



# Knights of Pi Math Tournament – Dec. 4, 2010

## Probability & Potpourri 5th/6th

1	The series of letters MATHISGOOD is repeated infinitely like so: "MATHISGOODMATHISGOOD..." What is the 9998th letter in the series?																																																																																																				
2	A bug is located on the middle of a side of an equilateral triangle with side length 4 units. It crawls clockwise 1 unit per second along the edges of the triangle. How many seconds does it take the bug to reach its starting position?																																																																																																				
3	5 kids, Aaron, Brian, Cathy, David, and Ethan line up for recess. Aaron is somewhere in front of David; Aaron is also somewhere ahead of Ethan. Cathy is standing by David. Ethan is second in line. There is someone between Cathy and Brian. Who is fourth in line?																																																																																																				
4	How many squares of any size are there in a 4 by 4 grid of squares?																																																																																																				
5	Define the operator @ such that $x@y = \frac{x+y}{x-y}$ . If $3@a = 3$ , find $a$ .																																																																																																				
6	Consider the set $X = \{1, 11, 111, 1111, \dots, 111111111\}$ . What is the sum of all elements of X?																																																																																																				
7	An extremely thick coin has equal probability of coming up heads and coming up tails when flipped, but unlike a normal coin, it has a 10% chance of landing on its edge. If this coin is flipped 200 times, what is the expected number of times it flips heads?																																																																																																				
8	Two random faces of a standard die are painted red. What is the probability that these faces are next to each other? (Express your answer as a fraction.)																																																																																																				
9	Consider the prime number 37. This number is special because when its digits are reversed, the result is 73, which is also prime. How many two digit numbers exhibit this property?																																																																																																				
10	For what <b>positive</b> value of $x$ is the sum $\frac{x}{4} + \frac{9}{x}$ minimized?																																																																																																				
11																																																																																																					
12	<table style="margin-left: auto; margin-right: auto;"> <tr><td>X</td><td>N</td><td>K</td><td>C</td><td>P</td><td>M</td><td>Y</td><td>L</td><td>S</td><td>N</td></tr> <tr><td>O</td><td>F</td><td>R</td><td>B</td><td>D</td><td>K</td><td>N</td><td>M</td><td>F</td><td>N</td></tr> <tr><td>U</td><td>F</td><td>Q</td><td>M</td><td>Q</td><td>R</td><td>F</td><td>K</td><td>P</td><td>R</td></tr> <tr><td>J</td><td>P</td><td>W</td><td>P</td><td>W</td><td>O</td><td>B</td><td>Y</td><td>W</td><td>M</td></tr> <tr><td>K</td><td>T</td><td>X</td><td>N</td><td>B</td><td>F</td><td>S</td><td>Q</td><td>I</td><td>T</td></tr> <tr><td>F</td><td>V</td><td>R</td><td>A</td><td>Q</td><td>K</td><td>V</td><td>G</td><td>E</td><td>K</td></tr> <tr><td>A</td><td>Z</td><td>F</td><td>Q</td><td>X</td><td>A</td><td>P</td><td>H</td><td>V</td><td>K</td></tr> <tr><td>F</td><td>L</td><td>J</td><td>W</td><td>W</td><td>R</td><td>L</td><td>N</td><td>G</td><td>P</td></tr> <tr><td>N</td><td>O</td><td>I</td><td>T</td><td>C</td><td>A</td><td>R</td><td>F</td><td>T</td><td>T</td></tr> <tr><td>K</td><td>Z</td><td>L</td><td>G</td><td>K</td><td>A</td><td>N</td><td>P</td><td>B</td><td>Y</td></tr> </table> <p style="text-align: center;">Find the mathematical word.</p>	X	N	K	C	P	M	Y	L	S	N	O	F	R	B	D	K	N	M	F	N	U	F	Q	M	Q	R	F	K	P	R	J	P	W	P	W	O	B	Y	W	M	K	T	X	N	B	F	S	Q	I	T	F	V	R	A	Q	K	V	G	E	K	A	Z	F	Q	X	A	P	H	V	K	F	L	J	W	W	R	L	N	G	P	N	O	I	T	C	A	R	F	T	T	K	Z	L	G	K	A	N	P	B	Y
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 84080480480489531119382853393184804069604860855935164086028604820860728068205

The answer to this problem is extremely odd.

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The following is what is known as a KenKen puzzle. It is in its solved state:

<sup>1-</sup> 3	4	<sup>5+</sup> 1	<sup>6×</sup> 2
<sup>2+</sup> 2	<sup>2-</sup> 1	4	3
4	3	<sup>1-</sup> 2	<sup>5+</sup> 1
<sup>3+</sup> 1	2	3	4

The rules are as follows:

1. Each row and each column must contain the numbers 1 through 4 without repeating.
2. The numbers within the heavily outlined boxes, called cages, must total the target number in the top left of the cage, using the math operation given. For example "2 −" means the numbers in the cage total 2 through subtraction (3 and 1 or 4 and 2, in any order).
3. Freebies: In single-box cages, fill in the number in the top-left corner of that cage. A good way to start is to fill in these boxes first.

Solve the following KenKen and write the numbers on the top row, from left to right, on your answer sheet.

<sup>6+</sup>	<sup>8×</sup>		<sup>8+</sup>
<sup>24×</sup>	<sup>3-</sup>		<sup>1-</sup>
		1	

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Aardvarks.  
 They are widely considered to be endangered.  
 Humans have hunted and annihilated many.  
 Some think that they are extinct!  
 This is an exaggeration.  
 Please be considerate.  
 We can't allow this species to go.  
 Protect the environment.  
 Only we can steer the future of our planet.

The answer is related too math.