Name: ID #: Section #:

**Q.1** [**2pts**] Find an equation of the tangent line to the curve $x = t\sin t,\ y = t\cos t$ at $t = \pi$.

**Q.2** [**3pts**] Find the length of the curve $x = 3\cos t - \cos 3t,\ y = 3\sin t - \sin 3t,\ \ 0 \le t \le \pi$.

**Q.3** [**2pts**] Sketch the polar curve $r = 1 + 2\cos(\theta/2)$.

**Q.4** [**3pts**] Find the area of the region that lies inside both curves $r = 3 + 2\cos\theta,\ \ r = 3 + 2\sin\theta$.

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**Q.1** [**2pts**] Find $d^2y/dx^2$, if $x = t^3 - 12t,\ y = t^2 - 1$. For which values of $t$ is the given curve concave upward?

**Q.2** [**3pts**] Find the length of the curve
$x = 3\cos t - \cos 3t,\ y = 3\sin t - \sin 3t,\ \ 0 \le t \le \pi$.

**Q.3** [**2pts**] Sketch the curve $(x^2 + y^2)^3 = 4x^2y^2$.

**Q.4** [**3pts**] Find the area of the region that lies inside both curves
$r = 3 + 2\cos\theta,\ \ r = 3 + 2\sin\theta$.