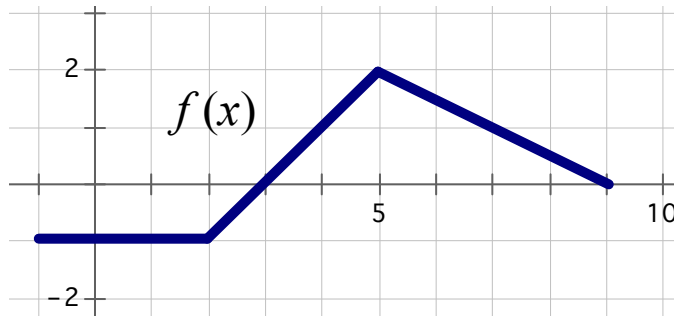


Part II: Free Response – Show all work.



$x$	$g(x)$	$g'(x)$
0	-1	1
2	1	3
4	3	6
6	6	12
8	4	8

1. Let  $f(x)$  be the function whose graph is given above and let  $g(x)$  be a differentiable function with selected values for  $g(x)$  and  $g'(x)$  given on the table above. Furthermore, let  $h$  be the function defined by  $h(x) = \ln(x^2 + 4)$ .

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(a) Find the equation of the line tangent to  $f(x)$  at  $x = 4$ .

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(b) Let  $K$  be the function defined by  $K(x) = h(f(x))$ . Find  $K'(3)$ .

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(c) Let  $M$  be the function defined by  $M(x) = g(x) \cdot f(x)$ . Find  $M'(6)$ .

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(d) Let  $J$  be the function defined by  $J(x) = \frac{g(x)}{h\left(\frac{1}{2}x\right)}$ . Find  $J'(8)$ .

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2. Consider the differential equation  $\frac{dy}{dx} = \frac{y-1}{x^2}$ . Let  $y = f(x)$  be the particular solution to the differential equation with the initial condition  $f(1) = 2$ . The function  $y = f(x)$  is defined for all real numbers.

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a) Find the equation of the line tangent to  $y = f(x)$  at  $f(1) = 2$

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b) Use your answer in part a) to approximate  $f(0.9)$ .

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c) Find  $y = f(x)$ , the particular solution to the differential equation with the initial condition  $f(1) = 2$ .

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<u><math>t</math></u> days	0	1	2	3	4
<u><math>H(t)</math></u> in mm per day	0	0.9	1.4	1.7	2.1

3. A small plant is purchased from a nursery and the change in height of the plant is measured at the end of each day for four days. The data, where  $H(t)$  is measured in millimeters per day and  $t$  is measured in days, are listed above.

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a. Estimate  $H'(3)$ . Show the work that leads to your answer. Indicate the units.

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b. Explain the difference between  $H(3)$  and  $H'(3)$  in terms of the plant's growth.

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c. Use right-hand rectangles with subintervals indicated by the table to approximate  $\int_0^4 H(t) dt$ . Using correct units, explain the meaning of this value in the context of the problem.

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d. Using correct units, explain the meaning of  $\frac{1}{4} \int_0^4 H(t) dt$  in the context of the problem.

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