



Grade 6 Math Circles
Fall 2018 - December 4/5
Jeopardy

Vectors

\$100 What is a scalar? What is a vector? What is the difference between them?

\$200 If $\vec{A} = 3 \text{ km [West]}$, what is $-2\vec{A}$?

\$300 Alice goes to the supermarket 5 km North of her house and back. Assuming she took a straight path, what is the distance she travelled? What is her displacement?

\$400 Sam wants to row across a river. She can row at 3 km/h. The river has a current of 5 km/h [N]. She wants to end up directly East across the river from where she started. What information are we given (in terms of speed, velocity, and direction) for this vector addition?

\$500 Carl is out cycling. He first goes 3 km [NE] and then cycles 10 km [NW]. Finally, he goes 4 km [SW]. Determine his final displacement.

Matrices

\$100 What is A^T ?

$$A = \begin{bmatrix} 13 & 2 & 1 \\ 5 & 3 & 4 \end{bmatrix}$$

\$200 What is the matrix that results from this addition?

$$\begin{bmatrix} 4 & -2 \\ 24 & 0 \\ 7 & 30 \end{bmatrix} + \begin{bmatrix} 9 & 11 \\ 5 & 16 \\ 8 & -4 \end{bmatrix}$$

\$300 Evaluate the following.

$$3 \begin{bmatrix} 2 & 4 & 1 \\ 12 & 0 & 5 \\ 20 & 3 & 4 \end{bmatrix} - \begin{bmatrix} 3 & 6 & 1 \\ 17 & 4 & 8 \\ 53 & 5 & 10 \end{bmatrix}$$

\$400 Given the following vectors, find the area of the parallelogram formed by them.

$$\vec{p} = \begin{bmatrix} 12 \\ 7 \end{bmatrix} \quad \vec{q} = \begin{bmatrix} 5 \\ 4 \end{bmatrix}$$

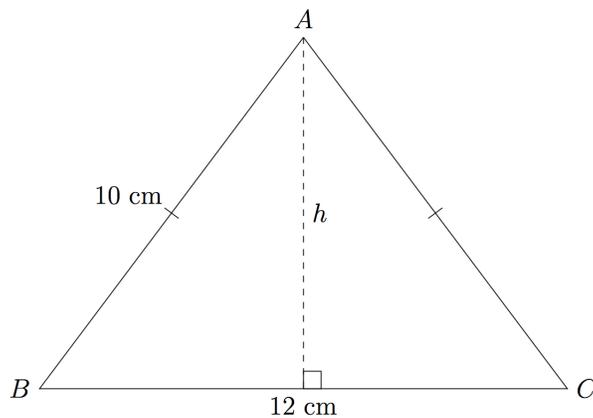
\$500 How does Google PageRank determine the importance of a webpage?

Area of Triangles

\$100 Name 3 methods that can be used to find the area of a triangle.

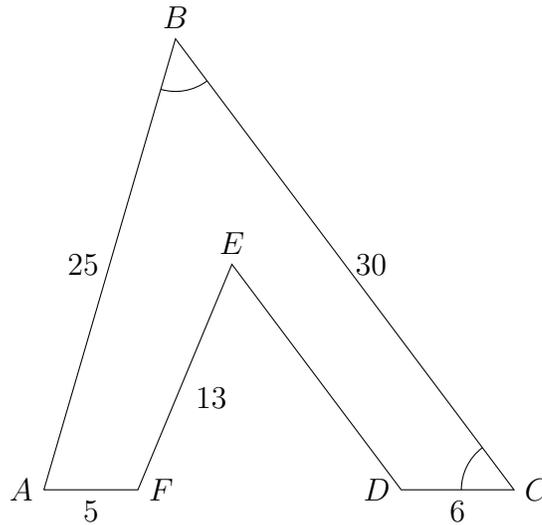
\$200 What is the area of a triangle with side lengths of 12 cm, 16 cm, and 20 cm?

\$300 What is the area of this triangle?



\$400 What type of triangle only requires one triangle be subtracted from the rectangle in the complete the rectangle method?

\$500 Given that the perimeter of $\triangle DEF$ is 42, $AB=AC$, and the area of $\triangle ABC$ is 300 units², what is the area of hexagon $ABCDEF$?



Structure of Math

\$100 What is an axiom? What is a definition? How are they similar?

\$200 How are inductive and deductive logic different? Which one does math normally use?

\$300 What does it mean for a definition to be “well-defined”?

\$400 “For all puppies, for any puppy you choose there exists a collar such that if the puppy is wearing the collar, then the puppy won’t get lost.” What kind of statement is this?

\$500 Consider this group (set) of numbers $\{1,3,6,19\}$. Prove that there exists a number in the set such that this number is not triple another number in the set.

Misc.

\$100 What is the earliest year of past Grade 6 Math Circles material on the Math Circles website?

\$200 What does University of Waterloo’s DC building stand for?

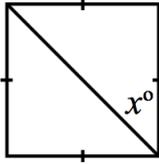
\$300 What is the name of a Grade 11 Math Contest that the CEMC creates?

\$400 How old are the Math Circles instructors?

\$500 What is the capital of Denmark?

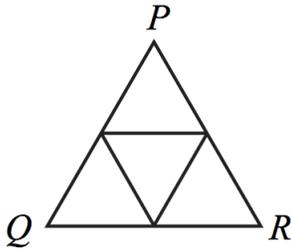
Gauss Contest

\$100 In the square shown, what is the value of x ? (*Gauss 2017 Question 6*)



- A. 0 B. 45 C. 60 D. 180 E. 360

\$200 In the diagram, $\triangle PQR$ is equilateral and is made up of 4 smaller equilateral triangles. If each of the smaller triangles has a perimeter of 9 cm, what is the perimeter of $\triangle PQR$? (*Gauss 2017 Question 10*)



- A. 15 cm B. 9 cm C. 36 cm D. 27 cm E. 18 cm

\$300 Five students ran a race. Ryan was faster than Henry and Faiz. Henry was slower than Faiz. Toma was faster than Ryan but slower than Omar. Which student finished fourth? (*Gauss 2017 Question 15*)

- A. Faiz B. Henry C. Omar D. Ryan E. Toma

\$400 If $\frac{1}{2}$ of the number represented by x is 32, what is $2x$? (*Gauss Grade 7 2000 Question 8*)

- A. 128 B. 64 C. 32 D. 256 E. 16

\$500 In the diagram all rows, columns, and diagonals sum to 12. What is the sum of the four corner numbers? (*Gauss Grade 7 2000 Question 15*)

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	3	

- A. 14 B. 15 C. 16 D. 17 E. 12

Final Jeopardy

In the diagram, $ABCD$ is a square with area 25 cm^2 . If $PQCD$ is a rhombus with area 20 cm^2 , what is the area of the shaded region in cm^2 ? (*Gauss Grade 8 2003 Question 24*)

