

Problem One

12 Points

Find the following limits

1. $\lim_{x \rightarrow 1} \frac{x^2 + 3x - 4}{x^2 + 2x - 3}$

2. $\lim_{x \rightarrow -\infty} \frac{x - 3x^2}{2x^2 - 3x + 5}$

3. $\lim_{x \rightarrow 3} \frac{|3x - 9|}{3 - x}$

Problem Two10 Points

Let $f(x) = \frac{2}{x-1}$

- Use the limit to find $f'(x)$
- Find the equation of the Tangent line at $x = 2$

Problem Three12 Points

Find the derivatives of the following functions (**do not simplify**)

1. $f(x) = \sqrt[5]{3 + x^3 - 2x}$

2. $f(x) = (x^{-2} - 4) \left(4 + \frac{1}{x^2} \right)$

3. $f(x) = \frac{2x-1}{3x^2-2}$

Problem Four8 Points

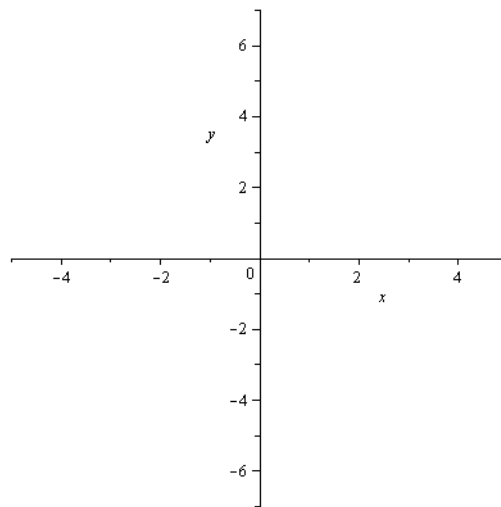
Consider the implicit function given by the equation $-x^2 + 5xy + y^2 - 7 = 0$

- Find y' at $(1,1)$
- Find the equation of the Normal line to the graph at $(1, 1)$

Problem Five10 Points

Consider the parabola given by the equation $y^2 - 2y - 8x - 31 = 0$. Find

- The equation in standard form
- The vertex
- The focus
- The directrix
- Sketch the graph of the parabola (identify the vertex, the focus and the directrix).



Problem Six

8 Points

The voltage of a certain thermocouple as a function of the temperature T (in $^{\circ}\text{C}$) is given by $E = 2.800T + 0.006T^2$. The temperature is increasing at the rate of $1.00\text{ }^{\circ}\text{C}/\text{min}$, how fast is the voltage increasing when $T = 100^{\circ}\text{C}$?