

- A) The largest integer value of x that does **NOT** satisfy the inequality $3x - 7 + 8x > 4x + 1 + 3x$.
- B) How many values of x satisfy $(2x)^2 \geq 5x^2$?
- C) What is the largest value of x that makes the statement $-x^2 - 2x - 1 \geq 0$ true?
- D) How many integers solve the inequality $\sqrt{48} < x < \sqrt{2401}$?

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Let $f(x) = \frac{3x}{x-1}$ and let $g(x) = \frac{1-2x}{2x}$. Compute each of the following.

- A) $f(g(2)) - 1$
- B) $g(f(2)) + 1$
- C) c such that $g(c) = 1$.
- D) The maximum value of $g(x)$ on the interval $1 \leq x < 10$.

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For this question, factor to solve each quadratic equation. The answer to each part is the larger of the two roots.

A) $2x^2 + 3x + 1 = 0$

B) $x^2 + x - 12 = 0$

C) $8x^2 - 14x + 3 = 0$

D) $9x^2 - 12x + 4 = 0$

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Solve for x in each equation below:

A) $2^{2x+3} = 8^{1-x}$

B) $27^{2x} = 81^{x-2}$

C) $49^{1/x} = 343^{1+2x}$

D) $2^{x+2} + 3^{2x-2} = 5^2$

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Solve for x in each equation below:

A) $|x - 2| = |2x - 1|$

B) $||x - 2| - 1| = 1$

C) $|x^2 - 7x + 10| = 1$

D) $\left|\frac{x-1}{x}\right| = 4$

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For all four parts of this question, a can is 12 ounces, a bottle is 16 ounces, and a gallon is 128 ounces.

- A) How many cans of soda does Chance need to open in order to fill 13 half-gallon containers? NOTE: There may be some soda left in one of the cans when she is finished filling the containers!
- B) A mixture of cans and bottles totals to 5 gallons. If there are a total of 50 cans and bottles together, how many bottles are there?
- C) A fish tank can hold 540 ounces of water. Using only these three sized containers, what is the smallest total number of containers we can use to fill the fish tank?
- D) (The number of bottles in 4 gallons) – (the number of cans in three gallons) = ?

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- A) The sum of the digits of a certain number is 15. What positive integer (less than 10) can we say with absolutely certainty cannot divide this number?
- B) The largest prime divisor of 9240 is p and the smallest is q . Find $q - p$.
- C) How many positive integers, $x \leq 52$, have the property such that $\text{gcf}(52, x) = 1$? This is also known as being “relatively prime” to 52. NOTE: gcf means greatest common factor.
- D) Square the first 8 prime numbers then add them together. What is the sum?

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Solve each system of equations and give each answer as the sum of $x + y$.

A) $2x + 3y = 10$
 $x - 8y = -14$

B) $9x - 4y = 40$
 $3x + 3y = 9$

C) $3x + 4y = 24$
 $6xy = 72$

D) $x - 8y = 31$
 $2x + 5y = -17$

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- A) How many integers, x , satisfy the inequality $\sqrt{13} < 2x < \sqrt{122}$?
- B) What is the largest number the expression $2 - 3x^2$ can attain?
- C) What is the sum of the solutions to $\frac{2x}{x-1} + 3 = 2x$?
- D) Solve for x in the following equation $\frac{x-2}{2x-2} = 3$.

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Evaluate each expression, leaving in simplest radical form.

A) $\sqrt{15} \times \sqrt{21} \times \sqrt{35}$

B) $\sqrt{11 + \sqrt{841}}$

C) $\sqrt{16 + \sqrt[3]{729}}$

D) Solve for x : $2^5 + 2^5 = 2^x$.

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The first two given numbers are the rate at which person X and person Y can do a task. Give the total time that it takes (with units) to complete the specified task TOGETHER. NOTE: Your answers must include the units to receive credit since some parts require unit conversions!

- A) X paints 1 room in 4 hours; Y paints 2 rooms in 5 hours; How long to paint 13 rooms in hours?
- B) X fills 1 bucket in 2.5 minutes; Y empties 2 buckets in 10 minutes; How long to fill 9 buckets in minutes?
- C) X stamps 5 envelopes in 7 seconds; Y stamps 15 envelopes in one minute; How long to stamp 135 envelopes in seconds?
- D) X finishes 2 MAO problems in 4 minutes; Y finished 3 problems in 4 minutes; How long to complete 30 questions in minutes?

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Find the shortest distance between roots of the following quadratic equations:

A) $x^2 - 5x - 14 = 0$

B) $x^3 + 3x^2 - x - 3 = 0$ Pair up the roots, then find the shortest of the distances between the pairs of roots.

C) $8x^2 - 10x + 3 = 0$

D) $4x^2 - 4x + 1 = 0$

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- A) What is the sum of the solutions of $2x^2 - 14x - 12 = 0$?
- B) How many solutions are there for the equation $x^3 + 3x^2 - x - 3 = 0$?
- C) If $f(x) = x^2 - 7x + 12$, find the sum of the roots of $2f(x)$.
- D) The vertex of a parabola that opens down has x -coordinate $x = \frac{9}{2}$. What is the sum of the roots of this parabola?

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Given: $f(x) = \frac{2}{x-3}$, $g(x) = \sqrt{1+x^2}$, $h(x) = \frac{-x+\sqrt{x^2-4}}{2}$

- A) Compute $\frac{1}{2}f(x+3)$ evaluated at $x = 2$.
- B) Compute $(2g(x)) + 1$ evaluated at $x = 2$.
- C) Compute $h(3)$.
- D) Compute $f(g(x))$ evaluated at $x = \sqrt{3}$.

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