Ans. key

Math 2551 A1-3 Exercise 16

Section:
Name:
Student ID:

Let $f(x, y, z)$ and $g(x, y, z)$ be differentiable functions and $\mathbf{r}(t)$ be a smooth curve. Mark "true" or "false" for each of the following statements.

True

(1) If $f(\mathbf{r}(t))$ has a local minimum value at $t = t_0$ then $\nabla f(\mathbf{r}(t_0))$ is perpendicular to $\mathbf{r}'(t_0)$ if neither is zero.

Let $g(t) = f(\vec{r}(t))$, then $g'(t_0) = 0$, i.e. $\nabla f(\vec{r}(t_0)) \cdot \vec{r}'(t_0) = 0$

True

(2) If $\mathbf{r}(t)$ lies on $g(x, y, z) = 0$ then $\mathbf{r}'(t) \cdot \nabla g = 0$ at every point passed by $\mathbf{r}(t)$.

$$g(\vec{r}(t)) = 0$$

$$\Rightarrow \quad \frac{d}{dt}\{g(\vec{r}(t))\} = 0$$

$$\Rightarrow \quad \nabla g \cdot \vec{r}'(t) = 0$$