

# Week 21: Practice Problems

(Properties of triangles)

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1. If  $A \neq \frac{\pi}{2}$ , prove that  $(b - a \cos C) \tan A = a \sin C$
  2.  $b^2 \sin 2C + c^2 \sin 2B = 2bc \sin A$
  3.  $(b^2 - a^2) \cot A + (c^2 - a^2) \cot B + (a^2 - b^2) \cot C = 0$
  4.  $a^2 + b^2 + c^2 = 2(\sum_{cyclic} bc \cos A)$
  5. If  $3a = b + c$ , Prove that  $\cot \frac{B}{2} \cot \frac{C}{2} = 2$
  6. If the sides of a triangle are  $2a + 1, a^2 - 1, a^2 + a + 1$  for some  $a > 1$ . Find the greatest angle in the triangle.
  7. If  $a \cos A = b \cos B$ , the triangle is either isosceles or it is right-angled.
  8. If  $\sin^2 \frac{A}{2}, \sin^2 \frac{B}{2}, \sin^2 \frac{C}{2}$  are in HP, then  $a, b, c$  are in .....
  9.  $a \tan A + b \tan B = (a + b) \tan(A + B)$ , then the triangle is isosceles.
  10. In triangle  $ABC$ , let  $D$  be the midpoint of  $BC$ . If  $\angle DAC = \frac{\pi}{2}$ , prove that  $\tan A + 2 \tan C = 0$

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