

**MASSACHUSETTS MATHEMATICS LEAGUE**  
**CONTEST 2 - NOVEMBER 2006**  
**ROUND 5 TRIG: FUNCTIONS OF SPECIAL ANGLES**

**\*\*\*\*\* NO CALCULATORS ON THIS ROUND \*\*\*\*\***

**ANSWERS**

A) \_\_\_\_\_

B) \_\_\_\_\_

C) \_\_\_\_\_

A) If  $\cos A = \frac{1}{4}$  and  $\tan A < 0$ , find the exact value of  $\sin(90 - A) \cdot \cos(90 - A)$ .

B) If  $\sin^2\left(\frac{\pi}{9}\right) + \sin^2\left(\frac{2\pi}{9}\right) + \sin^2\left(\frac{3\pi}{9}\right) + \sin^2\left(\frac{4\pi}{9}\right) = \frac{a}{b}$ , then what is the value of  $\cos^2\left(\frac{\pi}{9}\right) + \cos^2\left(\frac{2\pi}{9}\right) + \cos^2\left(\frac{3\pi}{9}\right) + \cos^2\left(\frac{4\pi}{9}\right)$  ?

Express your answer as a single simplified fraction.

C) The figure in the diagram consists of 4 equilateral triangles each with side of length 6. A square pyramid is formed by joining sides  $\overline{AB}$  and  $\overline{BC}$ . Let  $\theta$  be the angle each face makes with the base. Find  $\sin(\theta)$ . If necessary, express your answer as a simplified radical.

