Unit 3 Worksheet 10
AP Calculus AB

Determine the absolute maximum and absolute minimum value over the stated interval by applying the Extreme Value Theorem.

1. $f(x) = x^2 + 4x + 4$ $[-4,0]$

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

3. $f(x) = x^3 - 3x + 1$ $(-\frac{3}{2},3)$

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

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

6. $f(x) = x^3 - 12x$ $(0,4)$

7. $f(x) = \frac{x}{x-2}$ $[3,5]$

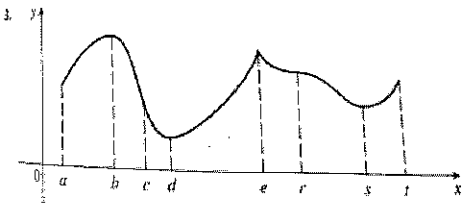
8. $f(x) = \frac{1}{x}$ $[-1,3]$

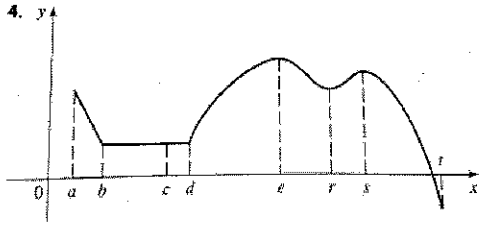
9. $f(x) = \frac{1}{1+x^2}$ $(-3,3)$

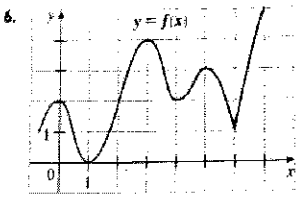
10. $f(x) = \sqrt[3]{x}$ $[-1,27]$

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

12. $f(x) = \sqrt{9-x^2}$ $[-1,2]$

3. 

4. 

6. 

7–10 ■ Sketch the graph of a function f that is continuous on $[0, 3]$ and has the given properties.

7. Absolute maximum at 0, absolute minimum at 3, local minimum at 1, local maximum at 2

8. Absolute maximum at 1, absolute minimum at 2

9. 2 is a critical number, but f has no local maximum or minimum

10. Absolute minimum at 0, absolute maximum at 2, local maxima at 1 and 2, local minimum at 1.5

11. (a) Sketch the graph of a function that has a local maximum at 2 and is differentiable at 2.
    (b) Sketch the graph of a function that has a local maximum at 2 and is continuous but not differentiable at 2.
    (c) Sketch the graph of a function that has a local

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① $f(x) = x^2 + 4x + 4$ $[-4, 0]$

$f'(x) = 2x + 4$

$x = -2$

x	y
-4	4
-2	0
0	4

Abs max (-4,4), (0,4)

Abs min (-2,0)

NOTATION

Max $y = 4$ at $x = -4, 0$

Min $y = 0$ at $x = -2$

② $f(x) = x^2 + 3x$ $[-2, 1]$

$f'(x) = 2x + 3$

$x = -3/2$

x	y
-2	-2
$-3/2$	-2.25
1	4

Abs max (1,4)

Abs min $(-3/2, -9/4)$

↑ -2.25

③ $f(x) = x^3 - 3x + 1$ $(-3/2, 3)$

$f'(x) = 3x^2 - 3$

$x = \pm 1$

x	y
$-3/2$	2.125
-1	3
1	-1
3	19

Abs max: None

Abs. min (1,-1)

~~④ $f(x) = x^3 - 3x$ $[-3/2, 3]$~~

NOT on WS

~~$f'(x) = 3x^2 - 3$~~

~~$x = \pm 1$~~

x	y
$-3/2$	1.125
-1	2
1	-2
3	18

~~Abs max (3,18)~~

~~Abs. min (1,-2)~~

④ $f(x) = x^3 - 3x^2$ $[-1, 3]$

$f'(x) = 3x^2 - 6x$

$3x(x-2)$

$x = 0, 2$

x	y
-1	-4
0	0
2	-4
3	0

Abs min (-1,-4), (2,-4)

Abs max (0,0), (3,0)

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⑤ $f(x) = x^3 - 12x$ $(0,4)$

$f'(x) = 3x^2 - 12$

$3(x^2 - 4) = 0$

$x = \pm 2$

x	y
0	0
2	-16
4	16

Abs min $(2, -16)$

Abs max None

⑥ $f(x) = \frac{x}{x-2}$, $[3,5]$

$f'(x) = \frac{(x-2)(1) - x}{(x-2)^2}$

$f'(x) = \frac{-2}{(x-2)^2}$

$f'(x) \neq 2$

x	y
3	3
5	1.6667

Abs min $(5, 1.6667)$

Abs max $(3,3)$

⑦ $f(x) = \frac{1}{x}$ $[-1,3]$

VA $x = 0$

not continuous

Abs min none (VA)

Abs max none

⑧ $f(x) = \frac{1}{1+x^2}$ $(-3,3)$

$f'(x) = \frac{-(2x)}{(1+x^2)^2}$

$x = 0$

x	y
-3	.1
0	1
3	.1

Abs max $(0,1)$

Abs min none

⑨ $f(x) = \sqrt[3]{x}$ $[-1,27]$

$f'(x) = \frac{1}{3}x^{-2/3}$

$x \neq 0$

x	y
-1	-1
0	0
27	3

Abs max $(27,3)$

Abs min $(-1,-1)$

⑩ $f(x) = \sqrt{9 - x^2}$ $[-1,2]$

$f'(x) = \frac{1}{2}(9-x^2)^{-1/2}(-2x)$

$x \neq \pm 3$ $x = 0$

x	y
-1	$\sqrt{8}$
0	3
2	$\sqrt{5}$

Abs max $(0,3)$

Abs min $(2, \sqrt{5})$

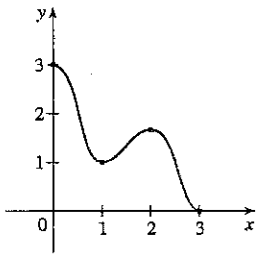
Section 4.2 Maximum and Minimum Values

3. Absolute maximum at b; absolute minimum at d; local maxima at b, e; local minima at d, s; neither a maximum nor a minimum at a, c, r, and t.

4. Absolute maximum at e; absolute minimum at t; local maxima at c, e, s; local minima at b, c, d, r; neither a maximum nor a minimum at a.

6. Absolute maximum value is $f(7) = 5$; absolute minimum value is $f(1) = 0$; local maximum values are $f(0) = 2$, $f(3) = 4$, and $f(5) = 3$; local minimum values are $f(1) = 0$, $f(4) = 2$, and $f(6) = 1$.

7.



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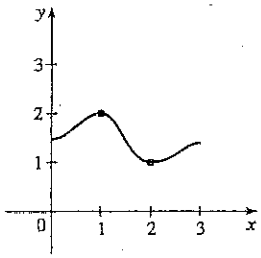

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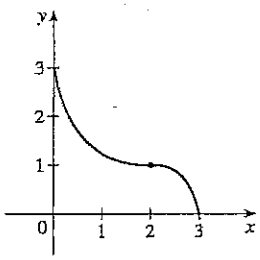

10.