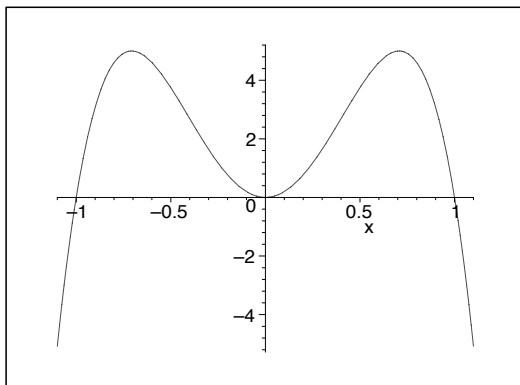


You must show all of your work to receive full credit!

| No. | 1 | 2 | 3 | 4 | 5 | 6 | Total |
|-------|---|---|---|---|---|---|-------|
| score | | | | | | | |

- (1) (12 points) Let $y = f(x)$ be a function whose graph is as shown below.



- (a)(6 points) On a separate set of axes, in the space next to the graph of f , sketch a reasonable graph of $y = f'(x)$ on the interval $[-1, 1]$.
- (b)(6 points) From the graph find the average rate of change of f on the interval $[0, 0.7]$; and determine if it is larger or smaller than $f'(-1)$.

- (2) (14 points) Find $f'(x)$ if $f(x) = 4x - x^5 - \frac{4}{x^2}$, **and** find the equation of the tangent line to f at $x = 1$. Here, you can use any method (the fastest) of your choice to compute $f'(x)$.

- (3) (12 points) By using the definition of the derivative only, find $f'(2)$ if $f(x) = \frac{3}{x-1}$. Any other method of computing $f'(2)$ will receive no credit.

- (4) (12 points) Let

$$G(x) = \begin{cases} 5x - x^3; & -\infty < x \leq 1 \\ k(2x + 1); & x > 1, \end{cases}$$

where k is a constant.

- (a)(8 points) Compute: $\lim_{x \rightarrow 1^+} G(x)$ and $\lim_{x \rightarrow 1^-} G(x)$.

- (b)(4 points) Find the value(s) of k for which the function G is continuous on $(-\infty, \infty)$. Make sure to show all of your work to receive full credit.

(5) (32 points) Find $\frac{dy}{dx}$ for each of the following (You Need Not Simplify):

(a) (10 points) $y = \sqrt{e^x + 1} \cos(7x)$.

(b)(10 points) $y = \frac{e^{\tan x} - \sin(3x)}{x^3 + \sec x}$.

(c)(12 points) $xy - e^{3y} + x^7 = 66$.

(6) (18 points) This problem deals with two different functions:

$$F(x) = \frac{x^2 + x - 6}{x^2 - 4} \quad \text{and} \quad G(x) = \frac{2x^3 + 5}{(x - 1)^3}.$$

(a)(4 points) Evaluate: $\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x^2 - 4}$.

(b)(4 points) Evaluate: $\lim_{x \rightarrow +\infty} \frac{x^2 + x - 6}{x^2 - 4}$.

(c)(4 points) Evaluate: $\lim_{x \rightarrow 1^-} \frac{2x^3 + 5}{(x - 1)^3}$.

(d)(6 points) Based on your answers in parts (a)–(c) above, determine whether the following statements are true or false by writing **T** or **F** and briefly **explain** your answer:

(i) The function F has a removable discontinuity at $x = 2$.

(ii) The line “ $y = 1$ ” is a horizontal asymptote for the function F .

(iii) The function G has no vertical asymptotes.