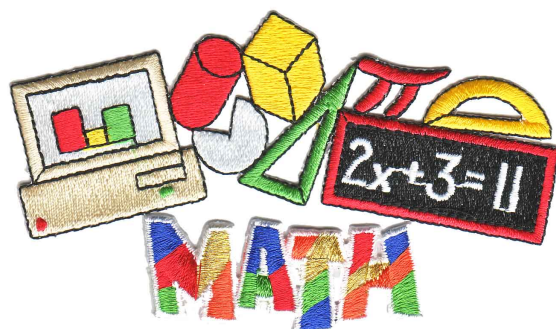


# IANH ONLINE MATH WORKSHOP

for

## NSF MATH BEE LEVEL III



### For Students in Grade 6, 7 & 8

Study materials and Monthly Problem Sets in the following topics will be made available approximately on the 15th of each month beginning from November, 2009 to March 2010.

Topic	Study Materials Available
Number Theory	November 15, 2009
Algebra (including sequences & series)	December 15, 2009
Geometry	January 15, 2010
Probability & Combinatorics	February 15, 2010
Miscellaneous (including rates & proportions)	March 15, 2010

Officially enrolled students will be able to email their solutions to the instructors and get feedback on their work.

**How to Enroll:** Please email [nheducationbee@gmail.com](mailto:nheducationbee@gmail.com) to enroll your child.

**Cost:** \$50.00 per child, payable to IANH.

Proceeds from the Workshop will be used towards the North South Foundation Education Bees in March 2010.

**A three-hour long class room style final workshop will be held during the Spring of 2010. Date and venue will be announced via email to all enrolled students.**

An excerpt from one of the study materials can be found on the next two pages.

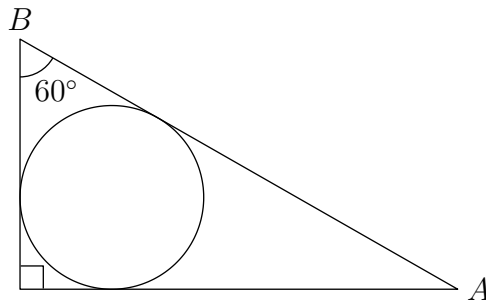
**Problem 17** A non-square rectangle has integer dimensions. The number of square units in its area is numerically equal to the number of units in its perimeter. What is the number of units in the perimeter of this rectangle?

**Problem 18** The point  $(2, 3)$  is reflected about the  $x$ -axis to a point  $P$ . Then  $P$  is reflected about the  $y$ -axis to a point  $Q$ . What is the sum of the coordinates of  $Q$ ?

**Problem 19** A regular hexagon and an equilateral triangle have equal perimeters. What is the ratio of the area of the hexagon to the area of the triangle? Express your answer as a common fraction.

**Problem 20** Sector  $OAB$  is a quarter of a circle of radius 3 cm. A circle is drawn inside this sector, tangent at three points. What is the number of centimeters in the radius of the inscribed circle? Express your answer in simplest radical form.

**Problem 21** The radius of the inscribed circle is 6 cm. What is the number of centimeters in the length of  $AB$ ? Express your answer in simplest radical form.



**Problem 22** A circular pizza with radius of 6 inches is cut along radii into three wedge-shaped slices. The measures of two of the central angles are 80 degrees and 130 degrees. What is the number of square inches in the area of the largest slice? Express your answer in terms of  $\pi$ .

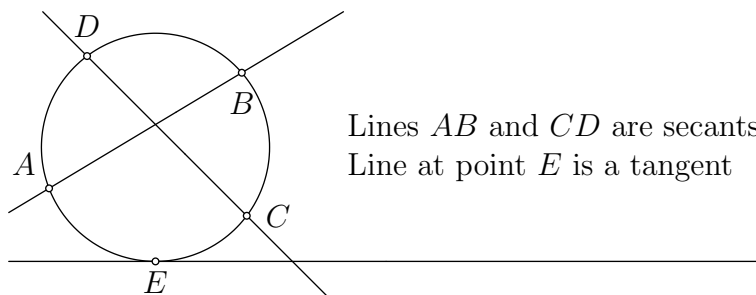
**Problem 23** What is the area of the region bounded by the three lines with equations  $2x + y = 8$ ,  $2x - 5y = 20$  and  $x + y = 10$ ?

**Problem 24** Two cubes of volumes  $8 \text{ cm}^3$  and  $27 \text{ cm}^3$  are glued together at their faces to form a solid with the smallest possible surface area. What is the number of square centimeters in the surface area of the resulting solid?

**Problem 25** A triangle has vertices at coordinates  $(2, 2)$ ,  $(5, 6)$  and  $(6, 2)$ . What is the number of units in the length of the longest side of the triangle?

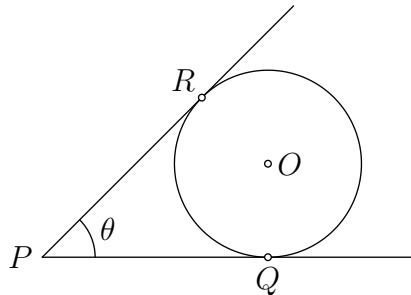
# Circle Tangents

A line meeting a circle at two distinct points is called a *secant*. If it meets the circle at exactly one point, it is called a *tangent*.



The tangents of a circle have interesting properties which could be very useful for problem solving.

**Theorem 1** Two tangents  $PQ$  and  $PR$  from an external point  $P$  to a circle are equal.



*Proof.* Since  $OR = OQ =$  radius and  $\angle PRO = \angle PQO = 90^\circ$ , using similar triangles, we can immediately see that  $PQ = PR$ .

**Example 13** From an external point  $P$ , two tangents  $PQ$  and  $PR$  are drawn. If  $\angle PQR = 65^\circ$ , find angle  $\angle QPR$ .