Instructor: Cheryl Jaeger Balm **Sections covered:** 5.4, 5.5, 6.1-6.5

These are *sample* topics and problems to help you study for Exam 3. This list is *not* meant to be exhaustive.

- **Trig identities (5.4, 5.5)**

Sum and Difference Formulas	
$\sin(u+v) = \sin u \cos v + \cos u \sin v$	$\sin(u-v) = \sin u \cos v - \cos u \sin v$
$\cos(u+v) = \cos u \cos v - \sin u \sin v$	$\cos(u-v) = \cos u \cos v + \sin u \sin v$
$\tan(u+v) = \dfrac{\tan u + \tan v}{1 - \tan u \tan v}$	$\tan(u-v) = \dfrac{\tan u - \tan v}{1 + \tan u \tan v}$

Double and Half Angle Formulas		
$\sin\left(\frac{u}{2}\right) = \pm\sqrt{\frac{1-\cos u}{2}}$	$\cos\left(\frac{u}{2}\right) = \pm\sqrt{\frac{1+\cos u}{2}}$	$\tan\left(\frac{u}{2}\right) = \frac{1-\cos u}{\sin u} = \frac{\sin u}{1+\cos u}$
$\sin(2u) = 2\sin u \cos u$	$\cos(2u) = \cos^2 u - \sin^2 u$	$^*\tan(2u) = \frac{2\tan u}{1-\tan^2 u}$ *If both sides exist

More Formulas	
$\sin u \sin v = \frac{1}{2}[\cos(u-v) - \cos(u+v)]$	$\sin u + \sin v = 2\sin\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$
$\cos u \cos v = \frac{1}{2}[\cos(u-v) + \cos(u+v)]$	$\sin u - \sin v = 2\cos\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$
$\sin u \cos v = \frac{1}{2}[\sin(u+v) + \sin(u-v)]$	$\cos u + \cos v = 2\cos\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$
$= \frac{1}{2}[\sin(u+v) - \cos(v-u)]$	$\cos u - \cos v = -2\sin\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$
$\sin^2 u = \frac{1-\cos(2u)}{2}$	$\tan^2 u = \frac{1-\cos(2u)}{1+\cos(2u)}$
$\cos^2 u = \frac{1+\cos(2u)}{2}$	

- Practice problems:
  - Find $\sin\left(\frac{5\pi}{12}\right)$.
  - Find $\tan(u+v)$ if $\sin u = -\frac{1}{3}$, $\cos v = -\frac{2}{5}$ and u and v are in the same quadrant.

- Solve $\sin(2x)\cos(x) = \sin(x)$.
- Find $\cos\left(\frac{\pi}{8}\right)$.
- If $\cos(x) = \frac{5}{13}$ and x is in Quadrant IV, find $\tan(2x)$ and $\sin\left(\frac{x}{2}\right)$.
- Find $\tan(105^o)$.
- Find $2\cos(45^o)\sin(15^o)$
- Find the general solution for $\sin(4x) + \sin(x) = 0$

- **Oblique triangles (6.1, 6.2)**
  - **Law of Sines**
  - **Law of Cosines**
  - Area $= \frac{1}{2}bc\sin A$
  - Area $= \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$

- **Vectors (6.3, 6.4)**
  - Find the **magnitude** and **direction angle** of a vector
  - Addition, subtraction and scalar multiplication of vectors
  - Find a **unit vector** in the direction of the vector $\mathbf{v}$
  - **Dot product**
  - Find the angle between $\mathbf{u}$ and $\mathbf{v}$ using $\cos\theta = \frac{\mathbf{u}\cdot\mathbf{v}}{||\mathbf{u}||\ ||\mathbf{v}||}$
  - Determine if two vectors are **orthogonal**
  - Find the **projection** $\text{proj}_{\mathbf{v}}\mathbf{u}$ and use it to decompose $\mathbf{u}$ into **components** $\mathbf{u} = \mathbf{w}_1 + \mathbf{w}_2$

- **Complex numbers (6.5)**
  - The **trigonometric form** of a complex number is $z = r(\cos\theta + i\sin\theta)$
  - Multiplication: $z_1 z_2 = r_1 r_2(\cos(\theta_1+\theta_2) + i\sin(\theta_1+\theta_2))$.
  - Division: $\frac{z_1}{z_2} = \frac{r_1}{r_2}(\cos(\theta_1-\theta_2) + i\sin(\theta_1-\theta_2))$.
  - **DeMoivre's Theorem**: $z^n = r^n(\cos(n\theta) + i\sin(n\theta))$
  - **Complex roots**: $\sqrt[n]{z} = \sqrt[n]{r}\left(\cos\left(\frac{\theta+2\pi k}{n}\right) + i\sin\left(\frac{\theta+2\pi k}{n}\right)\right)$ for $k = 0, 1, 2, \ldots n-1$