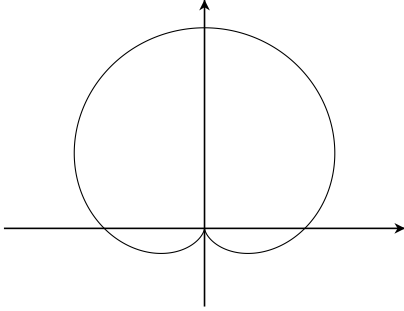


Math 126 Winter 2017  
Final Exam Answers

1. (a)  $t = \pm 1$   
 (b) No. If  $\mathbf{B}$  is parallel to the  $z$ -axis, then  $\mathbf{T}$  is parallel to the  $xy$ -plane. But  $\mathbf{T}$  is parallel to  $\mathbf{v}$  and the  $\mathbf{k}$ -component of  $\mathbf{v}$  is 1. This means that  $\mathbf{v}$  is not parallel to the  $xy$ -plane and thus  $\mathbf{B}$  is not parallel to the  $z$ -axis.
2. (a)



- (b)  $y = 2$  and  $y = -\frac{1}{4}$   
 (c)  $\frac{3\pi}{4} - 2$
3. (a)  $y - x = 0$   
 (b)  $\mathbf{r}(t) = \langle 2017 + 2016t, 2 + 2018t, -2t \rangle$  (Other correct answers exist.)  
 (c) Yes.

4. (a)  $\frac{\partial z}{\partial x} = \frac{2x}{ze^z + e^z}, \frac{\partial z}{\partial y} = \frac{-2y}{ze^z + e^z}$   
 (b)  $L(x, y) = 2(x - 1) - 2(y - 1)$   
 $f(1.01, 0.98) \approx 0.06$

5.  $\frac{3}{\sqrt{2}}$

6. (a)  $\frac{1}{3}(1 - \cos 1)$

(b) volume =  $\int_0^{2\pi} \int_{1/20}^1 \frac{1}{r} \cdot r \, dr \, d\theta - \int_0^{2\pi} \int_{1/20}^1 1 \cdot r \, dr \, d\theta + \pi \left(\frac{1}{20}\right)^2 \cdot 19 = \frac{19\pi}{20}$

7. (a)  $T_3(x) = 1 + \left(x - \frac{\pi}{2}\right) - \frac{1}{3} \left(x - \frac{\pi}{2}\right)^3$

(b) For all  $t$  in the interval  $\left[\frac{\pi}{2} - 0.1, \frac{\pi}{2} + 0.1\right]$ ,

$$|f^{(4)}(t)| = |-4(\sin t)e^{(t-\pi/2)}| < 4e^{0.1} < 4e < 12.$$

Taking  $M = 12$  (other values of  $M$  are correct), the error is at most 0.00005.

- (c) The smallest value is 0.

8. (a)  $F(x) = \sum_{k=0}^{\infty} \frac{\left(\frac{1}{k!} + \frac{(-1)^{k+1}}{2k+1}\right)}{2k+2} x^{2k+2}$
- (b) Interval of Convergence is  $(-1, 1)$ .
- (c)  $F^{(6)}(0) = 36$