

$$f(x) = x^2 - 2x + 4$$

$$g(x) = 2 \sin(x) + 4 \cos(x)$$

$$h(x) = e^x - \frac{2}{x} + ex - 2e$$

**Directions:** The functions  $f$ ,  $g$ , and  $h$  are defined above along with the graph of  $m$  and a table of selected values for the differentiable functions  $k$  and  $k'$ . Use this information to find the following.

1. Find the average rate of change of  $k(x)$  on the interval  $[-4, 6]$ .

$$\overrightarrow{(-4, k(-4)) \text{ and } (6, k(6))}$$

$$\frac{7-3}{6+4} = \frac{4}{10} = \boxed{\frac{2}{5}}$$

2. Approximate  $k'(2)$ .

$$\frac{k(3)-k(1)}{3-1} = \frac{4+2}{2} = \frac{6}{2} = \boxed{3}$$

3. Find the instantaneous rate of change of  $k$  at  $x = 3$ .

$$k'(3) = \boxed{6}$$

4. Write an equation of the line tangent to  $k$  at  $x = 1$ .

$$(1, -2) \quad k'(1) = 3 \quad \boxed{y + 2 = 3(x - 1)}$$

5. Find the instantaneous rate of change of  $g$  at  $x = \frac{\pi}{6}$ .

$$g'(x) = 2\cos x - 4\sin x \Rightarrow g'(\frac{\pi}{6}) = 2\cos \frac{\pi}{6} - 4\sin \frac{\pi}{6} = 2\left(\frac{\sqrt{3}}{2}\right) - 4\left(\frac{1}{2}\right) = \boxed{\sqrt{3} - 2}$$

6. Find the instantaneous rate of change of  $m$  at  $x = \pi$ .

$$m'(\pi) = \frac{4}{2} = \boxed{2}$$

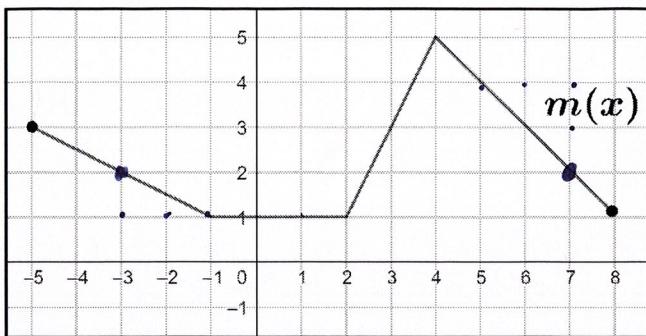
7. Is there a time  $c$ , where  $-4 < c < 6$ , such that  $k(c) = 5$ ? Give a reason for your answer.

$k(-4) = 3$  and  $k(6) = 7$ ;  $3 < 5 < 7$ , since  $k$  is differentiable,  $k'$  must be continuous on  $(-4, 6)$ , so yes IWT guarantees there must be at least one

8. Is there a time  $c$ , where  $-4 < c < -1$ , such that  $k'(c) = -4$ ? Give a reason for your answer.

$$f'(-4) = -5 \text{ and } k'(-1) = 2; -5 < -4 < 2 \quad K(c) = 5$$

Since  $k'$  is differentiable,  $k'$  must be continuous on  $(-4, -1)$ , so IWT guarantees there must be at least one  $k'(c) = 4$



$x$	-4	-1	1	3	6
$k(x)$	3	0	-2	4	7
$k'(x)$	-5	2	3	6	-4

*9-16 pt*  
 $f(x) = x^2 - 2x + 4$   
 $f'(x) = 2x - 2$

$$g(x) = 2 \sin(x) + 4 \cos(x)$$

$$h(x) = e^x - \frac{2}{x} + ex - 2e$$

**Directions:** The functions  $f$ ,  $g$ , and  $h$  are defined above along with the graph of  $m$  and a table of selected values for the differentiable functions  $k$  and  $k'$ . Use this information to find the following.

9. Find the average rate of change of  $f(x)$  on the interval  $[-1, 2]$ .

$$\frac{f(2) - f(-1)}{2 - (-1)} = \frac{(2^2 - 4 + 4) - ((-1)^2 + 2 + 4)}{3} = \frac{4 - 7}{3} = \boxed{-1}$$

10. Find the average rate of change of  $m(x)$  on the interval  $[-3, 7]$ .

$$\frac{m(7) - m(-3)}{7 - (-3)} = \frac{2 - 2}{10} = \boxed{0}$$

11. Let  $p(x) = 2m(x) - x^3$ . Find  $p'(-3)$ .

$$p'(x) = 2m'(x) - 3x^2; \quad p'(-3) = 2m'(-3) - 3(-3)^2 \\ = 2(-\frac{1}{2}) - 27 = \boxed{-28}$$

12. Find  $h'(x)$ .

$$h'(x) = e^x + \frac{2}{x^2} + e + \boxed{0}$$

13. Let  $q(x) = m(x)k(x)$ . Find  $q'(1)$ .

$$q'(x) = m(x) \cdot k'(x) + k(x) \cdot m'(x) \\ q'(1) = m(1) \cdot k'(1) + k(1) \cdot m'(1) = 1 \cdot 3 + (-2) \cdot 0 = 3$$

14. Let  $r(x) = \frac{f(x)}{k(x)}$ . Find  $r'(3)$ .

$$r'(3) = \frac{k(3) \cdot f'(3) - f(3) \cdot k'(3)}{[k(3)]^2} = \frac{4 \cdot 4 - 7 \cdot 6}{16} = \frac{16 - 42}{16} = \frac{-26}{16} = \boxed{-\frac{13}{8}}$$

15. Find the slope of the line tangent to the graph of  $m$  at  $x = -4$ .

$$m'(-4) = \boxed{-\frac{1}{2}}$$