Department of Civil Engineering and Applied Mechanics
McGill University

ANLYTICAL MECHANICS, CIVE281
Assignment No.1

To be submitted to the assignment box located in Room MDENG475 before 4:00 p.m. on Friday, September 14

1. B. and J. 11.93

2. At a general time t a particle has an acceleration

$$\mathbf{a} = 4e^{-2t}\,\hat{\mathbf{i}} + 3t^2\,\hat{\mathbf{j}} + 6\cos(3t)\,\hat{\mathbf{k}}$$

If this particle starts from the origin at $t = 0$ with a velocity of $2\hat{\mathbf{j}}$. find its velocity and position at a general time t.

3. At a general time t, a particle has position

$$\mathbf{r} = 3t\,\hat{\mathbf{i}} + 2t^3\,\hat{\mathbf{j}} + 3t^2\,\hat{\mathbf{k}}$$

in which $\mathbf{r}$ is in m and t in s. Find at $t = 1$ s, the following:
(i) velocity and acceleration vectors in Cartesian coordinates
(ii) unit tangent vector to path $\hat{\tau}$
(iii) tangential component of acceleration a_τ
(iv) normal component of acceleration a_n
(v) radius of curvature of path ρ
(vi) unit normal vector $\hat{\mathbf{n}}$

4. B. and J. 11.141

5. B. and J. 11.166