1. (3 points) Fill in the blank:

If you drive 120 miles down a straight highway in 2 hours, then the **Mean Value Theorem** says that there is some instant during your trip when your velocity is exactly \( 60 \) miles per hour.

*(Simplify your answer to a single number)*

2. (8 points) Find where the function \( f(x) = x^2 - 6x + 10 \) attains a **global minimum** value for \( 0 \leq x \leq 4 \).

First, differentiate:

\[
f'(x) = 2x - 6
\]

The critical points are the solutions to the equation:

\[
2x - 6 = 0
\]

\[
x = 3
\]

So we need to test \( x = 3 \) and the endpoints \( x = 0 \) and \( x = 4 \).

\[
f(0) = 10
\]
\[
f(3) = 1
\]
\[
f(4) = 2
\]

So the global minimum occurs at \( x = 3 \).
3. (9 points) Consider the function \( f(x) = x^3 - x \) on the domain \([-2, 2]\).

(a) Find all the critical points of \( f(x) \) on this domain.

The derivative is given by \( f'(x) = 3x^2 - 1 \). So we need to solve:

\[
\begin{align*}
  f'(x) &= 0 \\
  3x^2 - 1 &= 0 \\
  3x^2 &= 1 \\
  x^2 &= \frac{1}{3} \\
  x &= \pm \frac{1}{\sqrt{3}}
\end{align*}
\]

(b) Tell on what intervals \( f(x) \) is increasing or decreasing.

The graph of \( f'(x) = 3x^2 - 1 \) is a parabola. Since the leading coefficient is positive, it is an upward-pointing parabola. So it will be negative between the roots, and positive outside them. This means that \( f(x) \) will be increasing on \((-2, -\frac{1}{\sqrt{3}}) \) and \((\frac{1}{\sqrt{3}}, 2)\), and \( f \) will be decreasing on \((-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}})\).

(c) For each critical point in part (a), tell whether it is a local minimum, local maximum, or neither.

The point \( x = -\frac{1}{\sqrt{3}} \) will be a local maximum, since the derivative changes from positive to negative there.

The point \( x = \frac{1}{\sqrt{3}} \) will be a local minimum, since the derivative goes from negative to positive there.