Math 2030, Fall 2017, Test 1
22 September 2017
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1. Find the intersection of the line through $(0, 4, 4)$ and $(1, 3, 3)$ with the plane $3x - 2y - z = 12$. (10 pts)

2. Find the plane which contains the line $\overrightarrow{r}(t) = (1, 1, 1) + t(1, 2, 3)$ and the point $(2, 2, 0)$. (10 pts)

3. Find the line of intersection of the planes $x + y = 2$ and $y + 2z = 3$. (10 pts)

4. (a) Find the point of the plane $x - y + 2z = 2$ closest to $(5, -3, 9)$. (10 pts)
   (b) Find the distance from $(5, -3, 9)$ to the plane $x - y + 2z = 2$. (5 pts)
   (c) Find a point half way from $(5, -3, 9)$ to the plane. (5 pts)

5. Let $\overrightarrow{r}(t) = (t,\ 1/t,\ t^2)$.
   (a) Compute $\overrightarrow{v}(t)$. (5 pts)
   (b) Compute $\overrightarrow{a}(t)$. (5 pts)
   (c) Decompose $\overrightarrow{a}(1)$ into normal and tangential components. (5 pts)
   (d) Compute (ds/dt) when $t = 1$. (5 pts)
   (e) Compute the curvature κ at $t = 1$. (5 pts)
   (f) Write an equation for the line tangent to the curve at $t = 1$. (5 pts)

6. Find the projection of $\overrightarrow{(1, 3, 5)}$ onto $\overrightarrow{(1, 1, 1)}$. Write $\overrightarrow{(1, 3, 5)}$ as the sum of a vector parallel to $\overrightarrow{(1, 1, 1)}$ and a vector perpendicular to $\overrightarrow{(1, 1, 1)}$. (10 pts)

7. Show that the line through $(3, 1, 5)$ in the direction $\overrightarrow{(2, 1, 4)}$ lies in the surface $z = x + 2y$. (10 pts)

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