Show all work. Answers given with incomplete reasoning will not receive full credit.

Question 1 (4 points) Let \( f(x) = x^5 - 5x \)

For the function \( f(x) \), determine its:
(a): Domain; (b): Intercepts; (c): Symmetry; (d): Asymptotes; (e): Intervals of increase and decrease; (f): Local maximum and minimum values; (g): Concavity and points of inflection.

Then, using your answers to (a) through (g) above, sketch a graph of \( f(x) \).

- \( \mathbb{R} \) = all real numbers
- \( x - \text{int}: \ f(x) = 0 \Rightarrow x(x^4 - 5) = 0 \Rightarrow x = 0, \pm \sqrt[4]{5} \)
- \( (0, 0), \left( \sqrt[4]{5}, 0 \right), \left( -\sqrt[4]{5}, 0 \right) \)
- \( y - \text{int}: \ f(0) = 0 \)
- \( f''(x) = 20x^3 = 0 \Rightarrow x = 0 \)
- \( x = 0 \) is a point of inflection
- \( IP \) at \( (0, 0) \)
- \( f(x) = 5x^4 - 5 \Rightarrow 5(x^4 - 1) = 0 \Rightarrow x = \pm 1 \)
Question 2 (2 points) Find the point on the line 
\[ f(x) = 2x - 3 \]
That is closest to the origin.

We want to minimize:

\[ d(x) = (x-0)^2 + [(2x-3)-0]^2 \]
\[ = x^2 + (4x^2 - 12x + 9) \]
\[ = 5x^2 - 12x + 9 \quad \text{(1)} \]

Now, \( d'(x) = 10x - 12 \) and \( d'(x) = 0 \) gives

\[ 10x - 12 = 0 \implies x = \frac{12}{10} = \frac{6}{5} \quad \text{(2)} \]

This is a min, \( \text{min} \): \[ \frac{d}{dx} d'(x) \]

So, the point is \( (\frac{6}{5}, f(\frac{6}{5})) \)
\[ = (\frac{6}{5}, 2 \cdot \frac{6}{5} - 3) \]
\[ = (\frac{6}{5}, \frac{12}{5} - \frac{15}{5}) \]
\[ = (\frac{6}{5}, -\frac{3}{5}) \quad \text{(3)} \]