UNIVERSITY OF WATERLOO

Faculty of Mathematics
Waterloo, Ontario N2L 3G1

Centre for Education in
Mathematics and Computing

# Grade 6, Math Circles

3/4 April, 2018

***Jeopardy***

## Introduction

Today I will be testing your knowledge of the topics that we have covered over the past few months in Math Circles. We will be playing a game of Jeopardy which will have questions varying in difficulty that cover each of the topics that were taught in class. The game is broken into 6 categories with five questions each ranging from easiest ($100) to hardest ($500).

## Number Theory

**$100** Find the prime factorization of 30.

**$200** Use 78 to find a palindromic number.

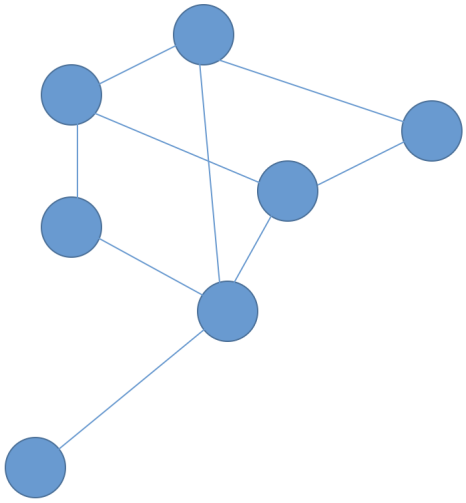
**$300** Find a Pythagorean triple starting with 11.

**$400** Find a Pythagorean triple starting with 14.

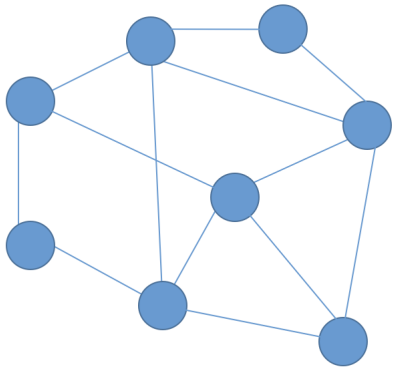
**$500** What is the largest prime factor of the sum of all prime numbers between 20 and 40?

# Graph Theory

**$100** Is the following graph bipartite?

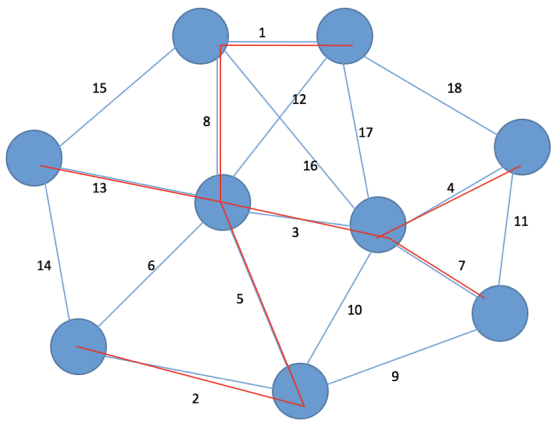


**$200** What is the colouring of the following graph?



**$300** If a graph has 5 vertices and 10 edges, can it be planar?

**$400** Find the weight of the minimum spanning tree from the following graph:




**$500** A graph has 15 edges. What is the sum of the number of edges incident to all vertices in this graph?

# Types of Numbers

**$100** Which sets of numbers does $\pi$ belong to?

**$200** What is $\sqrt{-49}$ in terms of $i$?

**$300** What complex number is represented by the following line?

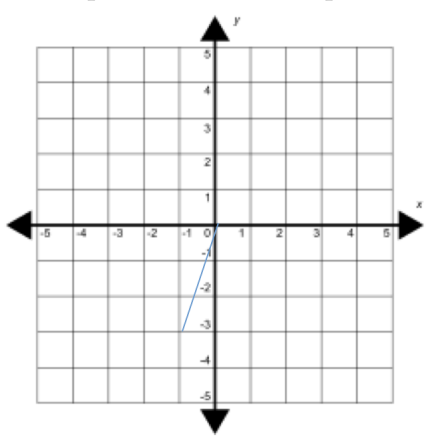



Image: printablepaper.net

**$400** Evaluate (4 - 4$i$) - (-4 + 4$i$).

**$500** Evaluate (-4 + 2$i$) $\times$ (7 - 3$i$).

# Math of Voting

**$100** Who wins the following election using the plurality method and with how many votes?

| Number of voters | 17 | 3 | 14 | 5 | 11 | 12 |
|---|---|---|---|---|---|---|
| 1st | Ronaldo | Ronaldo | Neymar | Neymar | Messi | Messi |
| 2nd | Neymar | Messi | Ronaldo | Messi | Ronaldo | Neymar |
| 3rd | Messi | Neymar | Messi | Ronaldo | Neymar | Ronaldo |

**$200** Who wins the following election using the borda count method and with how many points?

| Number of voters | 3 | 1 | 2 |
|---|---|---|---|
| 1st (15 pts) | C | A | B |
| 2nd (10 pts) | A | B | C |
| 3rd (5 pts) | B | C | A |

**$300** Who wins the following election using the plurality with elimination method and with how many votes?

| Number of voters | 17 | 3 | 14 | 5 | 11 | 12 |
|---|---|---|---|---|---|---|
| 1st | Ronaldo | Ronaldo | Neymar | Neymar | Messi | Messi |
| 2nd | Neymar | Messi | Ronaldo | Messi | Ronaldo | Neymar |
| 3rd | Messi | Neymar | Messi | Ronaldo | Neymar | Ronaldo |

**$400** Who wins the following election using the pairwise comparison method and with how many points?

| Number of voters | 3 | 1 | 2 |
|---|---|---|---|
| 1st (15 pts) | C | A | B |
| 2nd (10 pts) | A | B | C |
| 3rd (5 pts) | B | C | A |

**$500** Which of the fairness criteria are violated using the plurality with elimination method?

# Algebra

**$100** Solve the following question $[(7 \times 4 - 6) + 18 \div (2 + 1)]$

**$200** Solve for $x$. $-4 + 3x - 14 = 24 \times 4 \div 2$

**$300** Simplify the following: $x - y + 2z + 14 \div 2 + ([17 - 3 + 6] \div 2)^3 + 16y = -\frac{12}{2}(4)x + 4z + \frac{6^2}{4}$

**$400** The capacity of the gas tank in Kathy's car is 48 litres. When the tank is one-third full, how many litres of gas must be added to make the tank three-quarters full?

**$500** At Barker High School, a total of 36 students are on either the baseball team, the hockey team, or both. If there are 25 students on the baseball team and 19 students on the hockey team, how many students play both sports? (Fermat, 2015)

## Circuits

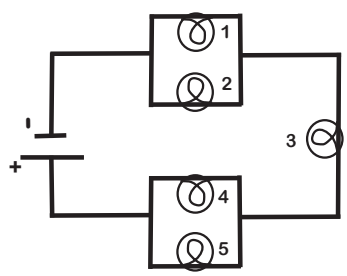
**$100** In a string of lights, if one burns out and the rest stay on, what type of circuit are the lights connected in?

**$200** If you have several lights connected in a series circuit and you add one more light to the circuit, what will happen to the overall brightness of the lights?

**$300** In a parallel circuit there is a 20 volt battery with 2 light bulbs that each have 5 amps of current running through them. What is the total resistance in the circuit?

**$400** A series circuit with two light bulbs has a total current of 4 amps. If light one has 12 volts and light two has a resistance of 9 ohms, what is the total voltage in the circuit?

**$500** Fill out the missing information from the table below:




| | | | | | |
|---|---|---|---|---|---|
| $V_{total} =$ | $V_1 = 6$V | $V_2 = 6$V | $V_3 = 15$V | $V_4 = 3$V | $V_5 = 3$V |
| $I_{total} = 15$A | $I_1 = 7$A | $I_2 =$ | $I_3 =$ | $I_4 = 8$A | $I_5 =$ |
| $R_{total} =$ | $R_1 =$ | $R_2 =$ | $R_3 =$ | $R_4 =$ | $R_5 =$ |

## Final Jeopardy

Successfully preform a mathematical card trick learned in class.