Algebra 1 Exam
University of Houston Mathematics Contest 2026

Instructions for the Algebra 1 Contest. (These only appear once.)
When a graph is given, the distance between adjacent grid lines is one unit unless otherwise noted.

1. A rabbit and a turtle are racing against each other. The rabbit is running 20 miles per hour faster than the turtle but started when the turtle was already 6 miles ahead. After how much time will the rabbit catch up with the turtle?

    (a) 10 mins
    (b) 15 mins
    (c) 18 mins
    (d) 25 mins
    (e) 30 mins
    (f) 1 hour

2. The sum of three consecutive terms q^n, q^{n+1} and q^{n+2} of a geometric progression of ratio q is equal to 3 times the first of these three terms. Which of the following is a possible value for q?

    (a) 3
    (b) -2
    (c) -1
    (d) 2
    (e) 3/2
    (f) None of the above

3. At a school play, adult tickets cost \$ 8 and student tickets cost \$ 5. A total of 50 tickets were sold for \$310. How many adult tickets and how many student tickets were sold?

    (a) 12 adult tickets and 38 student tickets
    (b) 10 adult tickets and 46 student tickets
    (c) 30 adult tickets and 20 student tickets
    (d) 15 adult tickets and 35 student tickets
   (e) 20 adult tickets and 30 student tickets
    (f) None of the above

4. Find the slope of the straight line passing through the points $(-3, 4)$ and $(5, 0)$.

   (a) $-1/2$
   (b) 2
   (c) $1/2$
   (d) -2
   (e) 1
   (f) None of the above

5. A country with a current population of 10 million people has a constant growth rate of 3% per year. After how many years will the population exceed 15 million.

   (a) 2 years
   (b) 3 years
   (c) 5 years
   (d) 10 years
   (e) Never
   (f) None of the above

6. The sum of 10 consecutive integers is equal to 35. What is the first of the numbers?

   (a) -5
   (b) -2
   (c) -1
   (d) 0
   (e) 2
   (f) None of the above

7. What is the set of all x that verify the inequality $|x - 2| - |x + 1| < 1$?

   (a) $(0, +\infty)$
   (b) $[0, +\infty)$
   (c) $(2, +\infty)$
   (d) $(-1, 2)$
   (e) $(-1, 0)$
   (f) There is no such x

8. What are all the solutions to the equation $\frac{1}{x+1} + \frac{1}{x-1} = \frac{4x(x+2)}{x^2-1}$?

   (a) $x = -2$

   (b) $x = 0$

   (c) $x = 0$ and $x = -3/2$

   (d) $x = 0$ and $x = 2$

   (e) There are no solutions

   (f) None of the above

9. Find the intersection of the two parabolas of equations $y = x^2 - 1$ and $y = -(x+1)^2$.

   (a) The single point $(0, 0)$

   (b) The single point $(0, -1)$

   (c) The two points $(0, -1)$ and $(0, 1)$

   (d) The two points $(0, -1)$ and $(-1, 0)$

   (e) The four points $(0, -1)$, $(0, 1)$, $(-1, 0)$ and $(1, 0)$

   (f) None of the above

10. Assume that we are given the function $f(x) = x^2 + ax + b$ where a and b are unknown. We know, however, that $f(-1) = 0$ and $f(1) = 6$. Find the values of a and b.

   (a) $a = 0$ and $b = -1$

   (b) $a = 1$ and $b = 0$

   (c) $a = 1$ and $b = 4$

   (d) $a = 2$ and $b = 3$

   (e) $a = 3$ and $b = 2$

   (f) None of the above

11. What is the least common multiple between the two numbers 42 and 77?

   (a) 126

   (b) 154

   (c) 166

   (d) 420

   (e) 462

   (f) None of the above

12. A right triangle has its hypotenuse that is twice the length of one of its side and an area equal to $\sqrt{3}$. What is the triangle's perimeter?

    (a) $3+\sqrt{3}$

    (b) $3\sqrt{2}+\sqrt{6}$

    (c) $4\sqrt{\sqrt{3}}$

    (d) $3\sqrt{3}/2$

    (e) $3\sqrt{6}$

    (f) None of the above

13. Simplify the expression: $\frac{a\,\sqrt{b}\,c^2}{b^{-1/2}\,(ac)^{3/2}}$.

    (a) $a\,\sqrt{a}\,c$

    (b) $\sqrt{\frac{c}{a}}\,b$

    (c) $b\,\sqrt{a\,c}$

    (d) $\sqrt{\frac{b\,c}{a}}$

    (e) $\sqrt{a\,b\,c}$

    (f) None of the above

14. Charles will be taking the final exam for his Algebra course next week. He has so far received the grades 85 and 86 on the two class midterm exams, and obtained an overall grade of 93 on his homeworks. The final course grade is obtained as a weighted average where each midterm counts for 20%, homeworks for 30% and the final exam for 30% of the overall course grade. What is the smallest grade he should receive on his final exam in order to get an A on the course (i.e. a final course grade of at least 90)?

    (a) 90

    (b) 91

    (c) 92

    (d) 93

    (e) 94

    (f) None of the above

15. The area of a sphere varies linearly with the square of its radius while the volume inside it depends linearly in the cube of the radius. If a sphere is rescaled in a way that its volume gets 64 times larger, by what factor is its area being multiplied by?

    (a) 16

    (b) 32

    (c) 64

    (d) 256

    (e) 512

    (f) None of the above

16. The conversion between a temperature F in Fahrenheit and the corresponding temperature K in Kelvin is given by the formula $F = \frac{9}{5}K - 460$. At which temperature do the two values coincide with each other?

    (a) They never match.

    (b) 100 °F

    (c) 440 °F

    (d) 550 °F

    (e) 575 °F

    (f) None of the above

17. Find the sum of the slopes of $\overline{AB}$, $\overline{BC}$, and $\overline{AC}$.
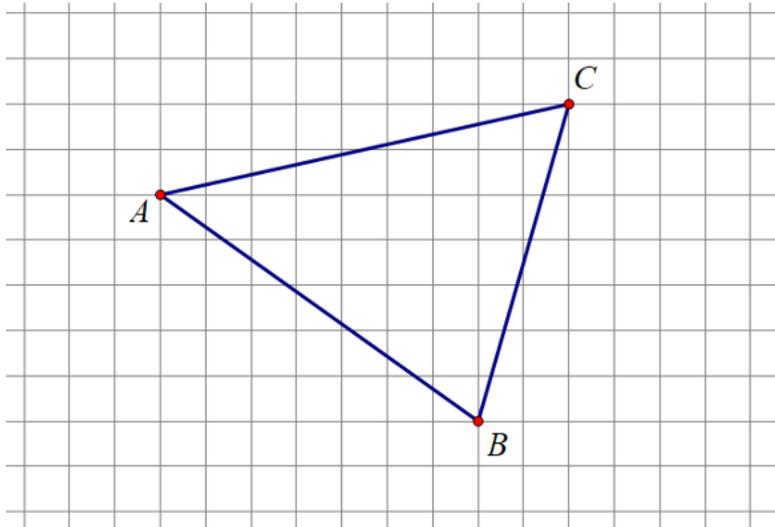
Answer: _____

18. Audrey decides to place $100 in an investment account that has 3% monthly interests and $100 on a second account with a constant yield of 5$ per month. After how many months will the total amount of money in the first account exceed that of the second one?

    (a) 18 months
    (b) 24 months
    (c) 28 months
    (d) 30 months
    (e) 32 months
    (f) None of the above

19. The product of the ages of Alex and Chase is 240. If twice the age of Chase is exactly 4 years more than the age of Alex, what is Alex's age?

    (a) 12
    (b) 20
    (c) 22
    (d) 24
    (e) 26
    (f) None of the above

20. One throws two unbiased dices. What is the probability that the sum of their two numbers is smaller or equal than 6?

    (a) 1/3
    (b) 7/18
    (c) 5/12
    (d) 5/8
    (e) 2/3
    (f) None of the above

21. Two dogs are running each at constant speed towards one another in straight line. They are initially 242 feet away and the first dog runs 20% faster than the second. What is the total distance crossed by the first dog when the two meet?

    (a) There is not enough information to conclude.
    (b) 110 feet
    (c) 121 feet
    (d) 132 feet
    (e) 145 feet
    (f) None of the above

22. Consider two numbers x and y such that the squared difference of the two is equal to the square of x minus the square of y. Which of the following statement is true?

   (a) The two numbers must have opposite signs

   (b) x must equal to 0

   (c) y must equal to 0

   (d) The product xy must equal to 0

   (e) Either y equals to 0 or the two numbers are equal to each other

   (f) None of the above

23. Consider the two points A and B of the plane with coordinates $A = (1, -1)$ and $B = (-2, 3)$. How many points in the plane are simultaneously at distance 4 from the point A and at distance 1 from the point B?

   (a) None

   (b) 1

   (c) 2

   (d) 4

   (e) Infinitely many

   (f) None of the above

24. One draws 5 cards at random from a 52 cards deck made of 13 cards for each of the four suits (hearts, clubs, diamonds and spades). What is the probability of drawing a flush, i.e. that the 5 cards are of the same suit (rounded to the closest hundredth of a percent)?

   (a) 0.05%

   (b) 0.10%

   (c) 0.20%

   (d) 0.39%

   (e) 1.56%

   (f) None of the above

25. What are all the solution(s) of the equation $\sqrt{3x - 2} = x - 4$?

    (a) There is no solution

    (b) $x = 2$

    (c) $x = 4$

    (d) $x = 9$

    (e) $x = 2$ and $x = 9$

    (f) None of the above

26. Let f be a function of the form $f(x) = ax + b$ with a and b being unknown real numbers. If we assume that $f(-1) = 1$ and $f(f(1)) = 0$, what are the values of a and b?

    (a) There are no possible a and b satisfying the conditions

    (b) a and b are not uniquely determined by these conditions

    (c) $a = 1/2$ and $b = 3/2$

    (d) $a = -5/2$ and $b = -3/2$

    (e) $a = -1$ and $b = 0$

    (f) None of the above

27. Consider a 4 pins lock, with each pin allowing for any digit between 0 and 9. How many combinations are there with at least two pins having the same digit?

    (a) 6000

    (b) 5040

    (c) 5000

    (d) 4960

    (e) 4320

    (f) None of the above

28. Twelve people are in a room and shake each other's hands once. How many handshakes does this amount to?

    (a) 12

    (b) 24

    (c) 144

    (d) 132

    (e) 66

    (f) None of the above

29. For which value(s) of the parameter k does the following system of equations:

$$\begin{cases} 2x + 2y = k \\ -x - y = 2 \end{cases}$$

have infinitely many solutions?

    (a) $k = 1$

    (b) $k = 2$

    (c) $k = 4$

    (d) $k = -4$

    (e) $k \neq -4$

    (f) None of the above

30. The figure below shows a circle in the xy plane centered at the origin, on which we consider the four points p_1, p_2, p_3, p_4 marked in blue. Let us denote $s_{12}, s_{13}, s_{14}, s_{23}, s_{24}, s_{34}$ the slopes of the lines connecting the points p_1 and p_2, p_1 and p_3, ... respectively. Which of these slopes is the largest?
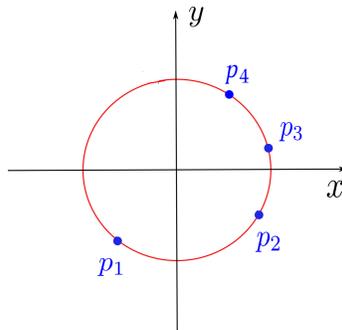
    (a) s_{12}

    (b) s_{13}

    (c) s_{14}

   (d) s_{23}

    (e) s_{24}

    (f) s_{34}

31. Let S_n be the sum of all even integers between 0 and $2n$ included. What is the value of the ratio S_{21}/S_{20}?

   (a) 1.1
   (b) 2.2
   (c) 22/21
   (d) 43/41
   (e) 10/11
   (f) None of the above

32. A father is 4 times as old as his son. In 20 years, the father will be twice as old as his son. What will be their respective ages 10 years from now?

   (a) The father will be 70 and his son 25
   (b) The father will be 60 and his son 30
   (c) The father will be 50 and his son 20
   (d) The father will be 40 and his son 10
   (e) The father will be 30 and his son 15
   (f) None of the above

33. Points E, N, and $T(4,3)$ are shown below. Find the y-intercept of the line passing through point N which is perpendicular to $\overline{ET}$.
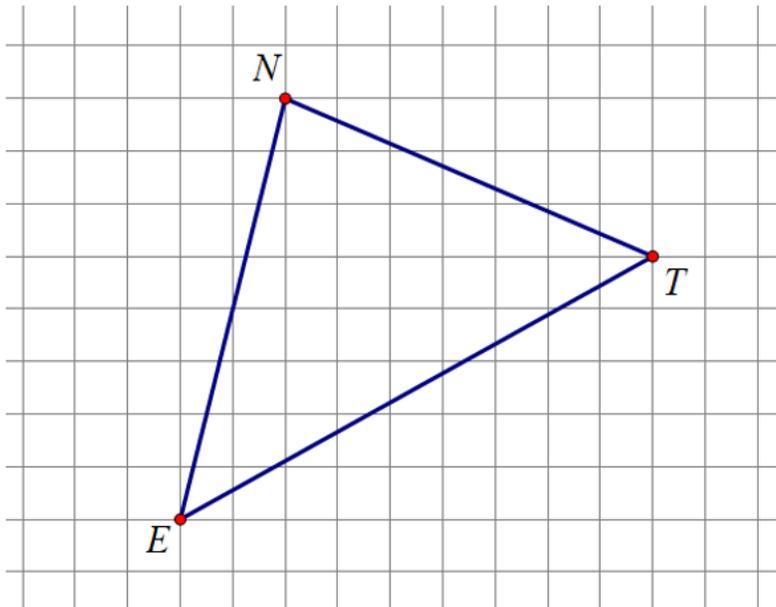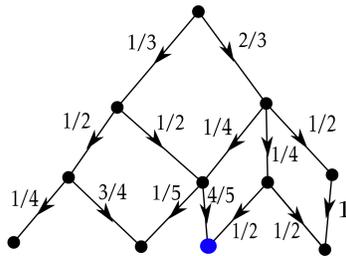

   Answer: _____

34. How many times does the line of equation $y = 2x - 3$ intersect the regular grid shown below that is made of the horizontal and vertical lines passing through the points of coordinates (m, n) with m and n being integers from 0 to 10 (included)?
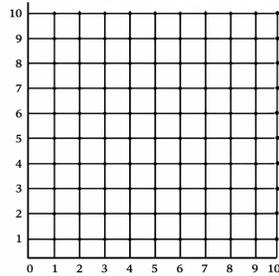
    (a) 16 times

    (b) 15 times

    (c) 11 times

    (d) 10 times

    (e) 5 times

    (f) None of the above

35. A ball is going down the system of pipes below in which its probability of going through one of the branches is given by the fraction next to each corresponding arrow. What is its probability of ending up at the terminal node colored in blue?
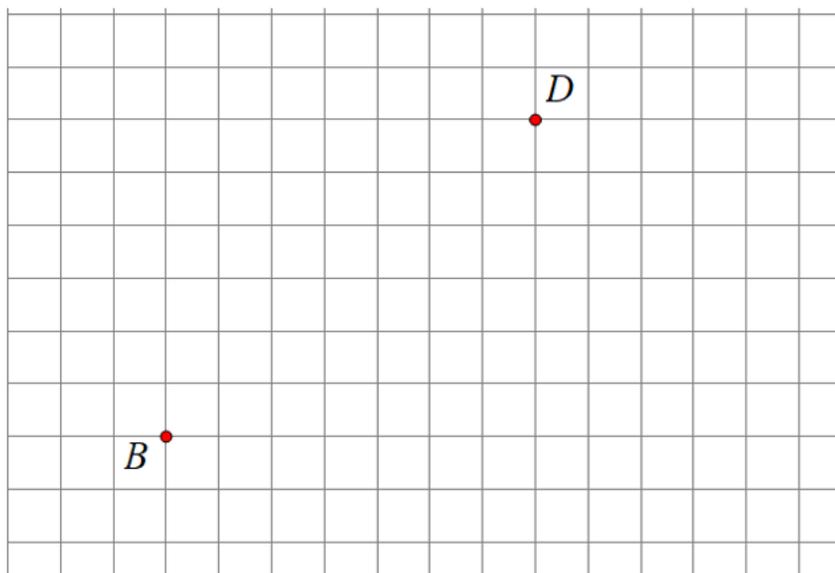

    (a) 4/5

    (b) 2/15

    (c) 4/15

    (d) 13/60

    (e) 2/3

    (f) None of the above

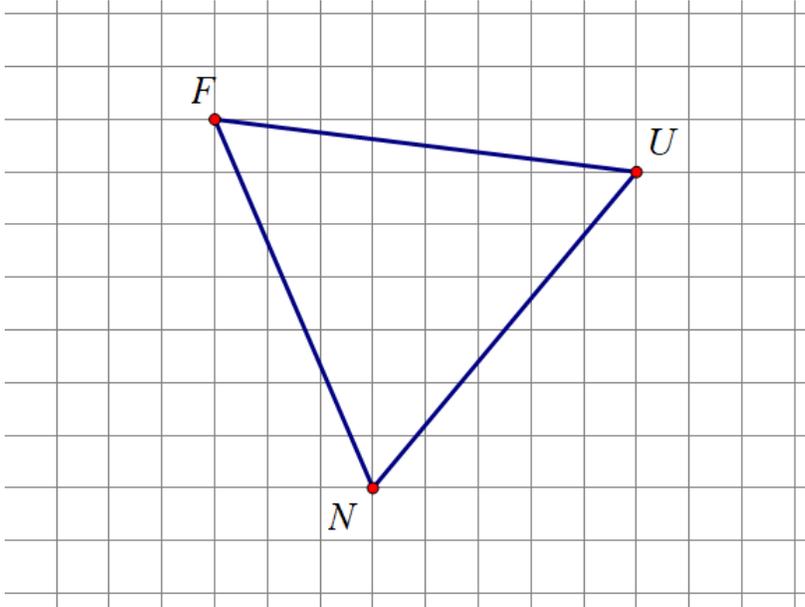36. Which of the following is a simplification of $\frac{2\sqrt{5}}{4+\sqrt{8}}$?

   (a) $\left(1 - \frac{\sqrt{2}}{2}\right)\sqrt{5}$

   (b) $(1 - \sqrt{2})\sqrt{5}$

   (c) $\sqrt{10} - 2\sqrt{5}$

   (d) $2\sqrt{5} - \sqrt{10}$

   (e) $\sqrt{10}/4$

   (f) None of the above

37. Points $B(-2,1)$ and D represent the diameter of a circle with center (h, k) and radius r. Find $h + k + r$.

   Answer: _____

38. A triangle is shown below with vertices F, U, and $N(-2, -3)$.
Find the area of the triangle.

Answer: _____

39. The sum of two real numbers is 4, and the sum of their squares is 20. Find the product of the two numbers.

Answer: _____

40. Consider the sequence defined by $a_1 = 1$ and $a_{n+1} = 3a_n + 2$. What is a_5?

Answer: _____