



## Grade 6 Math Circles

April 4/5, 2017

### *Math Jeopardy*

#### Exponents and Primes

- \$100** What is  $8^7$ ?
- \$200** What is the 11th prime number?
- \$300** Find all the prime factors of 36.
- \$400** What is the prime factorization of 396?
- \$500** A palindromic prime is a prime number that is read the same forwards and backwards. What is the smallest 3-digit palindromic prime?

#### Sorting

- \$100** Sort these alphabetically: Regulus, Scorpius, Remus, Kingsley, Sirius
- \$200** What sorting algorithm uses the “divide and conquer” strategy?
- \$300** How many steps does it take to sort 6, 4, 1, 7 using Insertion sort?
- \$400** Draw a tree diagram to sort 83, 42, 21, 69
- \$500** How many times do you need to go through every pair in the list 3, 9, 4, 2, 0 when sorting it with Bubble sort?

## Patterns

**\$100** What are the next 3 terms in this pattern: 3, 15, 27, 39, 51, ...

**\$200** What are the next 3 terms in this pattern: 4, 16, 64, 256, 1024, ...

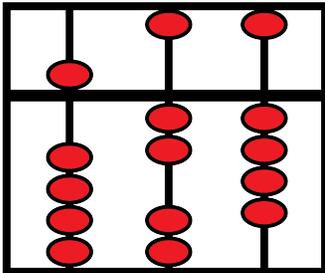
**\$300** What is the sum of the whole numbers from 1 to 572?

**\$400** What is the 16th term of the Fibonacci sequence?

**\$500** What is the next term in this pattern: 8, 22, 64, 190, 568, ...

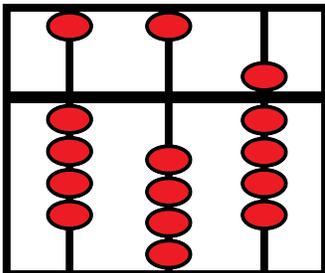
## Abacus

**\$100** What is this number?

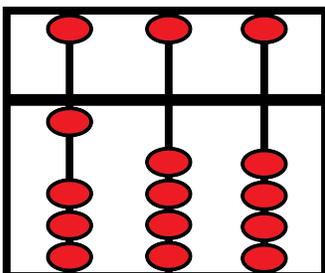


**\$200** How do you show 728 on the abacus?

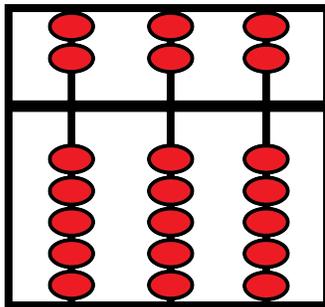
**\$300** What will this abacus look like after you add 102?



**\$400** What will this abacus look like after you subtract 32?



**\$500** Using the Chinese abacus, (with 2 beads in the upper deck, 5 beads in the lower deck), show 15 in 3 different ways.



## Counting

**\$100** How many ways can you make a PBJ sandwich with these ingredients? You need to use 1 type of bread, 1 type of jam, and 1 type of peanut butter.

- **Bread:** White, whole wheat, 9 grain
- **Jam:** Grape, strawberry, raspberry, apricot, blackberry
- **Peanut butter:** Crunchy, smooth

**\$200** A 5-character password contains first 3 digits and then 2 letters. How many different passwords are possible if repeats are allowed?

**\$300** How many ways can you shuffle 9 cards?

**\$400** How many ways are there to choose 2 flavours of frozen yogurt to combine if there are 101 flavours total to choose from?

**\$500** The top 3 contestants in the math contest will win gold, silver, and bronze medals. How many ways can the medals be given out if there are 64 contestants?

## Clock Arithmetic

**\$100** Write 3 pm mathematically (in mod 12).

**\$200** If it is 85 hours after midnight, what time is it?

**\$300** What is  $4 + 7 \pmod{9}$ ?

**\$400** What is  $3 \times (5 + 9) \pmod{20}$ ?

**\$500** Hermione has knit 592 scarves, Ron has knit 15, and Harry has knit 43. They plan to send packs of 27 scarves. How many scarves will be left over?

## Magic and Latin Squares

**\$200** What is  $x$  in this magic square?

6		8
	5	$x$
		4

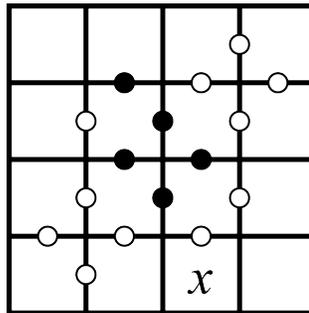
**\$400** Find  $x$  in this calcudoku puzzle.

$2\div$ 4	2	$2\div$	$7+$
$6\times$	$4\div$		
		$3\div$	
	$24\times$		$x$

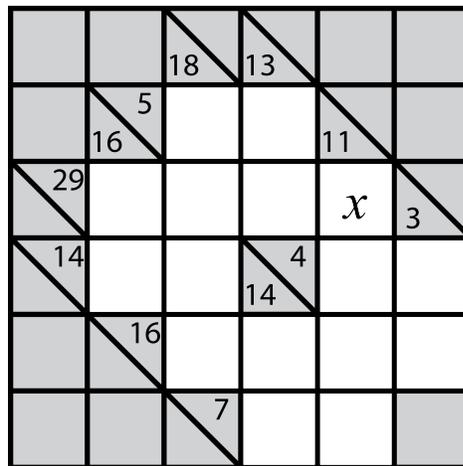
**\$600** Find  $x$  in this futoshiki puzzle.

<input type="text"/>	>	<input type="text"/>	<input type="text"/>	<input type="text"/>
		∨		
<input type="text"/>	$x$	<input type="text"/>	<	<input type="text"/>
		∨		
<input type="text"/>				
		∨		
<input type="text"/>				

**\$800** Find  $x$  in this kropki puzzle.



**\$1000** Find  $x$  in this kakuro puzzle.



$$x = 5$$

## Probability

**\$200** What is the probability of picking a face card (jack, queen, or king) from a deck of cards?

**\$400** What is the probability of flipping a coin 4 times and getting heads every time?

**\$600** 2 white erasers and 3 pink erasers are in a pencil case. What is the probability that a pink eraser is picked out first, then a white eraser, then another pink eraser? (If you do not put erasers back in the pencil case in between picks.)

**\$800** What is the probability of picking a clubs card OR an even numbered card (face cards no not count)?

**\$1000** This Markov Chain shows the probability of which city a traveling circus will perform at next week. The circus only visits Hamilton, Kingston, and Waterloo.

$$\begin{matrix} & H & K & W \\ H & \left( \begin{matrix} 0 & \frac{3}{4} & \frac{1}{4} \end{matrix} \right) \\ K & \left( \begin{matrix} \frac{5}{7} & 0 & \frac{2}{7} \end{matrix} \right) \\ W & \left( \begin{matrix} \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \end{matrix} \right) \end{matrix}$$

What is the probability that, starting in Hamilton, the circus will go to Kingston for 1 week, then Waterloo for 2 weeks.

## Game Theory

**\$200** Find the Nash Equilibrium(s) based on the following payoff table:

		Player 2	
		A	B
Player 1	A	0, 0	3, 1
	B	3, 2	4, 5

**\$400** Find the Nash Equilibrium(s) based on the following payoff table:

		Player 2	
		A	B
Player 1	A	21, 9	7, 6
	B	14, 10	11, 13

**\$600** Find the Nash Equilibrium(s) based on the following payoff table:

		Player 2	
		A	B
Player 1	A	2, 8	7, 7
	B	3, 2	10, 0

**\$800** Find the Nash Equilibrium(s) based on the following payoff table:

		Player 2			
		A	B	C	D
Player 1	A	1, 3	4, 2	1, 4	2, 2
	B	0, 2	3, 2	0, 2	3, 1
	C	2, 2	2, 4	1, 5	4, 3
	D	3, 0	4, 2	3, 3	4, 1

**\$1000** Counting from 36 game follows these rules:

- Player A starts at 36.
- Each turn, a player can count down 1, 2, or 3 numbers.
- The player who says 0 wins.

What should Player A do to guarantee a win?

## Pascal's Triangle

**\$200** What is the 6th row of Pascal's Triangle?

**\$400** What is the 8th triangular number?

**\$600** What is  $1 + 5 + 10 + 5 + 1$  expressed as a power of 2?

I.e. What is  $n$  for  $2^n = 1 + 5 + 10 + 10 + 5 + 1$ .

**\$800** According to the hockey stick pattern, what are the 5 numbers that add to 35?

**\$1000** This is a section from Pascal's triangle. Find  $x$ .

3003	2002	_____	364
5005	3003	_____	
_____	$x$	_____	

# Number Systems and Bases

**\$200** What is this Egyptian number?



**\$400** What is this number:  $(3)(10^6) + (9)(10^5) + (2)(10^3) + (7)(10^2) + (4)(10^0)$ ?

**\$600** What is 3119 in binary (base 2)?

**\$800** What is this hexadecimal (base 16) number in decimal (base 10):  $B8FE$ ?

**\$1000** Convert this hexadecimal (base 16) number to base 11:  $D3C$ ?

## Random

**\$200** What is  $(1 + 2)^2 - (1^2 + 2^2)$ ?

- (a) 14                      (b) 4                      (c) 2                      (d) 12

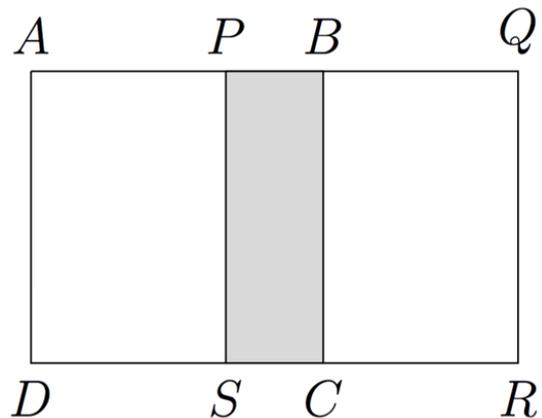
**\$400** If  $x = -4$  and  $y = 4$ , then which is the largest?

- (a)  $\frac{x}{y}$                       (b)  $y - 1$                       (c)  $-xy$                       (d)  $x + y$

**\$600** If  $2^a = 8$  and  $a = 3c$ , then  $c$  is:

- (a) 6                      (b)  $\frac{3}{4}$                       (c) 1                      (d)  $\frac{4}{3}$

**\$800** 2 identical squares,  $ABCD$  and  $PQRS$ , have side lengths 12. They overlap to form the 12 by 20 rectangle  $AQRD$  shown below. What is the area of the shaded rectangle  $PBCS$ ?



- (a) 24  
(b) 72  
(c) 96  
(d) 48

**\$1000** Andrea has finished the 3rd day of a 6 day canoe trip. If she has completed  $\frac{3}{7}$  of the trip's total distance of 168 km. How many km per day must she average for the remainder of the trip?

(a) 29 km

(b) 32 km

(c) 24 km

(d) 26 km

## Final Jeopardy

12 points are marked on a rectangular grid. How many squares can be made by connecting these points?

