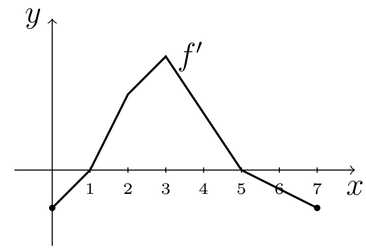
Name: ______________________________ **Section**: ______________

Clear your desk of everything excepts pens, pencils and erasers. **Show all your work.**
If you have a question raise your hand and I will come to you.

1. (2 points) **Fill-in-the-Blank. No partial credit available**

   To the right is a graph of $f'(x)$:



   (a) $f(x)$ is concave up on the interval: $(0, 3)$.

   (b) $f(x)$ is concave down on the interval: $(3, 7)$.

2. (2 points) **Multiple Choice. Circle the best answer. No partial credit available**

   Find the horizontal asymptote(s) of $f(x) = \dfrac{x^4 - 2x^2 + 1}{x^4 + x}$

   A. $y = x$

   B. $y = 1$

   C. $y = 0$

   D. There are no horizontal asymptotes

   E. None of the above

Solution: Divide the numerator and denominator by x^4 and then take the limit:

$$\begin{aligned}\lim_{x\to\infty} \frac{x^4 - 2x^2 + 1}{x^4 + x} &= \lim_{x\to\infty} \frac{1 - \frac{2}{x^2} + \frac{1}{x^4}}{1 + \frac{1}{x^4}} \\ &= \frac{1 - 0 + 0}{1 + 0} \\ &= 1\end{aligned}$$

3. (2 points) Given that

$$f(x) = \sin x - \cos x \qquad f'(x) = \cos x + \sin x \qquad f''(x) = -\sin x + \cos x$$

   Find the inflection points of f on the interval $[0, 2\pi]$.

Solution: The potential inflection points are where $f''(x) = 0$ which is when $\sin x = \cos x$ which occurs at $\pi/4$ and $5\pi/4$ on the interval $[0, 2\pi]$. We still need to check that $f''(x)$ changes signs at these points. So plug in points in the intervals $(0, \pi/4)$, $(\pi/4, 5\pi/4)$, and $(5\pi/4, 2\pi)$, and verify that f'' does in fact change sign at $x = \pi/4$ and $x = 5\pi/4$.