json -> latex convert test

kora

Questions

1. [NCEA] Given $z = x + yi$, find the Cartesian equation of the locus described by $|z - i| + |z + 3i| = 5$. Write your solution in terms of x and y. [5]

2. [NCEA] Solve the differential equation $\frac{d^2y}{dx^2} = 4 - x + x^3$, given that when $x = 1$, $y = 0$, and $\frac{dy}{dx} = 1$. [5]

3. [NCEA] Differentiate the function $y = (3x^2 - x + 7)^4$ using the chain rule. [5]

4. [NCEA] Find the area under the curve described by $y = e^{-x}\sin(x)$ from $x = 0$ to $x = \pi$. [5]

5. [NCEA] The percentage of crops harvested depends on the number of days after planting and is modeled by the function: [5]

$$H(d) = -2d^3 + 18d^2 + 45d$$

where H is the percentage of crops harvested and d is the number of days since planting. Find the day when the rate of harvesting is maximized.

6. [NCEA] The graph below shows the function $y = \cos(x/2)$ and the lines $x = k$ and $x = 2\pi$. Find the value of k so that the areas under the curve between $x = 0$ to $x = k$ is half the area from $x = 0$ to $x = 2\pi$. [5]

7. [NCEA] Solve the differential equation $\frac{d^3y}{dx^3} = 18x - 6$, given that when $x = 0$, $y = 2$ and $\frac{dy}{dx} = 4$. [5]

8. [NCEA] Find the volume of the solid generated by revolving the region bounded by the graphs of $y = x^2 - 4x + 5$ and $y = 1$ around the line $y = 0$. [5]

9. [NCEA] Differentiate the function $y = e^{3x^2-x}$ using the chain rule. [5]

10. [NCEA] A company's profit, in thousands of dollars, is modeled by the function $P(t) = t^4 - 6t^3 + 9t^2 + 15t + 7$, where t represents time in years since the company [5]

started. Find the year when the rate of profit increase starts to decrease.