UNIVERSITY OF WATERLOO

Faculty of Mathematics
Waterloo, Ontario N2L 3G1

Centre for Education in
Mathematics and Computing

Grade 7/8 Math Circles

April 4 & 5, 2017

Gauss Contest Preparation

General Information

The Gauss contest is an opportunity for students from grades 7 to 8 to have fun and challenge their mathematical problem solving skills. It is one of the many math contests that the University of Waterloo offers for students worldwide!

Registration Deadline: April 21, 2017

Contest Date: May 10, 2017

How can I prepare for the contest?

Practice! Work on a bunch of problems to improve your problem-solving skills. There are many resources available for you online. The best resource for practicing for the contest is by working on past contests! You have free access to all previous contests and solutions on the CEMC website: `http://www.cemc.uwaterloo.ca/contests/past_contests.html`

Problem Solving Strategies for Success

Make a list of problem-solving strategies!

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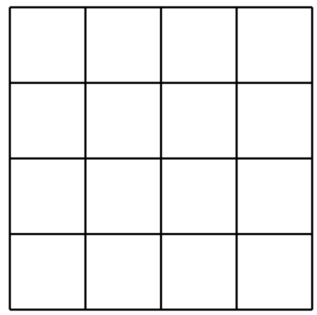
Warm Up Questions

1. **How Many Squares?**

   In the grid below, how many squares are there in total?



2. **Let's Be Friends!**

   Alyssa, Elli, Franco, Jelena, and Pauline recently joined Facebook and decide to all friend each other. How many friendships are there?

Gauss Contest Problems

1. Which of these fractions is larger than $\frac{1}{2}$?

   (a) $\dfrac{2}{5}$ (b) $\dfrac{3}{7}$ (c) $\dfrac{4}{7}$ (d) $\dfrac{3}{8}$ (e) $\dfrac{4}{9}$

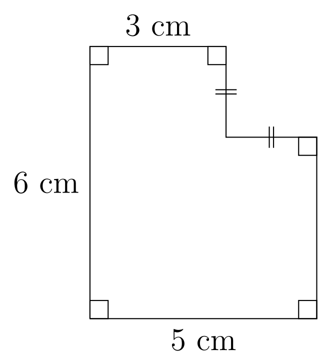
2. The number 10 101 is equal to

   (a) 1000 + 100 + 1 (b) 1000 + 10 + 1 (c) 10 000 + 10 + 1
   (d) 10 000 + 100 + 1 (e) 100 000 + 100 + 1

3. How many prime numbers are there between 10 and 30?

   (a) 4 (b) 7 (c) 6 (d) 3 (e) 5

4. The perimeter of the figure, in cm, is



   (a) 30 (b) 28 (c) 25 (d) 24 (e) 22

5. The value of $(2^3)^2 - 4^3$ is

   (a) 0 (b) -8 (c) 4 (d) 10 (e) 12

6. In the addition of three-digit numbers shown below, the letters x and y represent different digits.

$$\begin{array}{cccc} & 3 & x & y \\ + & y & x & 3 \\ \hline 1 & x & 1 & x \end{array}$$

The value of $y - x$ is

(a) 3 (b) -5 (c) 7 (d) -7 (e) 2

7. Two positive integers have a sum of 11. The greatest possible product of these two positive integers is

(a) 11 (b) 18 (c) 28 (d) 35 (e) 30

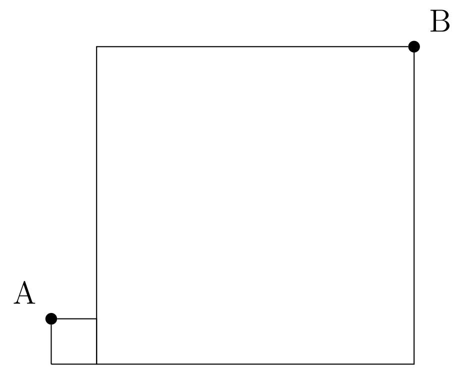
8. Abby has 23 coins. The coins have a total value of \$4.55. If she only has quarters (worth 25 cents each) and nickels (worth 5 cents each), how many quarters does she have?

(a) 15 (b) 17 (c) 18 (d) 16 (e) 21

9. Betty is making a sundae. She must randomly choose one flavour of ice cream (chocolate or vanilla or strawberry), one syrup (butterscotch or fudge) and one topping (cherry or banana or pineapple). What is the probability that she will choose a sundae with vanilla ice cream, fudge syrup and banana topping?

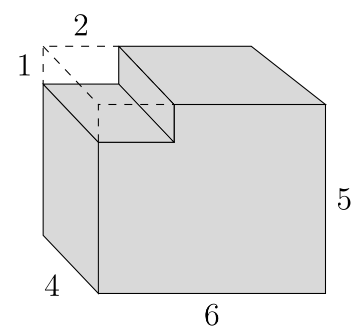
(a) $\frac{1}{18}$ (b) $\frac{1}{6}$ (c) $\frac{1}{8}$ (d) $\frac{1}{9}$ (e) $\frac{1}{12}$

10. Two squares are positioned, as shown. The smaller square has side length 1 and the larger square has side length 7. The length of AB is



(a) 14 (b) $\sqrt{113}$ (c) 10 (d) $\sqrt{85}$ (e) $\sqrt{72}$

11. In the diagram, the volume of the shaded solid is



(a) 8 (b) 112 (c) 113 (d) 120 (e) 128

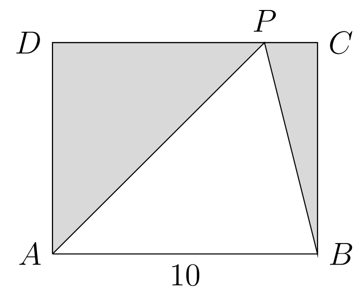
12. How many positive integers less than 400 can be created using only the digits 1, 2, or 3, with repetition of digits allowed?

(a) 30 (b) 33 (c) 36 (d) 39 (e) 42

13. A map has a scale of 1:600 000. On the map, the distance between Gausstown and Piville is 2 cm. What is the actual distance between the towns?

(a) 12 km (b) 1.2 km (c) 120 km (d) 1200 km (e) 12 000 km

14. In the diagram, $ABCD$ is a rectangle.



If the area of the triangle ABP is 40, then the area of the shaded region is

(a) 20 (b) 40 (c) 60 (d) 50 (e) 80

15. If a is an even integer and b is an odd integer, which of the following could represent an odd integer?

(a) ab (b) $a + 2b$ (c) $2a - 2b$ (d) $a + b + 1$ (e) $a - b$

16. Lorri took a 240 km trip to Waterloo. On her way there, her average speed was 120 km/h. She was stopped for speeding, so on her way home, her average speed was 80 km/h. What was her average speed, in km/h, for the entire round-trip?

(a) 90 (b) 96 (c) 108 (d) 102 (e) 110

17. Sally picks four consecutive positive integers. She divides each integer by four, and then adds the remainders together. The sum of the remainders is

(a) 6 (b) 1 (c) 2 (d) 3 (e) 4

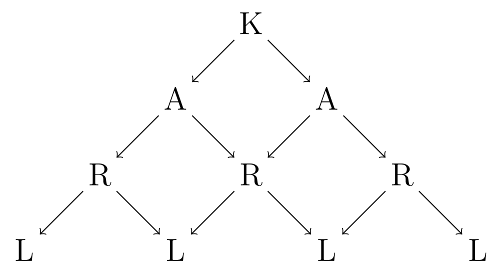
18. Lara ate $\frac{1}{4}$ of a pie and Ryan ate $\frac{3}{10}$ of the same pie. The next day Cassie ate $\frac{2}{3}$ of the pie that was left. What fraction of the original pie was not eaten?

(a) $\dfrac{9}{10}$ (b) $\dfrac{3}{10}$ (c) $\dfrac{7}{60}$ (d) $\dfrac{3}{20}$ (e) $\dfrac{1}{20}$

19. The entire contents of a jug can exactly fill 9 small glasses and 4 large glasses of juice. The entire contents of the jug could instead fill 6 small glasses and 6 large glasses. If the entire contents of the jug is used to fill only large glasses, the maximum number of large glasses that can be filled is

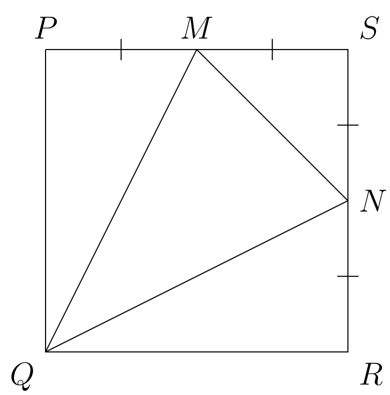
(a) 8 (b) 9 (c) 10 (d) 11 (e) 12

20. In the diagram, how many paths can be taken to spell "KARL"?



(a) 4 (b) 16 (c) 6 (d) 8 (e) 14

21. In square $PQRS$, M is the midpoint of PS and N is the midpoint of SR.



If the area of $\triangle SMN$ is 18, then the area of $\triangle QMN$ is

(a) 36 (b) 72 (c) 90 (d) 48 (e) 54

22. There are various ways to make \$207 using only \$2 coins and \$5 bills. One such way is using one \$2 coin and forty-one \$5 bills. Including this way, in how many different ways can \$207 be made using only \$2 coins and \$5 bills?

(a) 9 (b) 10 (c) 19 (d) 41 (e) 21

23. In downtown Gaussville, there are three buildings with different heights: The Euclid (E), The Newton (N), and The Galileo (G). Only one of the statements below is true.

    1. The Newton is not the shortest.
    2. The Euclid is the tallest.
    3. The Galileo is not the tallest.

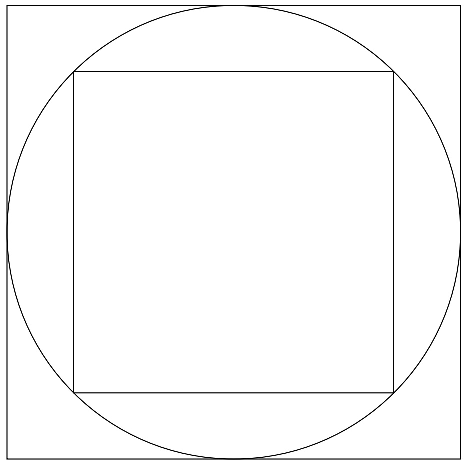
    Ordered from *shortest to tallest* in height, the buildings are

(a) N,G,E (b) G,E,N (c) E,N,G (d) N,E,G (e) E,G,N

24. Veronica has 6 marks on her report card.
The mean of the 6 marks is 74.
The mode of the 6 marks is 76.
The median of the 6 marks is 76.
The lowest mark is 50.
The highest mark is 94.
Only one mark appears twice and no other mark appears more than twice.
Assuming all of her marks are integers, the number of possibilities for her second lowest mark is

(a) 17 (b) 16 (c) 25 (d) 18 (e) 24

25. In the diagram, a circle is inscribed in a large square and a smaller square is inscribed in the circle.



If the area of the large square is 36, the area of the smaller square is

(a) 15 (b) 12 (c) 9 (d) 24 (e) 18