## ALGEBRA 1 STATE MATHEMATICS CONTEST FINALS APRIL 26, 2012

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1. Let *a* and *b* be non-zero real numbers such that x = 3 is the unique solution to equation ax+b=3 and x=2 is the unique solution to the equation bx-a=8. Find the value of a+b. d)  $\frac{32}{5}$ a)  $\frac{46}{7}$ b)  $\frac{25}{7}$ c)6 mytille # # 3 PS multine # # 3 PR R **2.** Consider the function *f*, defined by:  $f(x) = \sqrt{2x+1}$ . Determine the value of x such that f(x+2) = 5. c) 12 d) 11 e) 10 14 b) 13 a) 3. Find all real numbers that solve the equation |3x+1|=2x+3. a) {2} Institute # # \* \* R e)  $\{2, \frac{5}{4}\}$ 面动机机称林塔梯 4. Consider the system of inequalities defined over real numbers,  $\int \Delta$ Y. a) 20  $\begin{cases} x \le 15 - \frac{4}{10}y \\ y \le 5 - \frac{x}{3} \end{cases}$ Determine the maximum value of x + y. b) 11 c) 15 d) infinity N. e) None of the above d) infinity 5. Let *A* and *B* be 2×2 matrices defined over the real numbers:  $A = \begin{bmatrix} x + y & 2 \\ 1 & 4 \end{bmatrix} \text{ and } B = \begin{bmatrix} 4 & 3 \\ 8 & xy \end{bmatrix}.$ Compute the values of (*x*, *y*) such that  $A + B = \begin{bmatrix} 10 & 5 \\ 9 & 12 \end{bmatrix}.$ Y. c) {(-2,-4),(4,-2)} R. a) {(2,-4),(-4,-2)} b) {(-2,4),(2,-4)} e) None of the above to the We the Ph to the W. B. P. to the We By 上 按 按 浅 % 小 按 读 " Y. the the the







**21.** A particle executes translational kinematic motion such that the instantaneous displacement, d(t), in meters, is given by the table below. Compute the displacement at the end of the 40<sup>th</sup> second.

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2 3 5 (seconds) 0 1 4 Withit the the the the stitute # H 'S R d(t) (meters) 10 14 18 22 ·施兴·法保 6 N. mistime ### 冰喝 a) 200m b) 166m c) 342m d) 162m e) None of the above mutule # # # B 加加林塔路 **22.** Let x > 0 and y > 0 such that  $y^2 = 3x - 1$  and  $2y^2 = 5(x + 1)$ . Solve for (x, y). Ro  $2y^2$ c) (7,  $2\sqrt{5}$ ) a)  $(5, 3\sqrt{5})$ b)  $(7, 2\sqrt{7})$ d)  $(5, 2\sqrt{7})$  e) (2, 27)multinut # # 3 PR matinto # # \* 而对此他称林塔院 而此此此教林塔然 而如此地。新林塔 N. **23.** The area of a square pond is given by the expression  $A(x) = x^2 + 12x + 36$ . Find the expression matitute # # '3 PE for the perimeter of the pond. Y. matitute ## # b)  $4x + 6^{11110}$ c) 0.5x + 6x + 6d) 4x + 24e) 6x + 6a) 2x + 12而如此他教祥後然 innem林塔佛 前加新林後隊 山北新林道佛 Withite # # 'S PE 24. The number of bacteria growing in a nutrient culture on a petri dish can be modeled by the R. sequential equation  $N_t = 3N_{t-1}$  where  $N_t$  is the number of bacteria in the culture at the end of t minutes, and  $N_{t-1}$  is the number of bacteria in the culture at the end of t-1 minutes. Suppose there No. are 10,000 bacteria at the end of 6 minutes. How many bacteria will be in the culture at the end of 10 minutes? a) 30,000 b) 810,000 c) 270,000 d) 360,000 e) None of the above 而此此此就林塔然 面动机机新林塔然 Withill How How & PE mutule ## # 18 matinue ## # '\$ 1% matinue ## # 18 Y.

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25. An old man from the country of Jamais has 2 sons and a young daughter. At his death he leaves 1/3 of his money to the first son. Then 1/6 of the remainder is willed to his second son. The young daughter is bequeathed the difference between the amounts received by the first and second son. His butler is supposed to collect whatever is left after the old man's children received their shares. Find exactly what the butler received if the daughter received \$20,000.

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e) None of the above

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institute the t d) \$30,000 b) \$20,000 Y. **26.** Consider the data set S consisting of real numbers  $x_1, x_2, x_3, ..., x_n$  with mean  $\overline{x}$  and standard deviation s. If each data point is first multiplied by b and then increased by a value of c, find the values of the new mean and new standard deviation. 面射机机物样等除 c)  $\{c+b\overline{x}, nbs\}$ b)  $\{c+b\overline{x}, ncs\}$ e)  $\{c+nb\overline{x}, nbs\}$ R. a)  $\{cn+b\overline{x}, nbs\}$ d)  $\{c+b\overline{x}, bs\}$ 27. Suppose that m workers can finish a job in d days. How many days will it take m+n workers to finish the job? Assume that each worker can finish the same amount of work each day. c)  $\frac{md}{m+n}$  d)  $\frac{md}{m-n}$  e) None of the above b) *d*−*n* a) d+m**28.** Let  $\alpha$  and  $\beta$  be solutions to the quadratic equation  $2x^2 - mx - 4 = 0$ . Find the value of *m* if N.  $\frac{1}{\alpha} + \frac{1}{\beta} = 2.$ a) 4, '8 % 加加加格新林塔梯 b) -4 c) 8 d) -8 e) None of the above No.

withthe) 396 **29.** If 4y-3x=5, what is the smallest integer value of x for which y > 100? c) 132 a) 130 b) 131

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R 30. Among a group of 165 students, 8 are taking Calculus, Psychology and Computer Science; 33 are taking Calculus and Computer Science; 20 are taking Calculus and Psychology; 24 are taking Psychology and Computer Science; 79 are taking Calculus; 83 are taking Psychology; and 63 are e) 34<sup>3</sup> % taking Computer Science. How many students are taking none of the three subjects? d) 25 b) 16 matine ### institute ## a) 12 面对机机练样等除 Y. **31.** Consider the binary operations  $\oplus$  and  $\otimes$  defined over a set S of real numbers such that  $a \oplus b = 2^{a+b}$  and  $a \otimes b = 2^{ab}$ . Which of the following statements are valid? I. The operation  $\oplus$  is associative on S. II. The operation  $\otimes$  is commutative on S. III. The operation  $\otimes$  is distributive over  $\oplus$  on S. only e) None of the above Ro 8h a) I only b) II only c) I and III only d) II and III only Y. 6 80  $b = \frac{1}{2}$  where *a*, *b*, and *c* are non-zero real numbers. What is the mean value of *a* and *b*? a C b)  $\frac{ab}{c}$ ab  $\frac{2c}{ab}$ e) 2c而此此他新祥後 而如此他教林後然 matine # # B 面前加速教祥等席 multille # # 3 PE 而此此此称并生活死 N. 33. A club has 6 boys and 8 girls. During a membership drive, the same number of boys and girls joined the club. How many members does the club have now if the ratio of boys to girls is 4:5? 加加加加林塔塔 e) 27<sup>3</sup> K N. Institute \$5 # 13 b) 18 a) 16 c) 16 d) 21 k Inte d) 4 \*\*\*\* \*\* \*\* Astitute # # # B **34.** What is the area of the region enclosed by  $|x|+|y| \le 2$ ? c) 2 (1110 a) 0 b) 1 to the the B to the the the to the the B to the We B PR to the We B Ph to the W. B. Ro

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