

14. Where does $\frac{x-1}{2} = \frac{y-2}{-1}$, $z=3$ intersect $4x+3y+2z=6$?

$$\begin{aligned}x &= 2t+1 \\ y &= -t+2 \\ z &= 3\end{aligned}$$

$$\begin{aligned}4(2t+1) + 3(-t+2) + 6 &= 6 \\ 8t + 4 - 3t + 6 + 6 &= 6 \\ 5t + 16 &= 6 \\ t &= -2\end{aligned}$$

$$\begin{aligned}x &= -3 \\ y &= 4 \\ z &= 3\end{aligned}$$

15. If the temperature of a plate at the point (x, y) is $T(x, y) = 10 + 2x^2 - y^2$, then find the path a heat-seeking particle (which always moves in the direction of greatest increase of temperature) would follow if it starts at $(4, +2)$.

Let $\vec{r}(t)$ be the position vector of the

particle at time t . We know

$$\vec{r}'(t) = c(t) \nabla T$$

$$x' \hat{i} + y' \hat{j} = c(t) (4x \hat{i} - 2y \hat{j})$$

$$\frac{x'}{4x} = \frac{y'}{-2y} \quad -\frac{x'}{2x} = \frac{y'}{y}$$

$$-\frac{1}{2} \ln x = \ln y$$

$$\frac{e^k}{\sqrt{x}} = y$$

$$\frac{c}{\sqrt{x}} = y$$

when $x=4$ $y=2$ so $\frac{c}{\sqrt{4}} = 2$ $c=4$

$$\frac{4}{\sqrt{x}} = y$$