DAVID WETTRECHT
12300641

2/10/13 MA2E01 PROBLEM SET 1

7/10

1 a $r(t) = (t^2-1)i + \sqrt{t}j - t^3K$

domain of $(t^2-1) = (-\infty, \infty)$
domain of $\sqrt{t} = [0, \infty)$
domain of $-t^3 = (-\infty,\infty)$

$D(r) = [0, \infty)$ ✓ 1

b $r(t) = e^t i + t^2 j + \ln(t-2)K$

domain of $e^t = (-\infty,\infty)$
domain of $t^2 = (-\infty,\infty)$
domain of $\ln(t-2) = (2,\infty)$

$D(r) = (2,\infty)$ ✓ 1

2. $r(t) = 2ti + (1-t^2)j - \ln tK$

A. $\frac{dr}{dt} = 2i - 2tj - \frac{1}{t}K$ ✓ 1

b Norm $= \sqrt{(2)^2 + (-2t)^2 + (-\frac{1}{t})^2}$

$\sqrt{4 + 4t^2 + \frac{1}{t^2}}$

$2t + \frac{1}{t}$ ✓ 1

DAVID WETTORECHT 12300644

2c Unit tangent vector $T = \frac{r't}{\|r't\|}$

$$= \frac{2i - 2tj - \frac{1}{t}j}{2t + \frac{1}{t}}$$

✓ A

3 $r(t) = 2ti + (1-t^2)j - \ln t k$

$$\frac{2i - 2tj - \frac{1}{t}k}{\sqrt{4i - 4t^2 - \frac{1}{t^2}}}$$ $P_0\ (2,0,0)$

$F(x,y,z) = 2t, 1-t^2, \ln t$

$\nabla F = t, -2t, 1/t$

$\nabla F\ (2,0,0) = (2,0,0)$

Tangent plane is $2(x-2) + 0(y+0) + 0(z+0) = 0$

Normal line is $(2,0,0) + t(2,0,0) = (2+2t, 0, 0)$ ✗

$R(T) = \overset{\text{function derivative}}{r_0 + V_0 T}$ point $(2,4,0)$ equal eqn when $t=1$

$\overset{r_0}{2ti + (1-t^2)j - \ln(t)k} + \overset{V_0 T}{2i - 2tj - \frac{1}{t}k}$

$t=1 \Rightarrow 2i + \cancel{0} - \cancel{0} \quad + 2iT - 2jT - kT$

$\boxed{\cancel{\quad}}$

$\cancel{(2+2T)i + (3-2T)j + (-1-T)k}$

$(2+2T)i - 2Tj - Tk$ ✓ 2

DAVID WEITBRECHT 12300644

2/10/13 MA2E01 PROBLEM SET 1

4 a arc length over [1,4] $e^{2t} i + e^{2t} \sin(\pi t) j + e^{2t} \cos \pi t k$

$\int_0^4 \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2 + \left(\frac{dz}{dt}\right)^2}$ $\int_0^4 \left\|\frac{dr}{dt}\right\| dt$

$\int_1^4 \sqrt{(2e^{2t})^2_i + (-te^{2t})^2_j + (-e^{2t}(2t+1))^2}$ $\int_1^4 (2e^{2t})^2_i + (2e^{2t}\sin(\pi t) j + e^{2t}\cos \pi t)^2_j + (2e^{2t}\cos(\pi t) + e^{2t}\sin(\pi t))^2_k$

$\int_1^4 \sqrt{101e^{4t}} - \sqrt{30e^{4}}$

$= \sqrt{101e^{8}} - \sqrt{30}\, e^{2}$ $2^{3t} \int_1^4 4e^{4t} +$

$e^{2t} \sin(\pi t)$

$\sin(\pi t)($

b. $\frac{d\vec{r}}{du}$ at $t=0$ $= \sqrt{(2e^{0})^2 + (-4e^{0}) + -9e^{0}}$

$\sqrt{95} \Big|_0^t$

$s = \int_{t_0}^{t} \sqrt{95}\, du$

$= \sqrt{95}\, u \Big|_0^t = \sqrt{95}\, t$

$r(s) = e^{2t} i + e^{2t} \sin \pi t j + e^{2t} \cos \pi t k$