

2004 Mu Alpha Theta Convention  
Hustle: Calculus/Precalculus

- Find the area enclosed by the graph of  $x^2 + y^2 - 4x + 8y = 50$ .
- Find the slope-intercept form of the equation of the line tangent to the graph of  $y = x^3 - 5x + 3$  at the point where  $x = -1$ .
- Find the non-zero coordinates of the x-intercepts of the graph of  $y = (x^2 + x)^2 - 18(x^2 + x) + 72$ .
- Evaluate  $(1 + i)^{10}$ .
- Find the area of the region enclosed by one arch of the graph of  $y = 2 \sin 2x$  and the x-axis.
- A particle moves along the curve  $y = \sqrt{x}$ . Find the x-coordinate of the point at which the rate of change of the y-coordinate is 8 times the rate of change of its x-coordinate.
- Evaluate  $\sum_{k=1}^{100} (2k - 3)$ .
- Find the area of the region enclosed by the graph of  $|x| + |y| = 4$ .
- Find  $xy$  if  $(1/2)^x = 8^y$  and  $5^{x+2y} = 0.2$ .
- Find all points of intersection for the graphs of  $y = x^2 - 6x$  and  $y = -x^3$ .
- Find the value of  $\binom{10}{1} + \binom{10}{2} + \binom{10}{3} + \cdots + \binom{10}{10}$ .
- Find the slope of the normal to the graph of  $y = x^{1/3}$  at the point where  $x = 64$ .
- If  $x_1 = 2$  is the first approximation of a zero of  $2x^3 - 5x + 1 = 0$ , find  $x_2$  using Newton's method.
- Evaluate  $\lim_{h \rightarrow 0} \frac{3^h - 1}{h}$ .
- Find the area of the region enclosed by the graphs of  $y = x^2$  and  $y = x + 12$ .
- Evaluate  $\int_{\frac{\pi}{4}}^0 \tan^2 x dx$ .
- Solve the differential equation  $\frac{dy}{dx} = xe^{x^2}$  if  $(0, 3/2)$  is on the solution curve.
- Find all values of  $x$  so that  $4^{2x} + 8 = 6 \cdot 4^x$ .
- Evaluate  $\lim_{x \rightarrow 3^-} \frac{x^2 - 9}{|x - 3|}$ .
- For what values of  $x$  does the graph of  $y = x^3 - 3x^2 - 9x + 22$  have a horizontal tangent?
- A tank is in the shape of an inverted cone 8 meters in diameter at the top and 6 meters tall. Water is flowing into the tank at a rate of 10 cubic meters per hour. At what rate, in meters per hour, is the depth of water in the tank changing when it is 5 meters deep?
- The expression  $6t - 12$  gives the acceleration of a particle moving along a vertical line for any time  $t \geq 0$ . If the velocity of the particle at time 0 is 0 and the position of the particle at time 0 is  $-8$ , find the position function for the particle at any time  $t$ .
- Find  $k$  so that the vectors  $\langle 8, k \rangle$  and  $\langle k + 3, 5 \rangle$  are orthogonal.
- Evaluate  $\int \frac{e^x}{1 + e^{2x}} dx$ .
- Evaluate  $\int_0^{\pi} \sin^2 x dx$ .