Step 1: Find all the critical numbers of f in the given interval:

Critical numbers (found in previous example): 1, 3.

On $[-1, 2]$: critical number is 1

Step 2: Absolute max and absolute min can only occur at a critical # or at an endpoint.

So, we just need to plug critical #(s) and endpoint(s) to f and compare.

x	$f(x)$
Endpoint: -1	$f(-1) = (-1)^3 - 6(-1)^2 + 9(-1) + 1 = \boxed{-15}$
Critical #: 1	$f(1) = (1)^3 - 6(1)^2 + 9(1) + 1 = \boxed{5}$
Endpoint: 2	$f(2) = (2)^3 - 6(2)^2 + 9(2) + 1 = \boxed{3}$.

Absolute min $= -15$ and it occurs when $x = -1$

Absolute max $= 5$ and it occurs when $x = 1$.

Monday, March 18, 2019 9:38 AM

Ex. Find abs. max / abs. min of the given function on the given interval

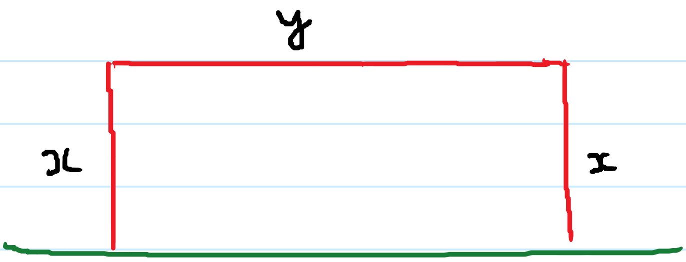
① $f(x) = x^{\frac{3}{5}}(4-x)$ on $[-1, 32]$.

② $g(x) = x + \sin x$ on $[0, 2\pi]$

③ $h(x) = \sin x + \cos x$ on $[0, 2\pi]$

④ $k(x) = 3x \cdot \sqrt{1-x^2}$ on $[0, 2]$.

Ex. A farmer has 2400 ft of fencing and wants to fence off a rectangular field that borders a river. He needs no fence along the river. What are the dimensions of the field that will maximize the area.



Area $= xy$

$\boxed{2x + y = 2400}$

$y = 2400 - 2x$

Area $= x \cdot (2400 - 2x)$; $[0, 1200]$

$= 2400x - 2x^2 \longrightarrow$ derivative $= 2400 - 4x = 0 \rightarrow \boxed{x = 600}$

1) Critical #s: $0, \frac{3}{2}$

x	$f(x) = x^{\frac{3}{5}}(4-x)$
Endpt: -1	$f(-1) = -5$
critical #: 0	$f(0) = 0$
critical #: $\frac{3}{2}$	$f\left(\frac{3}{2}\right) = 3.188\ldots$
Endpt: 32	$f(32) = -224.$

Absolute min $= -224$ occurs at $x = 32$

Absolute max $\simeq 3.188$ occurs at $x = \frac{3}{2}$

2) $g(x) = x + \sin x$ on $[0, 2\pi]$

$g'(x) = 1 + \cos x$

$g'(x) = 0 \rightarrow 1 + \cos x = 0 \rightarrow \cos x = -1 \rightarrow \boxed{x = \pi}$

critical #

x	$g(x) = x + \sin x$	
$\boxed{0}$	0	$\rightarrow$ abs. min
π	π	
$\boxed{2\pi}$	2π	$\rightarrow$ abs. max

③ $h(x) = \sin x + \cos x$ on $[0, 2\pi]$

$h'(x) = \cos x - \sin x$

$\rightarrow \cos x - \sin x = 0 \rightarrow \sin x = \cos x$

$\rightarrow \dfrac{\sin x}{\cos x} = 1 \longrightarrow \tan x = 1 \longrightarrow x = \dfrac{\pi}{4}, \dfrac{5\pi}{4}$

x	$h(x) = \sin x + \cos x$	
0	1	
$\frac{\pi}{4}$	$\sqrt{2}$	$\longrightarrow$ abs. max
$\frac{5\pi}{4}$	$-\sqrt{2}$	$\longrightarrow$ abs. min
2π	1	