Homework due 11/15

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Ok to post

Sec. 16.2

3) $x(t) = t \quad y(t) = t^{-1} \qquad 1 \leq t \leq 2$

a) $F(r(t)) = \langle t^{-2}, t^2 \rangle$

$dr = \langle 1, -t^{-2} \rangle$

b) $F(r(t)) \cdot dr = t^{-2} - 1$

$$\int_1^2 (t^{-2} - 1)\, dt = -\frac{1}{2}$$

9) $$\int_0^1 \sqrt{1+9x^4} \cdot \sqrt{9x^4+1}\, dx = \int_0^1 (9x^4+1)\, dx = \frac{14}{5}$$

11) $$\int_0^2 16t^2 \cdot \sqrt{29}\, dt = \frac{128\sqrt{29}}{3}$$

13) First part:

$r(t) = (0, 2t, 1-t)$

$$\int_0^1 0\, dt = 0$$

Second part:

$r(t) = (t, 2-t, t)$

$$\int_0^1 t \cdot e^{t^2} \cdot \sqrt{3}\, dt = \frac{\sqrt{3}}{2} e - \frac{\sqrt{3}}{2}$$

17) $\int_2^5 13\, dt = 39$, the arc length

27) $$\int_0^2 (x^2 \cdot 1 - x \cdot 2x)\, dx = \int_0^2 -x^2\, dx = -\frac{8}{3}$$

29) $r(t) = (t, 4t, 4t)$

$$\int_0^1 (-3t + 16t)\, dt = \frac{13}{2}$$

31) $r(t) = (1-t, t)$

$$\int_0^1 \frac{t+1-t}{(1-t)^2 + t^2}\, dt = \frac{\pi}{2}$$

35) First part:

$r(t) = (0, 0, t)$

$\int_0^1 1\, dt = 1$

Second part:

$r(t) = (0, t, 1)$

$\int_0^1 e^{-t}\, dt = 1 - e^{-1}$

third part:

$r(t) = (-t, 1, 1)$

$\int_0^1 -e\, dt = -e$

Result: $1 + 1 - e^{-1} + e = 2 - e^{-1} - e$

Sec. 16.3

1) $f(1, 1, \pi) - f(0, 0, 0) = 0 - 0 = 0$

3) $f_x = 3, \quad f_y = 6y$

$\int F \cdot dr = f(4, \tfrac{1}{2}) - f(1, 2) = 12.75 - 15 = -2.25$

5) $f_x = ye^z, \quad f_y = xe^z, \quad f_z = xye^z$

$\int F \cdot dr = f(4,8,1) - f(1,1,0) = 32e - 1$

9) $\text{curl}(F) = \langle e^z - e^z, 0 - 0, 2y - 2y \rangle = \langle 0, 0, 0 \rangle$

$f = \int y^2 \, dx = xy^2 + g(y,z)$

$2xy + g_y = 2xy + e^z \quad g_y = e^z$

$f = xy^2 + e^z + h(z)$

$e^z + h_z = ye^z \quad h_z = ye^z - e^z$

$f = xy^2 + ye^z$

13) $\text{curl}(F) = \langle 1-1, \sec^2 x - \sec^2 x, 0 - 0 \rangle = \langle 0, 0, 0 \rangle$

$f = \int z \sec^2 x \, dx = z \tan x + g(y,z)$

$g_y = z$

$f = z \tan x + z + h(z)$

$\tan x + 1 + h_z = \tan x + y \quad h_z = y - 1$

$f = z \tan x + z - z + yz = z \tan x + yz$

15) $\operatorname{curl}(F) = \langle -4+4,\ 0-0,\ 2x-2x\rangle = \langle 0,0,0\rangle$

$f = \int (2xy+5)\,dx = x^2y + 5x + g(y,z)$

$x^2 + g_y = x^2 - 4z \qquad g_y = -4z$

$f = x^2y + 5x - 4z + h(z)$

$-4 + h_z = -4y \qquad h_z = 4 - 4y$

$f = x^2y + 5x - 4z + 4z - 4yz = x^2y + 5x - 4yz$

17) $f = \int 2xyz\,dx = 2yz + g(y,z)$

$2z + g_y = x^2z \qquad g_y = x^2z - 2z$

$f = \cancel{2yz} + x^2yz - \cancel{2yz} + h(z)$

$\cancel{2y} + x^2y - \cancel{2y} + h_z = x^2y \qquad h_z = 0$

$f = x^2yz$

$f(4,1,1) - f(0,0,1) = 16 - 0 = 16$

19) $f(1,1,0) - f(0,0,0) = 1 - 0 = 1$

$f(1,1,0) - f(0,0,0) = 1 - 0 = 1$