

MVT, IVT, and EVT Worksheet

For problems 1-8, determine if the Mean Value Theorem applies to the function on the given interval. If it does, find the  $c$ -value. If it doesn't, explain why not.

1.  $f(x) = |x|$                        $[-1,3]$

2.  $f(x) = x^2 - 2x$                  $[1,3]$

3.  $f(x) = x^2 - 3x + 2$          $[1,2]$

4.  $f(x) = x^{2/3}$                      $[-2,2]$

5.  $f(x) = \frac{1}{x-4}$                      $[2,6]$

6.  $f(x) = \frac{x^2-x}{x}$                      $[-1,1]$

7.  $f(x) = \sin x$                      $[0, \pi]$

8.  $f(x) = \tan x$                      $[0, \pi]$

For problems 9-13, determine if the Intermediate Value Theorem would guarantee a  $c$ -value on the given interval.

9.  $f(x) = x^2 + x - 1$        $f(c) = 11$        $[0,5]$

10.  $f(x) = \frac{x}{x-1}$        $f(c) = 1$        $[0,2]$

11.  $f(x) = |x|$        $f(c) = 3$        $[-4,1]$

12.  $f(x) = \begin{cases} x, & x \leq 1 \\ 3, & x > 1 \end{cases}$        $f(c) = 2$        $[0,4]$

13.  $f(x) = \frac{x^2+x}{x-1}$        $f(c) = 6$        $\left[\frac{5}{2}, 4\right]$

For problems 14-16, find the  $c$ -values for the given problem.

14. Problem 9

15. Problem 11

16. Problem 13

For Problems 17-21, use the table below with selected values of the twice differentiable function  $k$ . Reach each explanation and decide whether you would apply IVT, EVT, or MVT.

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

17. Since  $k$  is differentiable, it is also continuous. Since  $k(6) = 2$  and  $k(7) = 0$ , and since 1 is between 2 and 0, it follows by \_\_\_\_\_ that  $k(c) = 1$  for some  $c$  between 6 and 7.
18. Since  $k$  is differentiable and, therefore, also continuous, and since  $\frac{k(3)-k(2)}{3-2} = -6$ , it follows by \_\_\_\_\_ that  $k'(c) = -6$  for some  $c$  in the interval  $(2,3)$ .
19. There must be a minimum value for  $k$  at some  $r$  in  $[1,7]$ , because  $k$  is differentiable and, therefore, also continuous. Hence the \_\_\_\_\_ applies.
20. There must be some value  $a$  in  $(2,6)$  for which  $k'(a) = 0$ , because  $k(2) = k(6)$ , and since  $k$  is differentiable, the \_\_\_\_\_ applies.
21. Since  $k$  is differentiable, the \_\_\_\_\_ guarantees some  $a$  in  $(4,5)$  for which  $k'(a) = 4$  and also some  $b$  in  $(5,6)$  for which  $k'(b) = -1$ . Then since  $k'$  is differentiable, and therefore also continuous, it follows by the \_\_\_\_\_ applied to  $k'$  that  $k'(c) = 0$  for some  $c$  in  $(a, b)$  and therefore in  $(4,6)$ .