet. If the customer asks the painter to use a more expensive brand of paint, which of the factors in the expression would change?

A) h
B) l
C) K
D) n

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11. The number of states that joined the United States between 1776 and 1849 is twice the number of statesthat joined between 1850 and 1900. If 30 states joined the United States between 1776 and 1849 and x states joined between 1850 and 1900, which of the following equations is true?

A) 30x = 2
B) 2x = 30
C) $\frac{x}{2} = 30$
D) x + 30 = 2

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12. Ken and Paul each ordered a sandwich at a restaurant. The price of Ken's sandwich was x dollars, and the price of Paul's sandwich was $1more than the price of Ken's sandwich. If Ken and Paul split the cost of the sandwiches evenly and each paid a 20% tip, which of the following expressions represents the amount, in dollars, each of them paid?
(Assume there is no sales tax.)

A) $0.2x + 0.2$
B) $0.5x + 0.1$
C) $1.2x + 0.6$
D) $2.4x + 1.2$

Straight Lines and Linear Models

13. Kathy is a repair technician for a phone company. Each week, she receives a batch of phones that need repairs. The number of phones that she has left to fix at the end of each day can be estimated with the equation $P = 108 - 23d$, where P is the number of phones left and d is the number of days she has worked that week. What is the meaning of the value 108 in this equation?

A) Kathy will complete the repairs within 108 days.
B) Kathy starts each week with 108 phones to fix.
C) Kathy repairs phones at a rate of 108 per hour.
D) Kathy repairs phones at a rate of 108 per day

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14. $h = 3a + 28.6$

A pediatrician uses the model above to estimate the height h of a boy, in inches, in terms of the boy'sage a, in years, between the ages of 2 and 5. Based on the model, what is the estimated increase, in inches, of a boy's height each year?

A) 3
B) 5.7

C) 9.5
D) 14.3

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15. A line in the *xy*-plane passes through the origin and has a slope of $\frac{1}{7}$. Which of the following points lies on the line?

A) (0, 7)
B) (1, 7)
C) (7, 7)
D) (14, 2)

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16. The line $y = kx + 4$, where k is a constant, is graphed in the *xy*-plane. If the line contains the point (c, d), where $c \neq 0$ and $d \neq 0$, what is the slope of the line in terms of c and d?

A) $\frac{d-4}{c}$

B) $\frac{c-4}{d}$

C) $\frac{4-d}{c}$

D) $\frac{4-c}{d}$

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17. $C = \frac{5}{9}(F - 32)$

The equation above shows how a temperature F, measured in degrees Fahrenheit, relates to a temperature C, measured in degrees Celsius. Based on the equation, which of the following must be true?

I. A temperature increase of 1 degree Fahrenheit is equivalent to a temperature increase of $\frac{5}{9}$ degree Celsius.
II. A temperature increase of 1 degree Celsius is equivalent to a temperature increase of 1.8 degrees Fahrenheit.
III. A temperature increase of $\frac{5}{9}$ degree Fahrenheit is equivalent to a temperature increase of 1 degree Celsius.

A) I only
B) II only
C) III only
D) I and II only

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18. While preparing to run a marathon, Amelia created a training schedule in which the distance of her longest run every week increased by a constant amount. If Amelia's training schedule requires that her longest run in week 4 is

a distance of 8 miles and her longest run in week 16 is a distance of 26 miles, which of the following best describes how the distance Amelia runs changes between week 4 and week 16 of her training schedule?

A) Amelia increases the distance of her longest run by 0.5 miles each week.
B) Amelia increases the distance of her longest run by 2 miles each week.
C) Amelia increases the distance of her longest run by 2 miles every 3 weeks.
D) Amelia increases the distance of her longest run by 1.5 miles each week.

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19. Which of the following equations represents a line that is parallel to the line with equation $y = -3x + 4$?

A) $6x + 2y = 15$
B) $3x - y = 7$
C) $2x - 3y = 6$
D) $x + 3y = 1$

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20. The mesosphere is the layer of Earth's atmosphere between 50 kilometers and 85 kilometers above Earth's surface. At a distance of 50 kilometers from Earth's surface, the temperature in the mesosphere is −5° Celsius, and at a distance of 80 kilometers from Earth's surface, the temperature in the mesosphere is −80° Celsius. For every additional 10 kilometers from Earth's surface, the temperature in the mesosphere decreases by k° Celsius, where k is a constant. What is the value of k ?

Linear relationships with more than one variable

21. $3x + y = -23$

$2y - x = -19$

What is the solution (x, y) to the system of equations above?
A) $(-5, -2)$
B) $(3, -8)$
C) $(4, -6)$
D) $(9, -6)$

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22. $x + y = -9$
$x + 2y = -25$
According to the system of equations above, what is the value of x

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23. $x+y=0$
$3x=2y=10$
Which of the following ordered pairs (x, y) satisfies the system of equations above?

A) $(3, -2)$
B) $(2, -2)$
C) $(-2, 2)$
D) $(-2, -2)$

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24. $2x-3y=-14$
$3x-2y=-6$

If (x, y) is a solution to the system of equations above, what is the value of $x-y$?

A) -20
B) -8
C) -4
D) 8

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25. $x - 3y = 4$
$4x - 5y = 7$

In the system of equations above, k is a constant and x and y are variables. For what value of k will the system of equations have no solution?

A) $\frac{12}{5}$
B) $\frac{16}{7}$
C) $\frac{-16}{7}$
D) $\frac{-12}{5}$

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26. At a lunch stand, each hamburger has 50 more calories than each order of fries. If 2 hamburgers and 3 orders of fries have a total of 1700 calories, how many calories does a hamburger have?

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27. $\frac{x}{y} = 6$
$4(y + 1) = x$

If (x, y) is the solution to the system of equations above, what is the value of y?

A) 2
B) 4
C) 12
D) 24

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28. $-3x + 4y = 20$
$6x + 3y = 15$

If (x, y) is the solution to the system of equations above, what is the value of x?