Concours de l'Association mathématique du Québec
Niveau collégial

Le mercredi 11 février 2026

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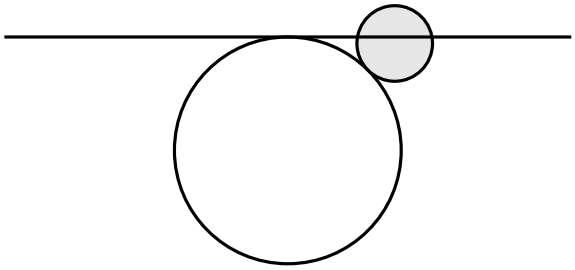
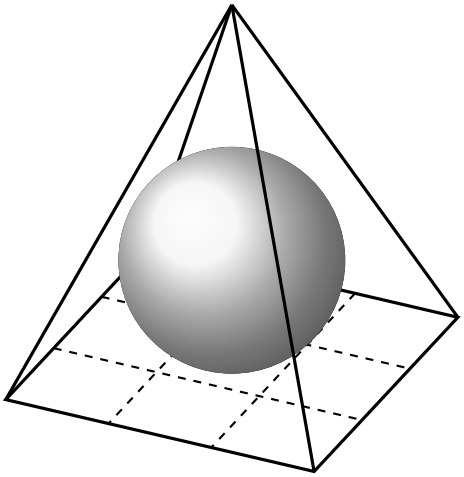
1. **The big division**
   Calculate the remainder obtained when dividing the number 999 998 997 . . . 003 002 001 by 7.

2. **Horizon**
   Consider two discs that are tangent to each other, as shown in the figure below. The radius of the white disc is three times larger than that of the grey one. If one were to draw every possible tangent line to the white disc, what proportion of them would intersect the grey disc ?



3. **Pyramidal sphere**
   Consider a right pyramid whose base is a square measuring 3 units by 3 units. A sphere of radius 1 is tangent to the five faces of the pyramid. What is the height of the pyramid ?



4. **Kenda's game**
   Kenda has a deck of cards numbered 1 to n. She chooses a card at random, puts it back into the deck and shuffles the deck. She repeats this process until n cards have been picked. Let P_n be the probability that the n chosen cards contain exactly $n-1$ different numbers. For what value of n is the probability P_n maximized ?

5. **From five to zero**
   Let f be a function defined for all integers such that for any pair of integers (m, n), we have
   $$2f(mn) + f(n-1) + 4n + 2m^2 = f(m)f(n) + f(1) + 1.$$
   Assuming that $f(0) = 1$, find the value of $f(5)$.

6. **Logo-Expo reflection**
   Let $k > 0$ be a constant. Find the value of k for which the equation
   $$e^{kx} = \ln(x^{1/k})$$
   has only one solution.