Trigonometry
Activity 3c - Angle Sum Formulas Part II

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1. In Part I, we developed the following formulas:

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A - B) = \cos A \cos B + \sin A \sin B$$

Use the first formula to find a formula for

$$\cos(90° + \theta)$$

2. It is also true that

$$\sin(90° + \theta) = \cos\theta$$

(This can be a bonus problem to be proved by the students)

3. Let $\theta = M + N$.

   (a) Use the formula for $\cos(90° + \theta)$ to show that

   $$\sin(M + N) = -\cos(90° + M + N)$$

   (b) Use the formula for $\cos(A + B)$, letting $A = 90° + M$ and $B = N$ to write a formula for $-\cos(90° + M + N)$

   (c) Simplify the previous expression using the formulas found in problems 1 and 2.

   (d) Combine problems 3a, b, c, to derive a formula for $\sin(M + N)$.

4. In problem 3) of Part I, you used a process to convert the formula for $\cos(A-B)$ to a formula for $\cos(A+B)$. Use this same process to convert the formula for $\sin(M+N)$ to a formula for $\sin(M-N)$.

5. Summarize your results:
   - $\cos(A - B) =$
   - $\cos(A + B) =$
   - $\sin(A - B) =$
   - $\sin(A + B) =$
6. Find formulas for $\tan(A - B)$ and $\tan(A + B)$ as follows:
   (a) Write $\tan(A - B)$ as $\dfrac{\sin(A - B)}{\cos(A - B)}$, then use 8) to rewrite in terms of $\sin A$, $\sin B$, $\cos A$ and $\cos B$.
   (b) Divide both the numerator and denominator by $\cos(A)\cos(B)$ and simplify.
   (c) Rewrite in terms of $\tan(A)$ and $\tan(B)$.
   (d) Repeat the process for $\tan(A + B)$
   (e) Summarize your results.
   - $\tan(A - B) =$
   - $\tan(A + B) =$