(1) Let M^n be a smooth manifold and let ∇ be a connection on M. Let R be the curvature of ∇, i.e.

$$\mathbb{R}(X,Y)Z = \nabla_X \nabla_Y Z - \nabla_Y \nabla_X Z - \nabla_{[X,Y]} Z$$

Prove that R is a tensor.

(2) Let ∇ be a connection on $\mathbb{R}^3$ given by the formula

$$\nabla_X Y = \nabla_X^{can} Y + X \times Y$$

where $\times$ is the cross product on $\mathbb{R}^3$.

(a) Find the curvature and the torsion of ∇.

(b) Let $\gamma(t) = (0,0,t)$ and $v = (1,0,0)$. Let $X(t)$ be the parallel vector field along γ with $X(0) = v$.
Find the explicit formula for $X(t)$.