# Midterm II

# MATH 153

*Sunday, July 44, 2039* 11:00 – 12:20 **Founders 4500**

***Instructions:*** **Show *all* work.** Failure to show work may result in loss of credit. Write your solutions in the space provided on the *answer sheets*. Do *not* hand in scratch paper. There are ten questions worth ten points each. You may use your scientific calculators (all types) and a one-page list of relevant formulae. Some partial credit ***may*** be given. **Good Luck!**

**1)** Find an equation of the tangent line to the curve $x = (2t-1)^3$, $y = 12t(1-t)$, $0 \le t \le 1$ at the point where $t = \frac{1}{2}$.

**2)** Sketch the curve $x = 3\cos t + 2\cos 4t$, $y = 3\sin t + 2\sin 4t$, $-\pi \le t \le \pi$.

**3)** Find a polar equation for the curve $y^2 - x^2 = 4$. Sketch the curve.

**4)** Graph the curve $r = 2 + \cos 2\theta$ and find the area that it encloses.

**5)** Approximate the function $f(x) = \sin(\cos x)$ by a Taylor polynomial of degree two at $a = \pi/2$. How accurate is that approximation when $1 \le x \le 2$ ?

**6)** Show that $x^2 + y^2 + z^2 - 2x + 8y + 12z = 11$ is the equation of a sphere, and find its center and radius.

**7)** Find, correct to the nearest degree, the three angles of the triangle with vertices $(0,0,-2)$, $(3,4,0)$, $(6,8,-2)$.

**8)** Find a vector $\boldsymbol{a}$ of length 5 that is orthogonal to both $\boldsymbol{i} - \boldsymbol{j} + 2\boldsymbol{k}$ and $\boldsymbol{i} + 3\boldsymbol{k}$.

**9)** Find the area of the triangle with vertices $(0,0,-2)$, $(3,4,0)$, $(6,8,-2)$ and a unit vector orthogonal to the plane through these points.

**10)** Find the volume of the parallelepiped with adjacent edges $OP$, $OQ$ and $OR$; $O(0,0,0)$, $P(0,0,-2)$, $Q(3,4,0)$, $R(6,8,-2)$.



You are welcome to keep this *Questions Sheet* for your files.