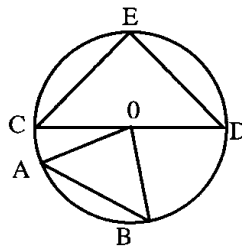


Isaac Newton (1642-1727)

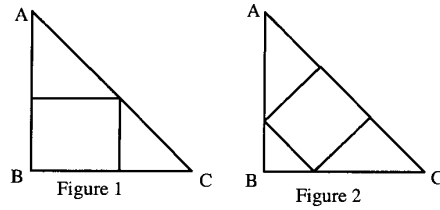
Individual Exam

2002 Newton Mathematical Society's 14th annual High School Mathematics Contest

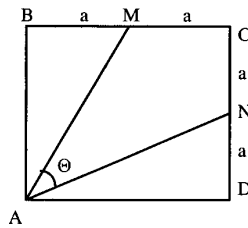
1. Let $f(x) = ax^7 + bx^3 + cx - 5$ where a, b, c are constants. If $f(-7) = 7$, then find $f(7)$.
2. If $b > 1, x > 0$ and $(2x^{\log^b 2} - (3x)^{\log^b 3}) = 0$, then solve for x .
3. Solve for $x, 2 \leq \frac{x}{x-3} \leq 3$.
4. Find the sum of all integers between 200 and 1000 that are divisible by 3.
5. Solve $\begin{cases} x + y + 3\sqrt{x+y} = 18 \\ x - y - 2\sqrt{x-y} = 15 \end{cases}$
6. In the figure, $CE = DE$ with the center O as center of circle. Arc AB is a quarter-circle. What is the ratio of triangular-area CED to area of triangle $A0B$?



7. There are two natural ways to inscribe a square in a given isosceles right triangle. If it is done in Fig. 1, one finds the area of the square is 441 cm^2 . What is the area in (cm^2) of the inscribed in the same $\triangle ABC$ as shown in figure 2?



8. If $b > 1$, $\sin x > 0$, $\cos x > 0$ and $\log_b \sin x = a$, find $\log^b \cos x$.
9. $ABCD$ is a square with sides length $2a$ and M and N are midpoints of BC and CD respectively. Find $\sin 2\theta$.



10. From a group of boys and girls, 15 girls leave. There are then left two boys for each girl. After this, 45 boys leave. Then, there are 5 girls for each boy. Find the number of boys and girls in the group at the beginning.