<u>Instructions</u>: Please show all of your work as partial credit will be given where appropriate, **and** there may be no credit given for problems where there is no work shown. All answers should be completely simplified, unless otherwise stated.

1. (15 points) Determine whether $F(x,y)=(e^x \sin y+1)i+(e^x \cos y+6)j$ is conservative. If so, find a function f such that $F=\nabla f$. If not, state that F is not conservative.

$$\frac{\partial M}{\partial y} = e^x \cos y \qquad \frac{\partial N}{\partial x} = e^x \cos y$$

So, $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$, so $\boxed{\vec{F} \text{ is conservative.}}$

$$\frac{\partial f}{\partial x} = e^x \sin y+1 \implies f(x,y) = e^x \sin y + x + C(y)$$

$$\frac{\partial f}{\partial y} = e^x \cos y + C'(y) = e^x \cos y + 6$$

$$\implies C'(y) = 6 \implies C(y) = 6y + C.$$

So, $\boxed{f = e^x \sin y + x + 6y + C}$

Conservative: (True) or   False   (circle one)

4.   If conservative, $f =$ ___$e^x \sin y + x + 6y + C$___
                              (Any choice of C is also acceptable.)

2. *(15 points)* For the vector field given above,
$$F(x,y)=(e^x \sin y +1)i+(e^x \cos y +6)j \, ,$$
calculate the line integral $\int_C F \cdot dr$ from (0,0) to $(2,\frac{\pi}{6})$ using any method you wish.

$$\int_{(0,0)}^{(2,\,\pi/6)} \vec{F} \cdot d\vec{r} = f\left(2, \frac{\pi}{6}\right) - f(0,0)$$

$$= e^2 \sin\left(\frac{\pi}{6}\right) + 2 + 6\left(\frac{\pi}{6}\right) - 0$$

$$= \frac{e^2}{2} + 2 + \pi$$

Answer $\underline{\quad \frac{e^2}{2} + 2 + \pi \quad}$

3. *(10 points)* What.... is your favorite color?

Answer: $\underline{\quad \text{Yellow} \quad}$

(Answers will, of course, vary.)