MA 104 **Due: 28 March 08**
Homework # 3 Choose 10 out of 11.

---

1. Find an equation of the sphere with center in the xz-plane and passing through the points $P = (0, 8, 0), Q = (4, 6, 2)$ and $R = (0, 12, 4)$.

2. Describe the intersection of the graphs $x^2 + y^2 = 1$ and $z = 2$.

3. Two objects are moving according to the parametric equations for with the time in seconds:
   Object 1: $x_1(t) = 10 - t$ and $y_1(t) = \dfrac{t}{2}$
   Object 2: $x_2(t) = t$ and $y_2(t) = \dfrac{5t}{4} - 2$
   (a) Find the point of intersection of the two objects.
   (b) Do the two objects collide? If they do collide, after how many seconds does the collision take place? If the two objects do not collide, how much of a time gap exists between the two objects at the point of intersection?

4. For what values of t are the following pairs of vectors parallel?
   (a) $2\vec{i} + (t^2 + \dfrac{2}{3}t + 1)\vec{j} + t\vec{k}$ and $6\vec{i} + 8\vec{j} + 3\vec{k}$
   (b) $\langle t, 1, (t-1)\rangle$ and $\langle 2, -4, 1\rangle$

5. If $\vec{v} \times \vec{w} = \langle 2, -3, 5\rangle$, and $\vec{v} \cdot \vec{w} = 3$, find θ where θ is the angle between $\vec{v}$ and $\vec{w}$.

6. Find the vector projection of $\vec{A} = \langle 1, 2, 4\rangle$ onto $\vec{B} = \langle 4, -2, 4\rangle$.

7. Show that the points $P = (2, -1, 5)$, $Q = (6, 0, 6)$ and $R = (14, 2, 8)$ are collinear. Give the vector representation, parametric representation, and rectangular representation for this line.

8. By methods of calculus, find the point $P = (x, y, z)$ on the line $x = 3 + t, y = 2 + t, z = 1 + t$ that is closest to the point $Q = (1, 2, 1)$, and verify that $\vec{PQ}$ is perpendicular to the line.

9. (a) Find the angle between the planes $4x+4y-2z = 9$ and $2x+y+z = -3$.
   (b) Find the line of intersection between the planes $4x + 4y - 2z = 9$ and $2x + y + z = -3$.
   (c) Find the equation of the plane containing the point $P = (1, 3, 1)$ and the line of intersection of the planes from above.

10. If $R(\theta) = \langle r\cos\theta, r\sin\theta\rangle$, with fixed $r > 0$, show that $R'(\theta)$ is perpendicular to $R(\theta)$.

11. Find the parametrization of the tangent line to the curve
    $\vec{r}(s) = \ln s\vec{i} + \dfrac{1}{s}\vec{j} + 9s\vec{k}$ at $s = 1$.