MATH 1113 FORMULAS

SPRING 2007

Formulas to know for Test IV and the Final

Reciprocal identities.

$$\sin u = \frac{1}{\csc u} \qquad \cos u = \frac{1}{\sec u} \qquad \tan u = \frac{1}{\cot u}$$
$$\csc u = \frac{1}{\sin u} \qquad \sec u = \frac{1}{\cos u} \qquad \cot u = \frac{1}{\tan u}$$

Quotient identities.

$$\tan u = \frac{\sin u}{\cos u} \qquad \cot u = \frac{\cos u}{\sin u}$$

Pythagorean identities.

$$\sin^2 u + \cos^2 u = 1 \qquad \tan^2 u + 1 = \sec^2 u \qquad 1 + \cot^2 u = \csc^2 u$$

Hint: The second and third of these can be derived from the first by dividing by $\cos^2 u$ and $\sin^2 u$, respectively.

Even/Odd identities.

$$\sin(-u) = -\sin(u) \qquad \cos(-u) = \cos(u) \qquad \tan(-u) = -\tan(u)$$
$$\cot(-u) = -\cot(u) \qquad \sec(-u) = \sec(u) \qquad \csc(-u) = -\csc u$$

Hint: If you know your reciprocal and quotient identities, you only need to know the even/odd identities for sine and cosine, and the rest come for free.

Double-angle formulas.

$$\sin(2u) = 2\sin u \cos u \qquad \cos(2u) = \cos^2 u - \sin^2 u$$

Power-reducing formulas.

$$\sin^2 u = \frac{1 - \cos(2u)}{2} \qquad \cos^2 u = \frac{1 + \cos(2u)}{2}$$

(Formulas provided on remaining tests are given on the next page.)

Formulas that will be provided for Test IV and the Final

Cofunction identities.

$$\sin\left(\frac{\pi}{2}-u\right)=\cos u \qquad \tan\left(\frac{\pi}{2}-u\right)=\cot u \qquad \sec\left(\frac{\pi}{2}-u\right)=\csc u$$

$$\cos\left(\frac{\pi}{2}-u\right)=\sin u \qquad \cot\left(\frac{\pi}{2}-u\right)=\tan u \qquad \csc\left(\frac{\pi}{2}-u\right)=\sec u$$

Sum and difference formulas.

$$\sin(u+v)=\sin u\cos v+\cos u\sin v \qquad \sin(u-v)=\sin u\cos v-\cos u\sin v$$

$$\cos(u+v)=\cos u\cos v-\sin u\sin v \qquad \cos(u-v)=\cos u\cos v+\sin u\sin v$$

$$\tan(u+v)=\frac{\tan u+\tan v}{1-\tan u\tan v} \qquad \tan(u-v)=\frac{\tan u-\tan v}{1+\tan u\tan v}$$

Double-angle and power-reducing formulas for tangent.

$$\tan(2u)=\frac{2\tan u}{1-\tan^2 u} \qquad \tan^2 u=\frac{1-\cos(2u)}{1+\cos(2u)}$$

Sum-to-product formulas.

$$\sin u+\sin v=2\sin\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$$

$$\sin u-\sin v=2\cos\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$$

$$\cos u+\cos v=2\cos\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$$

$$\cos u-\cos v=-2\sin\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$$

Product-to-sum formulas.

$$\sin u\sin v=\frac{1}{2}[\cos(u-v)-\cos(u+v)]$$

$$\cos u\cos v=\frac{1}{2}[\cos(u-v)+\cos(u+v)]$$

$$\sin u\sin v=\frac{1}{2}[\sin(u+v)+\sin(u-v)]$$

$$\cos u\sin v=\frac{1}{2}[\sin(u+v)-\sin(u-v)]$$