19. Use the guidelines of this section to sketch the curve.

$y = x\sqrt{5 - x}$

Domain: We can't have a negative number under radical. So, $5 - x \geq 0 \;\Rightarrow\; 5 \geq x.$

Therefore, D: $(-\infty, 5]$.

Intercepts:

$f(0) = 0$

$0 = x\sqrt{5-x}$

$x = 0$ and $x = 5$

Symmetry:

Even?
$f(x) = f(-x)$?

$f(2) = 6 \neq f(-2) = \text{undefined}$

Odd?
$-f(x) = f(-x)$?

$-f(2) = -6 \neq f(-2) = \text{undefined}$

Asymptotes:

$$\lim_{x\to 5^-} x\sqrt{5-x} = 0$$

$$\lim_{x\to -\infty} x\sqrt{5-x} = -\infty$$

$$\lim_{x\to \infty} x\sqrt{5-x} = \text{undefined}$$

Decreasing/Increasing Intervals:

$$f(x) = x \cdot (5-x)^{1/2}$$

$$f'(x) = 1 \cdot (5-x)^{1/2} + x \cdot \tfrac{1}{2}(5-x)^{-1/2} \cdot -1$$

$$= (5-x)^{1/2} - \frac{x}{2\sqrt{5-x}}$$

$$= \sqrt{5-x} - \frac{x}{2\sqrt{5-x}}$$

$$= \frac{(2\sqrt{5-x})(\sqrt{5-x}) - x}{2\sqrt{5-x}}$$

$$= \frac{2(5-x) - x}{2\sqrt{5-x}}$$

$$= \frac{10 - 2x - x}{2\sqrt{5-x}}$$

$$= \frac{10 - 3x}{2\sqrt{5-x}}$$

Local Min./Max.:

$f'(x) = 0$ @ $10 - 3x = 0$

$$\frac{10}{10} = \frac{3x}{3} = \frac{10}{3} = x$$

	$10-3x$	$2\sqrt{5-x}$	Prod	f
$(-\infty, 10/3)$	$+$	$+$	$+$	$\nearrow$
$(10/3, 5)$	$-$	$+$	$-$	$\searrow$

So, loc. max. @ $10/3$

$$\left(10/3, f(10/3)\right) = (10/3, 4.3)$$

Concavity:

$$f'(x) = \frac{10-3x}{2\sqrt{5-x}}$$

$$f''(x) = \frac{-3(2\sqrt{5-x}) - (10-3x)\left[\frac{1}{2}(2\sqrt{5-x})^{-1/2} \cdot -1\right]}{(2\sqrt{5-x})^2}$$

$$= \frac{-6\sqrt{5-x} - (10-3x)\left[-2(\sqrt{5-x})^{-1/2}\right]}{4(5-x)}$$

$$= \frac{(5-x)^{-1/2}\left[-6(5-x) + (10-3x)\right]}{4(5-x)}$$

$$= \frac{3x-20}{4(5-x)^{3/2}}$$

$$f''(x) = 0 \Rightarrow x = 20/3 > 5$$

$$f''(0) < 0 = \cap$$

Inflection Points:

There are no inflection points.

Graph: