# Answers to Test 1, 1999

1. (a) $\langle 2, 3, 1\rangle$
   (b) $\sqrt{14}$
   (c) $\pi/3$
   (d) $7\sqrt{3}/2$
   (e) $S = (5, -1, -4)$ or $S = (9, 5, -2)$ or $S = (3, 3, 2)$
2. (a) $\langle 6, 3t^2, 6t\rangle$
   (b) $\langle 1, 0, 0\rangle$
   (c) $7$
3. $2x - y + z = -5$
4. (a) If there is a $P = (x, y, z)$ on $\ell_1$ and $\ell_2$, then there is some $t$ and some $s$ such that

$$(x, y, z) = (2 + t, 0, -1 + t) = (3, 2s, 1 + s).$$

   Since $2 + t = 3$, $t = 1$. Since $0 = 2s$, $s = 0$. But then $-1 + t = 0$ and $1 + s = 1$ so that $-1 + t \neq 1 + s$. This implies that $P$ cannot exist. In other words, $\ell_1$ and $\ell_2$ do not intersect. Note now that $\langle 1, 0, 1\rangle$ is a vector parallel to $\ell_1$ and $\langle 0, 2, 1\rangle$ is a vector parallel to $\ell_2$. Also, $\langle 1, 0, 1\rangle \neq c\langle 0, 2, 1\rangle$ for any number $c$ (otherwise, $1 = c \times 0$, which is impossible). Hence, $\ell_1$ and $\ell_2$ are not parallel.

   (b) $2/3$
5. (i) (d), $(0, 0, 1/2)$ (or $(0, 0, -1/2)$)
   (ii) (b), a hyperbola
   (iii) (a), $(0, 0, 0)$