MATH1130: Calculus II

Self-Assessment Sheet 3: Lines & Planes

All lines and planes are in $\mathbb{R}^3$.

1.) Find the parametric equations $\boldsymbol{\ell}$ of the following lines.
Click on "Evaluate" after you have filled in the appropriate numbers.

(i) The line through the $\boldsymbol{p} = (2, -1, 5)$ and parallel to the line with parametric equation $\boldsymbol{r}(t) = (3\,t, 2 + t, 2 - t)$.
$\boldsymbol{\ell}(t) \;=\; \Big(\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_\Big) + t \cdot \Big(\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_\Big)$

(ii) The line through the $\boldsymbol{p} = (2, -3, 4)$ and perpendicular to the plane with equation $2\,x - y + 3\,z = 4$.
$\boldsymbol{\ell}(t) \;=\; \Big(\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_\Big) + t \cdot \Big(\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_\Big)$

Evaluate

2.) Find the equation of the plane with normal vector $\boldsymbol{n}$ that passes through the point $\boldsymbol{p}$.
Click on "Evaluate" after you have filled in the appropriate numbers.

(i) $\boldsymbol{p} = (0, 0, 0)$, $\boldsymbol{n} = (1, 2, 3)$;
$\_\_\_\_\_\; x + \_\_\_\_\_\; y + \_\_\_\_\_\; z = \_\_\_\_\_$

(ii) $\boldsymbol{p} = (3, -4, 5)$, $\boldsymbol{n} = (-2, 7, 3)$;
$\_\_\_\_\_\; x + \_\_\_\_\_\; y + \_\_\_\_\_\; z = \_\_\_\_\_$

(iii) $\boldsymbol{p} = (5, 12, 13)$, $\boldsymbol{n} = (1, 0, -1)$;
$\_\_\_\_\_\; x + \_\_\_\_\_\; y + \_\_\_\_\_\; z = \_\_\_\_\_$

Evaluate

Please turn over!

3.) Find the equation of the following planes.
Click on "Evaluate" after you have filled in the appropriate numbers.

(i) The plane through the origin and parallel to the plane with equation $3\,x + 4\,y = 5\,z + 10$.
_____ x + _____ y + _____ z = _____

(ii) Through $\boldsymbol{p} = (5, 7, -6)$ and parallel to the xz-plane (i.e., $y = 0$).
_____ x + _____ y + _____ z = _____

Evaluate

4.) Determine whether the line with parametric equation $\boldsymbol{\ell}$ and the given plane intersect or are parallel.
Click on "Evaluate" after you have ticked those which intersect.

◯ The line with parametric equation $\boldsymbol{\ell}(t) = (7-4\,t, 3+6\,t, 9+5\,t)$ and the plane with equation $4\,x + y + 2\,z = 17$. *Hint*

◯ The line with parametric equation $\boldsymbol{\ell}(t) = (3+2\,t, 6-5\,t, 2+3\,t)$ and the plane with equation $3\,x + 2\,y - 4\,z = 1$. *Hint*

Evaluate