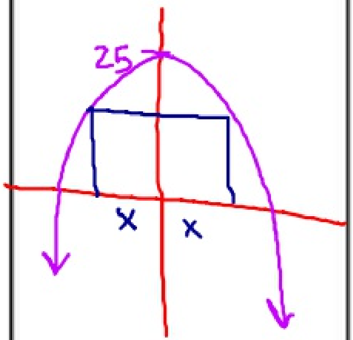
What you'll Learn About:
How to use derivatives to solve real world problems

A) A rectangle is to be inscribed under one arch of the sine curve. What is the largest area the rectangle can have, and what dimensions give that area.

B) A rectangle is to be inscribed between the curve $y = 25 - x^2$ and the x-axis. What is the largest area the rectangle can have, and what dimensions give that area.



$b = 2x$

$h = 25 - x^2$

$A = lw$

$A = b \cdot h$

$A(x) = 2x(25 - x^2)$

$A(x) = 50x - 2x^3$

$\boxed{A'(x) = 50 - 6x^2}$

$0 = 50 - 6x^2$

$6x^2 = 50$

$x^2 = \frac{50}{6}$

$x^2 = \frac{25}{3}$

$x = \frac{\pm 5}{\sqrt{3}}$ $\quad x = \frac{5}{\sqrt{3}}$

Local max b/c

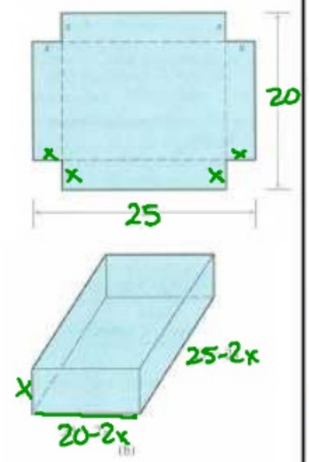
$A'\left(\frac{5}{\sqrt{3}}\right) = 0$ and

$A''(x) = -12x$

$A''\left(\frac{5}{\sqrt{3}}\right) = \boxed{-12\left(\frac{5}{\sqrt{3}}\right)} < 0$

$b = \frac{10}{\sqrt{3}}$ $\quad h = 25 - \left(\frac{5}{\sqrt{3}}\right)^2$

$A = \left(\frac{10}{\sqrt{3}}\right)\left(25 - \left(\frac{5}{\sqrt{3}}\right)^2\right)$



An open-top box is to be made by cutting congruent squares of side length x from the corners of a 20 by 25 inch sheet of tin and bending up the sides. How large should the squares be to make the box hold as much as possible? What is the resulting volume?

$V = lwh$

$h = x$

$l = 20-2x$

$w = 25-2x$

$V(x) = x(25-2x)(20-2x)$

$V(x) = x(500 - 90x + 4x^2)$

$V(x) = 500x - 90x^2 + 4x^3$

$V'(x) = 500 - 180x + 12x^2$

$0 = 500 - 180x + 12x^2$

$x = 3.681$

$V''(x) = -180 + 24x$

$V''(3.681) = -180 + 24(3.681)$

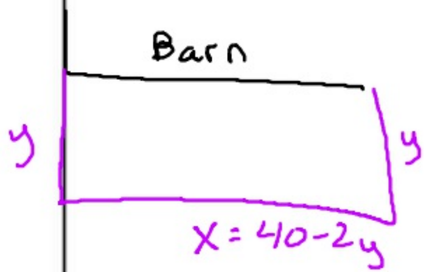
$V''(3.681) < 0$

window [0,10]

Box: 3.681in x 3.681 in

Volume = 820.528 in^3

You have 40 feet of fence to enclose a rectangular garden along the side of a barn. What is the maximum area that you can enclose?



$A = lw$ $\quad P = x + 2y$

$P = 40$

$40 = x + 2y$

$40 - 2y = x$

$A(y) = y(40-2y)$

$A(y) = 40y - 2y^2$

$A'(y) = 40 - 4y$ $\qquad A''(y) = -4 < 0$

$y = 10$ $\qquad$ Local Max

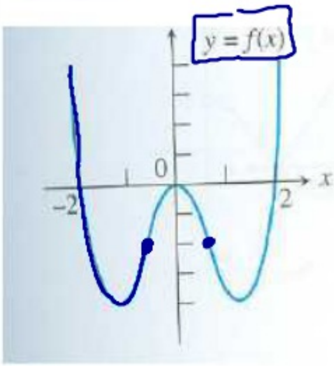
$w = 10$

$l = 20$

$A = 200 \text{ ft}^2$

What you'll Learn About:
How to interpret graphs of f(x), $f'(x)$, and $f''(x)$

22) ~~Use~~ the graph of the function f ~~to~~ estimate where → P.I.P.S → concave up
a) $\boxed{f'=0}$ b) $f'>0$ c) $f'<0$ d) $f''=0$ e) $f''>0$ f) $f''<0$



a) $x \simeq -1.2,\ 1.2,\ 0$ H.T. Max/min

b) pos slope $(-1.2, 0) \cup (1.2, \infty)$

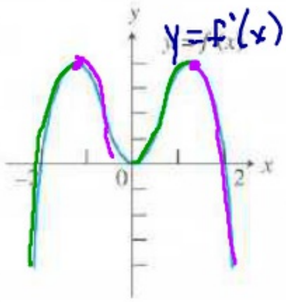
c) neg slope $(-\infty, -1.2) \cup (0, 1.2)$

d) $x \simeq -.6, .6$

e) $(-\infty, -.6) \cup (.6, \infty)$

f) $(-.6, .6)$

22) Use the graph of the function f' to estimate the intervals on which
a) f is increasing b) f is decreasing c) f is concave up d) f is concave down
and then use the graph of the function f' to find
e) any extreme values and f) any points of inflection



a) $f'>0$ $(-2, 0) \cup (0, 2)$

b) $f'<0$ $(-\infty, -2) \cup (2, \infty)$

e) Extreme Values
C.P. $f'=0$ $x = -2, 0, 2$
Minimum neither maximum

c) concave up
slope of $f' > 0$
$(f''>0)$
$(-\infty, -1.2) \cup (0, 1.2)$

d) concave down
slope of $f' < 0$
$(f''<0)$
$(-1.2, 0) \cup (1.2, \infty)$

f) Pts of Inflection
(max/mins of f')
$x \simeq -1.2, 0, 1.2$