Some Trigonometry Problems for Enrichment[1]

1. If θ, 2θ and 3θ are the angles of a triangle, evaluate $\cos^2 \theta + \cos^2 2\theta + \cos^2 3\theta$.

2. A triangle has sides of length 2, 2, and $\sqrt{6} - \sqrt{2}$. Find the value of each of the equal angles.

3. Find the greatest possible area for an isosceles triangle whose equal sides are each 4 units long.

4. Solve for x in the interval $0 \leq x \leq 2\pi$: $2\sin^3 x - 5\sin^2 x + 2\sin x = 0$.

5. In triangle ABC, the angles A, B and C satisfy the equation

$$\cos A \cos B + \sin A \sin B \sin C = 1.$$

Determine all possible values for C.

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[1]borrowed from some books of Canadian Mathematics Competition Problems produced by the University of Waterloo