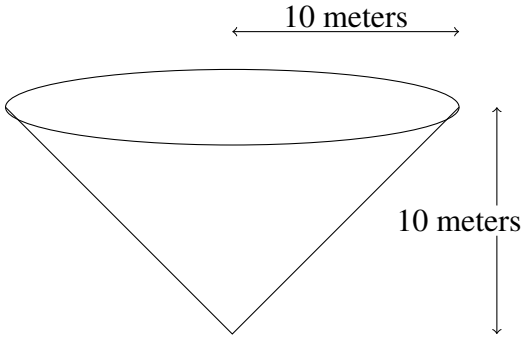
Name: _____ _____ **/ 25**

Please circle your section: 901 (Gossell) 902 (Gossell) 903 (Graves-McCleary)

No aids (book, calculator, etc.) are permitted. **Show all work for full credit.**

1. [10 points] A conical tank is being filled with water at a constant rate of 50 cubic meters per minute. The height and radius of the tank are both 10 meters. (See picture below.)



The volume of a cone is given by the formula $V = \frac{1}{3}\pi r^2 h$ where V is volume, r is the radius of the top of the cone and h is the height of the cone.

Using this infomation, **determine how fast the height of the water is changing** when the height of the water is 5 meters. Include units with your answer.

2. [6 points] Let $f(x) = \sin(x) + e^x$

a. Find the **linear approximation**, $L(x)$, to $y = f(x)$ near $a = 0$.

b. Use the linear approximation from part (a) above to estimate the value of $\sin(0.5) + e^{0.5}$. (You are trying to approximate $f(0.5)$. **You need to simplify your answer for full credit**.)

3. [9 points] Let $f(x) = \dfrac{x}{x^2+1}$.

a. Find $f'(x)$.

b. Find **all critical points** of $f(x)$.

c. Determine the **absolute maximum** and **absolute minimum** y-values of $f(x)$ on the interval $[0, 10]$. Show your work.