MATHEMATICS 317 December 2013 Final Exam Answers

1. (a) $\mathbf{r}(u) = u^3\,\hat{\boldsymbol{\imath}} + 3u^2\,\hat{\boldsymbol{\jmath}} + 6u\,\hat{\mathbf{k}}$ (b) $\int_{\mathcal{C}} ds = 7$ (c) $\frac{\mathrm{d}u}{\mathrm{d}t}(t_1) = 2$ (d) $\frac{\mathrm{d}^2u}{\mathrm{d}t^2}(t_1) = 1$
2. (a) $A = -4$, $B = -2$ (b) $\phi(x, y, z) = -x^4y^2z + yz^3 + C$ (c) $I = -2$
   (d) $J = -\frac{43}{24} \approx -1.7917$ (e) $\int_{\mathcal{T}} (z\hat{\boldsymbol{\imath}} + \mathbf{F}) \cdot \mathrm{d}\mathbf{r} = \frac{1}{2}$
3. (a) $\int_{\mathcal{C}} x\,\mathrm{d}s = \frac{1}{2} + \frac{1}{12}\left[5^{3/2} - 1\right] \approx 1.3484$ (b) $\int_{\mathcal{C}} \mathbf{F} \cdot \mathrm{d}\mathbf{r} = \frac{3}{4}$
4. (a) $\iint_{\mathcal{S}} \frac{x^2+y^2}{\sqrt{1+x^2+y^2}}\,\mathrm{d}S = \frac{8}{3}$ (b) $\iint_{\mathcal{S}} \mathbf{F} \cdot \hat{\mathbf{n}}\,\mathrm{d}S = \frac{16}{3}$
5. $\iint_{\mathcal{S}} \mathbf{F} \cdot \hat{\mathbf{n}}\,\mathrm{d}S = 30 + 24\pi$
6. (a) See the solution.
   (b) $|\mathbf{a}(t)| = \frac{h^2}{r(t)^3}$