

MAT 221 – 051
Spring 2008
Comprehensive Exam

Show all work.

On the integration problems, show the details of each step.

Some stuff:

$$\sin^2 x = \frac{1 - \cos 2x}{2}$$

$$\cos^2 x = \frac{1 + \cos 2x}{2}$$

$$\sin 2x = 2 \sin x \cos x$$

$$\cos 2x = \cos^2 x - \sin^2 x$$

reference angle	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$
	0°	30°	45°	60°	90°	180°	270°
sin	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	0	-1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	-1	0
tan	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	-	0	-

1. Integrate $\int_{\pi/4}^{\pi/3} \cos^3 x \sin^3 x dx$. Show all steps.

2. Set up definite integrals that represent the area inside $r = 3\sin\theta$ and outside $r = 2 - \sin\theta$. You may use your calculator to evaluate the integrals.

3. Write parametric equations for the line through $(2, -1, 5)$ and parallel to the line $x = 3t$, $y = 2 + t$, $z = 2 - t$.

4. Write an equation of the plane that contains the points $(1, 0, -1)$ and $(2, 1, 0)$ and is parallel to the line of intersection of the planes $x + y + z = 5$ and $3x - y = 4$.

5. Find parametric equations of the tangent line to the curve $\langle t^2 - 1, t^2 + 1, t + 1 \rangle$ at the point where $t = 0$.

6. A projectile is fired with an initial speed of 500m/s and angle of elevation of 30° . Find its velocity and acceleration vectors.