**1**. $L = \dfrac{1}{2}\left(\pi + \dfrac{3\sqrt{3}}{4}\right)$

**2**. $L = 8$

**3**. $\text{Comp}_{\mathbf{a}}\mathbf{b} = \dfrac{37}{\sqrt{75}}$ and $\text{Proj}_{\mathbf{a}}\mathbf{b} = \dfrac{37}{75}\langle 1, 7, 5\rangle$

**4**. $\text{Comp}_{\mathbf{a}}\mathbf{b} = \dfrac{7}{\sqrt{11}}$ and $\text{Proj}_{\mathbf{a}}\mathbf{b} = \dfrac{7}{11}\langle 1, 1, 3\rangle$

**5**. $\cos\theta = \dfrac{10}{\sqrt{35}\sqrt{116}}$

**6**. $\cos\theta = \dfrac{81}{\sqrt{101}\sqrt{91}}$

**7**. $\mathbf{a} \times \mathbf{b} = \left\langle \sin t - \dfrac{\cos t}{t}, 0, t\cos t - t^2 \sin t \right\rangle$

**8**. $\mathbf{a} \times \mathbf{b} = \langle t^4, -2t^3, t^2\rangle$

**9**. A vector equation is $\mathbf{r} = \langle 1+2t, 1-3t, 2+t\rangle$ and the parametric equations are $x = 1+2t$, $y = 1-3t$, and $z = 2+t$.

**10**. A vector equation is $\mathbf{r} = \langle -5+2t, 3-5t, 4-3t\rangle$ and the parametric equations are $x = -5+2t$, $y = 3-5t$, and $z = 4-3t$.

**11**. $-6x + 18y + 8z = 10$

**12**. $7x + 15y + 12z = 31$

**13**. $x = 4(y-2)^2 + (z-2)^2$ and this is an elliptic paraboloid

**14**. $\dfrac{(x-1)^2}{2} - \dfrac{(y-1)^2}{2} + \dfrac{(z+2)^2}{2} = 1$ and this is a hyperboloid of one sheet

**15**. Use the fact that $\|\mathbf{u}\|^2 = \mathbf{u}\cdot\mathbf{u}$ and the given inequality.