1. Let $L$ be a line in $\mathbb{R}^3$ (three-space), and let $a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2$ be two distinct planes containing $L$.

Show that for any real numbers $u$ and $v$, not both 0,

$$u(a_1x + b_1y + c_1z - d_1) + v(a_2x + b_2y + c_2z - d_2) = 0$$

is the equation of a plane containing $L$.

It is in fact true that other than these there are no further planes containing $L$. You might try convincing yourself of that—but it needn’t be handed in.

2. Find the equation of the cylinder in $\mathbb{R}^3$ consisting of all lines that are parallel to the vector $(3,2,1)$ and that pass through a point on the curve $y = e^x, z = x + e^x$.

In what follows, page numbers refer to the text.

You can also be view these problems online at coursecompass.com by clicking through to Chapter Contents/Chapter12/Section 12.6/Multimedia textbook exercise set.

3. p. 882, #78.

4. p. 883, #80.
Recall that the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is $\pi ab$.

5. p. 883, #81.