

# Freshman-Sophomore Contest 2004

## Sophomore Version, page 1

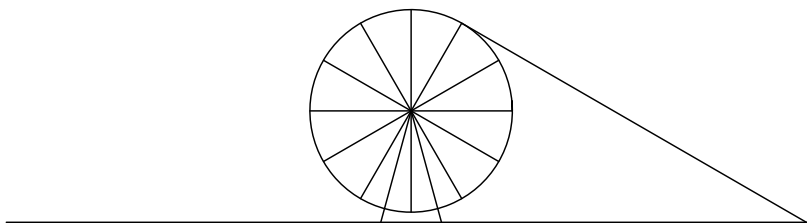
(There are problems on both the front and back of this sheet. The problems on the front are common to the freshman and sophomore versions of this contest.)

1. Graph  $y = \sin x \sin 2x$  on  $[0, 2\pi]$  and find the maximum value of  $\sin x \sin 2x$ .

2. Determine, with proof, whether or not the following sum converges:

$$\sum_{n=1}^{\infty} \frac{\sin(n\pi/4)}{n}.$$

3. A laser pointer is mounted on the rim of a ferris wheel, so that it throws a beam out parallel to the rim of the wheel and in the plane of the wheel. The wheel has a radius of ten meters and is mounted with its axle 11 meters off the ground. It is spinning at a rate of 1 revolution per minute.



The laser beam lights up a spot on the ground. How fast, in meters per second, is the highlighted spot on the ground moving, when the laser is 17 meters up?