$$\begin{aligned}\frac{d}{dx}x\sqrt{x-x^2} &= \sqrt{x-x^2} + x\frac{1}{2\sqrt{x-x^2}}(1-2x)\\ &= \sqrt{x-x^2} + \frac{x-2x^2}{2\sqrt{x-x^2}}\\ &= \frac{2(x-x^2)+(x-2x^2)}{2\sqrt{x-x^2}}\\ &= \frac{3x-4x^2}{2\sqrt{x-x^2}}\end{aligned}$$

Now critical points of f are where $f'(x) = 0$ or when $f'(x)$ is undefined. Zeroes of $f'(x)$ occur when the numerator of the derivative is zero.

$$3x - 4x^2 = x(3-4x) = 0 \Rightarrow x = 0 \text{ or } x = \frac{3}{4}$$

And $f'(x)$ is undefined when the denominator is 0, this happens

$$x - x^2 = x(1-x) = 0 \Rightarrow x = 0 \text{ or } x = 1$$

So the critical values are $x = 0, 3/4, 1$. Next I will combine the last two steps: We will evaluate $f(x)$ at the critical points and endpoints of the interval and then compare:

x	f(x)
0	$f(0) = 0\sqrt{0-0^2} = 0$
$\frac{3}{4}$	$f(3/4) = \frac{3}{4}\sqrt{\frac{3}{4}-(\frac{3}{4})^2} > 0$
1	$f(1) = 1\sqrt{1-1^2} = 0$

Since 0 is the smallest value we see for $f(x)$ in this chart, we have that 0 and 1 are both absolute minima of f(x). Since $f(3/4) > 0$ this means $x = 3/4$ is an absolute maximum of the function f(x).

Example Find the absolute maxima and minima of the function $f(x) = |x|$ on the interval $[-1, 2]$.
First absolute value function is continuous on all of $\Re$, so it is continuous on $[-1, 2]$. Next we need the derivative of f(x). Recall that

$$f'(x) = \begin{cases} -1 & \text{if } x < 0 \\ dne & \text{if } x = 0 \\ 1 & \text{if } x > 0 \end{cases}$$

So $x = 0$ is the only critical value of $f(x)$. Next we need to evaluate $f(x)$ at the critical point and endpoints of the interval.