MathCamp 2017

The University of Manitoba is offering its sixteenth summer camp for mathematically interested and talented grade nine and ten students. The purpose of the camp is to enable students to pursue knowledge in a subject they enjoy, in an environment that encourages and fosters such pursuits. Selected participants will gain knowledge and skills, emphasizing problem solving. The camp will afford participants a chance to meet and make friends with fellow MathCamp students, students who enjoy and value the pursuit of higher learning.

Who can apply?

Students who enjoy and are good at mathematics and who will have completed the equivalent of S1 or S2 mathematics in Manitoba by June 30, 2017.

Time, Location, and Cost

The camp will be held at The University of Manitoba from **Sunday, July 23** to **Wednesday, July 26**. Students will stay in St. John's Residence. Participants must make their own travel arrangements to and from the university. The program will commence at **10 AM** on Sunday and terminate at **5 PM** on Wednesday. The cost to students is $150.00 per student.

Program

A typical day in the life of a Mathcamper is:
Breakfast
Lecture (approximately one hour)
Problem solving
Lunch
Lecture (approximately one hour)
Problem solving
Sports and/or Games
Dinner
Mathematical diversions
Lights out

The program is delivered by mathematics professors from The University of Manitoba with assistance from highly skillful mathematicians.

If you are interested, please complete an application. An application consists of
(1) the application form (see below),
(2) a letter of recommendation,
(3) solutions or partial solutions to the quiz (see below).

Your application must be postmarked by June 15, 2017.

Letter of Recommendation

Your application is not complete unless accompanied by a letter of recommendation from a teacher. The letter should include a phone number or email address so that we can contact your teacher if we have any questions. The letter should comment on your creativity, initiative, maturity, ability to work with others, as well as your interest in mathematics and problem solving. We are looking for students who are enthusiastic problem solvers, and who will make a positive contribution to the camp.

MATHCAMP2017 APPLICATION FORM

Name: _____

Address: _____

Telephone: ( )– _____

Email: _____

Name of School: _____

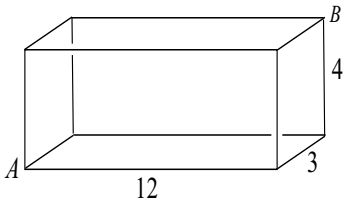
Present grade in school: S1 _____ S2 _____

University of Manitoba MathCamp Quiz

You should attempt as many questions on the quiz as you can. You are not expected to solve every problem. What is important is evidence of your reasoning. Justify your solutions. If you get stuck in a problem, give a partial solution. Be patient; there is no time limit.

1. Solve each of the following equations for x:
(a) $3^{x+4} = 9^x$ (b) $8^{x^2-2} = 4^{2-x}$

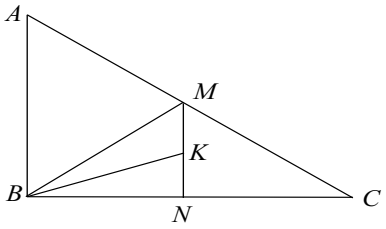
2. The lengths of the sides of a rectangular solid are indicated in the figure to the right. Find the length of the diagonal AB.



3. Prove that $n^3 + 3n^2 + 2n$, where n is a positive integer, is always divisible by 6.

4. Pipe A can fill a swimming pool in 20 hours. Pipe B can fill the pool in 25 hours. Drain pipe C can empty the pool in 30 hours. How long would it take to fill an empty pool if both pipes A and B are operating and the drain is open at the same time?

5. Triangle ABC in the figure to the right has a right angle at B with side $AC = 5$ m and side $BC = 4$ m. BM is a median of triangle ABC. MN is a median of triangle MBC. BK is a medain of triangle BMN. Find the area of triangle BKM.



6. In a game, there are three piles of stones. The first pile has 22 stones, the second has 14 stones, and the third has 12 stones. At each turn, you may double the number of stones in any pile by transferring stones to it from one other pile. The game ends when all three piles have the same number of stones. Find the minimum number of turns to end the game.

7. Determine whether it is possible to find positive integers m and n so that $m(m+1) = n(n+2)$.

8. Is it possible to place 26 points inside a rectangle that is 20 cm by 15 cm so that the distance between every pair of points is greater than 5 cm?

9. Your task is to house 100 pigeons in cages so that each cage contains at least one pigeon and no cage contains the same number of pigeons. Find the maximum number of cages that you can use.

10. Find all pairs of integers x and y that satisfy the equation $x^2 - y^2 = 99$.