

Homework Guide

1-8: Find the absolute maximum and absolute minimum values of f on the given interval.

1. $f(x) = 12 + 4x - x^2$, $[0, 5]$

2. $f(x) = 2x^3 - 3x^2 - 12x + 1$, $[-2, 3]$

$$f'(x) = 6x^2 - 6x - 12$$

$$0 = 6(x^2 - x - 2)$$

$$0 = 6(x - 2)(x + 1)$$

$x = 2 \quad x = -1$

x	$f(x)$
EP, -2	-3
C# -1	8 Abs max
C# 2	-19 Abs min
EP, 3	-8

$$f(-2) = 2(-8) - 3(4) - 12(-2) + 1 = -16 - 12 + 24 + 1 = 3$$

$$f(-1) = 2(-1) - 3(1) - 12(-1) + 1 = -2 - 3 + 12 + 1$$

$$f(2) = 2(8) - 3(4) - 12(2) + 1 = 16 - 12 - 24 + 1 = -19$$

$$f(3) = 2(27) - 3(9) - 12(3) + 1 = 54 - 27 - 36 + 1 = -8$$

Endpoints are absolute extrema OR nothing

3. $f(x) = x^3 - 6x^2 + 5$, $[-3, 5]$

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

$$f'(x) = 3(x^2 - 1)^2(2x)$$

$$0 = 6x(x^2 - 1)^2$$

$$6x = 0 \quad x^2 - 1 = 0$$

$$x = 0 \quad x^2 = 1$$

$$x = \pm 1$$

x	$f(x)$
EP -1	0
C# 0	-1 Abs min
C# 1	0
EP 2	27 Abs max

$$f(-1) = 0^3 = 0$$

$$f(0) = (-1)^3 = -1$$

$$f(1) = 0^3 = 0$$

$$f(2) = (3)^3 = 27$$

Answers:

- Absolute Max of 16 at $x = 2$
Absolute Min of 7 at $x = 5$
- Absolute Max of 5 at $x = 0$
Absolute Min of -76 at $x = -3$

- Absolute Max of 8 at $x = -1$
Absolute Min of -19 at $x = 2$
- Absolute Max of 27 at $x = 2$
Absolute Min of -1 at $x = 0$

5. $f(x) = \frac{x}{x^2 - x + 1}$, [0,3]

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

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

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

$$-x^2 + 1 = 0 \quad x^2 - x + 1$$

$$x^2 = 1 \quad \sqrt{(-1)^2 - 4(1)(1)}$$

$$x = \pm 1 \quad \sqrt{1 - 4}$$

~~garbage~~

x	f(x)
EP 0	0 Abs min
C# 1	1 Abs max
EP 3	.42857

6. $f(t) = \sqrt[3]{t(8-t)}$, [0,8]

7. $f(t) = 2\cos t + \sin 2t$, $\left[0, \frac{\pi}{2}\right]$

$$f'(t) = 2(-\sin t) + 2\cos(2t)$$

$$f'(t) = -2\sin t + 2\cos(2t)$$

$$0 = -2\sin t + 2\cos(2t)$$

$$y_1 = -2\sin(x) + 2\cos(2x)$$

Window $t = .523598$

x min: 0

x max: $\pi/2$

y min: -2

y max: 2

Find zeros EP. $\frac{\pi}{2} \approx 1.57$ | 0 Abs min

x	f(x)
EP. 0	2
C# .5235	2.5981 Abs max

8. $f(x) = xe^{-\frac{x^2}{8}}$, [-1,4]

Answers:

5) Absolute Max of 1 at $x = 1$
Absolute Min of 0 at $x = 0$

7) Absolute Max of 2.5981 at $t = \frac{\pi}{6}$

Absolute Min of 0 at $t = \frac{\pi}{2}$

6) Absolute Max of 7.5595 at $t = 2$
Absolute Min of 0 at $t = 0$ & 8

8) Absolute Max of 1.2131 at $x = 2$
Absolute Min of $-.8825$ at $x = -1$