

Algebra I Test  
UH Math Contest 2016

Name: \_\_\_\_\_ School: \_\_\_\_\_

1. Find the  $y$ -intercept of the line which passes through the point  $(-6, 7)$  and which is perpendicular to the line  $y = 3x - 7$ .

(A)  $-11$       (B)  $-7$       (C)  $-3$       (D)  $1$       (E)  $5$       (F)  $9$

2. The total enrollment for the Spring 2016 semester at a local college is 1848 students. If the Fall 2015 enrollment was 2100 students, find the percentage decrease in the enrollment from the fall to the spring.

(A) 8%      (B) 9%      (C) 12%      (D) 14%      (E) 15%      (F) 18%

3. If  $\sqrt{6048}$  is written in simplest radical form  $a\sqrt{b}$ , where  $a$  and  $b$  are positive integers and  $b$  is square-free, find  $a + b$ .

(A) 54      (B) 76      (C) 87      (D) 122      (E) 174      (F) 382

4. The graph of a quadratic function has its vertex at  $(4, 5)$  and passes through the point  $(2, -3)$ . If the function is expressed in the form  $f(x) = ax^2 + bx + c$ , find  $a + b + c$ .

(A)  $-13$       (B)  $-4$       (C)  $5$       (D)  $14$       (E)  $23$       (F)  $32$

5. Find the range of the exponential function  $y = -\left(\frac{1}{3}\right)^x$ .

(A)  $y < -3$       (B)  $y > 0$       (C)  $y < -\frac{1}{3}$

(D)  $y > -3$       (E)  $y < 0$       (F)  $y > -\frac{1}{3}$

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6. A commercial airliner travels at a speed of 540 miles per hour. If a mile is equivalent to 5280 feet, determine the speed of the plane in units of feet per second.

- (A) 720 ft/s                      (B) 792 ft/s                      (C) 864 ft/s  
(D) 936 ft/s                      (E) 1008 ft/s                      (F) 1080 ft/s

7. The given equation has two solutions. Find the product of these solutions.

$$17(x - 2) = 14 - 6(x - 2)^2$$

- (A)  $-4$               (B)  $-\frac{7}{3}$               (C)  $-2$               (D)  $\frac{8}{3}$               (E)  $3$               (F)  $\frac{35}{6}$

8. Assume  $Q$  varies directly as  $R$ , and  $R$  varies directly as  $S$ . If  $R = 60$  when  $Q = 35$ , and  $R = 75$  when  $S = 105$ , find the value of  $S$  when  $Q = 80$ .

- (A) 172              (B) 175              (C) 180              (D) 184              (E) 188              (F) 192

9. Find the value of the expression below when  $a = 2$ ,  $b = 5$ , and  $c = 4$ .

$$\frac{\sqrt{\frac{b^{-99}}{a^{50}c^{25}}}}{\sqrt{\frac{b^{-97}c^{-28}}{a^{46}}}}$$

- (A)  $\frac{25}{2}$               (B)  $\frac{16}{5}$               (C)  $\frac{5}{4}$               (D)  $\frac{1}{10}$               (E)  $\frac{2}{5}$               (F)  $\frac{5}{8}$

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10. Given the function  $f(x) = \frac{12x^2 - 11x - 5}{8x^2 - 34x + 30}$ , find the value of  $f(33)$ .

- (A)  $\frac{5}{3}$       (B)  $\frac{7}{4}$       (C)  $\frac{8}{5}$       (D)  $\frac{11}{6}$       (E)  $\frac{12}{7}$       (F)  $\frac{19}{12}$

11. How many integers  $x$  satisfy the given compound inequality?

$$\frac{2x + 1}{-5} \leq \frac{3 - x}{4} \leq \frac{x - 7}{-3}$$

- (A) 24      (B) 25      (C) 26      (D) 27      (E) 28      (F) 29

12. Solve for  $x$ :

$$1 + \frac{2}{1 + \frac{2}{x}} = 2 + \frac{1}{2 + \frac{1}{x}}$$

- (A)  $\frac{2 \pm \sqrt{3}}{2}$       (B)  $\frac{3 \pm \sqrt{15}}{2}$       (C)  $\frac{4 \pm \sqrt{21}}{2}$   
(D)  $\frac{5 \pm \sqrt{33}}{2}$       (E)  $\frac{6 \pm \sqrt{39}}{2}$       (F)  $\frac{7 \pm \sqrt{57}}{2}$

13. After her morning workout, Joyce drinks a 24 ounce smoothie consisting of two parts banana for every one part strawberry. Her friend prefers a smoothie with three parts banana for every two parts strawberry. How many additional ounces of strawberry should Joyce add to her usual mixture when preparing a drink for her friend? Round your answer up to the nearest tenth of an ounce.

- (A) 2.3      (B) 2.7      (C) 2.8      (D) 3.3      (E) 3.7      (F) 3.8

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14. A school survey indicates that one-fourth of all freshman, one-third of all sophomores, half of all juniors, and two-thirds of all seniors approve of a new dress-code policy. If the student body consists of 92 freshmen, 78 sophomores, 76 juniors, and 54 seniors, what percentage of the students approve of the new policy?

(A) 36%    (B) 37%    (C) 38%    (D) 39%    (E) 40%    (F) 41%

15. If the  $y$ -intercept of a linear function is 3 times its slope, and the graph of the function intersects the lines  $y = 8x - 4$  and  $y = -3x + 40$  at the same point, find the slope of the line.

(A) 2    (B) 3    (C) 4    (D) 5    (E) 6    (F) 7

16. The graph of an exponential function passes through the point  $(2, 27)$ . If the function has the form  $f(x) = b^x$  with  $b > 0$ , find  $f(-\frac{4}{3})$ .

(A)  $\frac{1}{4}$     (B)  $\frac{1}{8}$     (C)  $\frac{1}{9}$     (D)  $\frac{1}{16}$     (E)  $\frac{1}{64}$     (F)  $\frac{1}{81}$

17. A Martian observes Earth eclipse the sun on Martian New Year's Day. If a year on Mars is 686 days, and the Martian approximates a year on Earth to be 364 days, how many Martian years will pass until the Earth eclipses the sun on the same date?

(A) 14    (B) 26    (C) 49    (D) 91    (E) 143    (F) 169

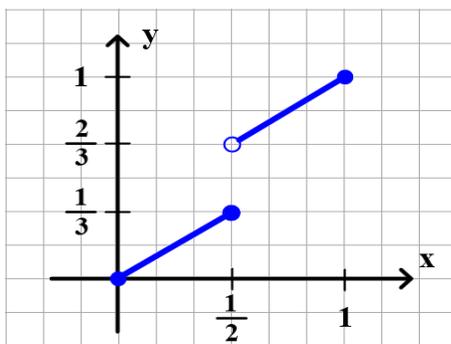
18. Let  $f(x) = -5x^2 + 30x - 41$ . If  $f(s) = f(s + 6)$ , find  $f(s + 3)$ .

(A) -11    (B) -6    (C) -1    (D) 4    (E) 9    (F) 14

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19. Let  $f(x)$  be the piecewise linear function whose graph is given below. If the value  $f(f(f(\frac{3}{4})))$  is expressed as a fraction of the form  $p/q$  where  $p$  and  $q$  have no common factors, find  $p + q$ .



- (A) 52      (B) 78      (C) 107      (D) 131      (E) 143      (F) 158
20. A line passes through the points  $(3a, 5b)$ ,  $(b, 0)$ ,  $(a, 3b)$ , where  $a$  and  $b$  are nonzero real numbers. Find the slope of the line.
- (A)  $\frac{1}{4}$       (B)  $-\frac{1}{3}$       (C)  $\frac{1}{2}$       (D)  $-2$       (E)  $3$       (F)  $-4$
21. On January 30, 2010, Julie was twice the age of her daughter Laura. Three years later (2013), Laura was three-fourths the age of her sister Kate, while one year earlier (2009) Kate was three-halves the age of her brother Andy. Assuming Andy is 29 years younger than his mother Julie, find the age difference of Kate and Laura.

- (A) 5      (B) 6      (C) 7      (D) 8      (E) 9      (F) 10

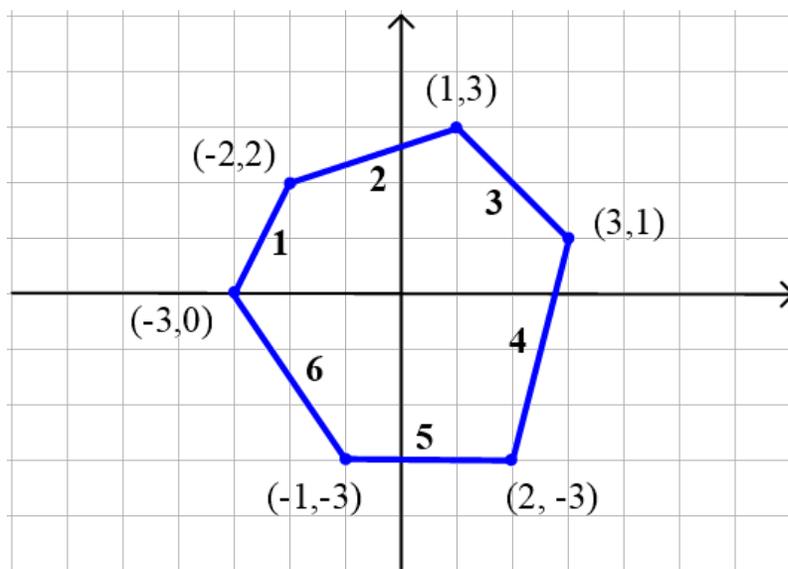
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22. Given the hexagon below, define the function

$$f(x) = f_1(x) + f_2(x) + f_3(x) + f_4(x) + f_5(x) + f_6(x)$$

where  $f_k(x) = m_kx + b_k$  is the linear function whose graph contains the  $k$ -th edge of the hexagon, as labeled below. Find the value of  $f(1)$ .



- (A) -3      (B) -2      (C) -1      (D) 0      (E) 1      (F) 2

23. A poker player begins a game with 72 chips, and after losing two bets has 40 chips remaining. If the proportion of chips wagered (relative to his total chip count) on the first bet was twice the proportion of chips wagered on the second bet, what is the difference of the number of chips wagered on the first and second bets?

- (A) 12      (B) 13      (C) 14      (D) 15      (E) 16      (F) 17

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24. Find the 85th term in the given sequence: 5, 7, 11, 17, 25, 35, 47, ...

(A) 5955    (B) 6295    (C) 6465    (D) 6635    (E) 6975    (F) 7145

25. Steve and Bill take turns paddling a tandem kayak on a 24 mile round trip river tour. If Steve paddles the first 12 miles upstream, and Bill paddles the remaining 12 miles downstream, the men complete the trip in 4 hours. If the paddlers switch roles, they complete the trip in 3 hours. Assuming the river flows at a rate of 2 miles per hour, find the difference in the paddling speeds (in miles per hour) of the two men.

(A) 1    (B) 2    (C) 3    (D) 4    (E) 5    (F) 6