

Individual Round — Arithmetic

- (1) What is the value of the following fraction?

$$\frac{1/5 - 1/4}{1/3 - 1/2}$$

- (2) The average of 25 numbers is what percent of the sum of the numbers?
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- (3) Find the smallest positive integer, n , such that $n \cdot 2009$ is a perfect cube.
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- (4) How many whole numbers, strictly between 1 and 2009, are divisible by 2 but not by 7?
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Individual Round — Algebra

- (1) Solve the linear equation $3x - 5 = 7$.
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- (2) Solve for x in

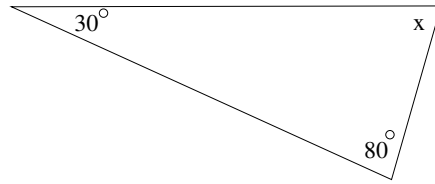
$$2^{21} + 2^{21} = 4^{3x+2}.$$

- (3) If the graphs of the equations $3x - 5y + 2 = 0$ and $2x + Ay - 11 = 0$ are perpendicular, find the value of A .
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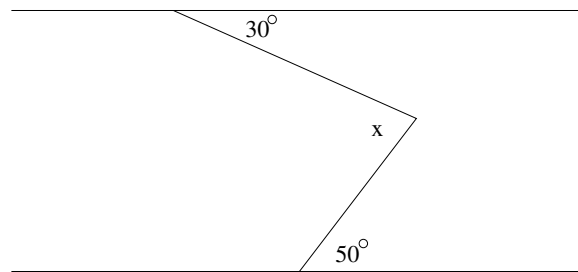
- (4) Find all possible solutions of $|x^2 - 12x + 31| = 4$.
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Individual Round — Geometry

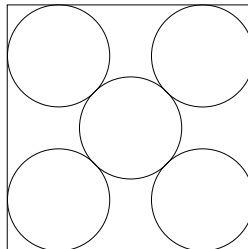
- (1) What is the value of angle x in the following triangle?



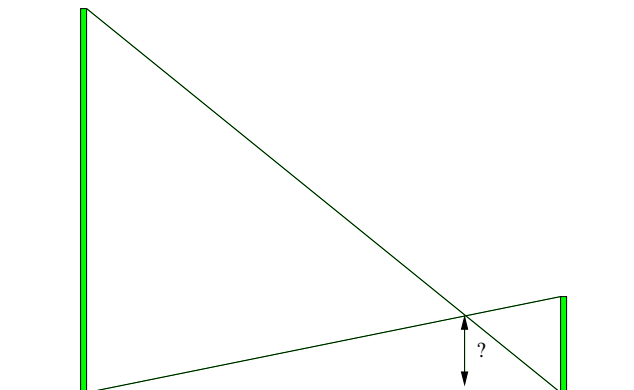
- (2) Find the value of angle x in the following figure. (The top and bottom lines are parallel.)



- (3) Five circles of diameter 2 are enclosed in a square as shown below. What is the side length of the square?



- (4) Two towers are 80 feet and 20 feet high respectively. Their bases are 100 feet apart and there are guy wires attached from the top of each tower to the base of the other. How high off the ground is the point where the wires cross?



Team Round — CAPT

An individual's Body Mass Index (BMI) is calculated using their height h (in meters) and their weight w (in kilograms) using the formula

$$BMI = \frac{w}{h^2}.$$

The World Health Organization has issued the following guidelines for health risk associated with various BMI values.

BMI, x	Health Risk
$19 \leq x < 24$	Minimal
$24 \leq x < 27$	Low
$27 \leq x < 30$	Moderate
$30 \leq x < 35$	High
$35 \leq x < 40$	Very High
$40 \leq x$	Extremely High

To answer the following questions you may also need the conversion factors

$$1 \text{ kilogram} = 2.2 \text{ pounds}$$

and

$$1 \text{ meter} = 39.4 \text{ inches}.$$

- (1) John is 6 feet 2 inches tall and weighs 240 pounds. What is his BMI?

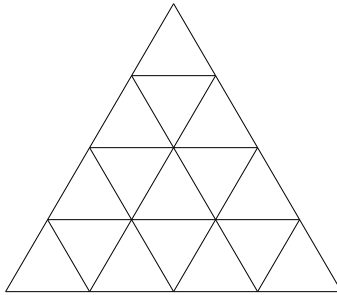
- (2) Sasha is 5 feet 6 inches tall and weighs 130 pounds. What is her BMI?
What is her health risk?

- (3) Determine a formula for BMI in terms of English units (pounds and inches).

- (4) What is the least amount of weight (in pounds) that John would need to lose in order to get into the "Low" health risk category?

Team Round — General

- (1) How many triangles are in the following figure?



- (2) A chemist wants to make 200 ml. of 40% potassium hydroxide solution. She has adequate supplies of 10% and of 50% solutions in her lab. How much of each should she mix to create the desired solution?

- (3) How many zeros are there at the end of $8^{26} \cdot 5^{79}$?

- (4) A right triangle with sides 5, 12 and 13 is positioned with its hypotenuse horizontal on top of a square that is 13 by 13. A vertical line is drawn downward from the 90° vertex of the triangle. This line divides the square into two rectangles. Find the area of the shaded rectangle in the diagram below.

