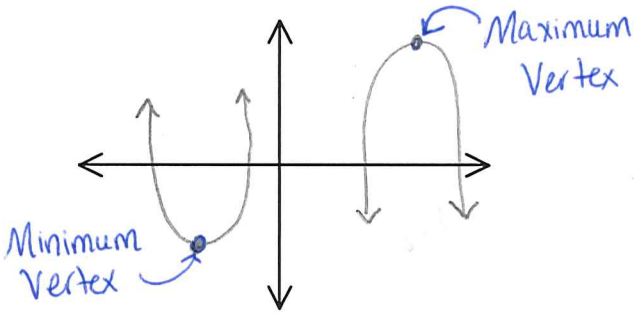


Section 2.4: Finding Maximums & Minimums of Polynomial Functions

Essential Question:

How do you find minimum or maximum values?

Let's Review QUADRATIC FUNCTIONS...



$$f(x) = ax^2 + bx + c \quad a \neq 0$$

$$\text{A.O.S } x = \frac{-b}{2a}$$

Vertex: plug in A.O.S x-value and solve for y
 $(-\frac{b}{2a}, y)$

Example 1: Two numbers have a difference of 6. Find their minimum possible product. multiply ↗

1st number = x

2nd number = $x + 6$
 (or $x - 6$)

$$f(x) = x(x+6) = x^2 + 6x$$

Minimum

$$x = \frac{-b}{2a} = \frac{-6}{2(1)} = \frac{-6}{2} = -3$$

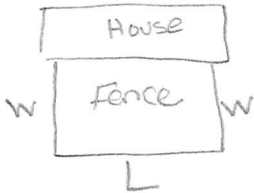
$$f(-3) = (-3)^2 + 6(-3) = -9$$



Min value = -9

*Notes: $x = -3$
 $x + 6 = -3 + 6 = 3 \therefore (-3)(3) = -9 \checkmark$

Example 2: Your neighbor is constructing a dog pen using one side of his house as a wall for the pen. If he has 60 m of fencing for the other three sides, find the dimensions of the pen that give the greatest area. $A = L \times W$



① $P = 2w + L$

$$60 = 2w + L$$

② $L = 60 - 2w$

③ $A = (60 - 2w)(w)$

④ $A = 60w - 2w^2$

max vertex opens down

⑦ $L = 60 - 2(15)$

$$L = 60 - 30$$

$$L = 30$$

⑧ Dimensions

$W = 15 \text{ ft}$

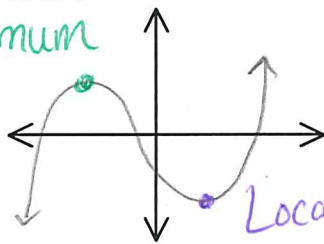
$L = 30 \text{ ft}$

$$A = (15)(30) = \underline{\underline{450 \text{ ft}^2}}$$

⑥ $x = w = 15$

CUBIC FUNCTIONS

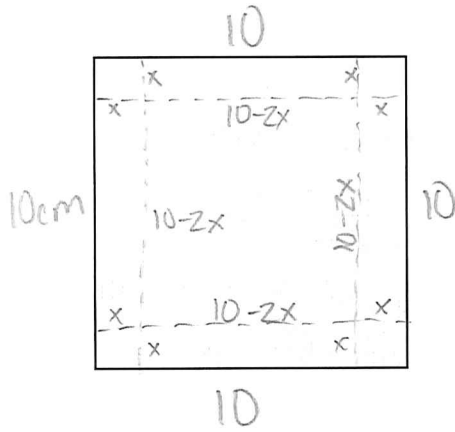
Local Maximum
 "Peak"



Local Minimum
 "Valley"

Example 3: An open box is to be formed by cutting squares from a square sheet of metal 10 cm on a side and then folding up the sides. Find the approximate value of x that maximizes the volume. Then give the approximate maximum volume.

$$V = L \cdot W \cdot H$$



$$V = (10 - 2x)(10 - 2x)(x)$$

$$V = (10 - 2x)^2(x)$$

Roots/zeros = 0 and 5

$x = 0$
 $10 - 2x = 0$
 $10 = 2x$
 $x = 5$



Adjust graph "Window" to zoom in @ peak "trace" (1.67, 74.07)

Section 2.4 Summary:

Max Area Vol = 74.07 cm^3 @ height = $x = 1.67 \text{ cm}$

To find max or min vertex of a quadratic use A.O.S formula $x = \frac{-b}{2a}$, then plug in x value to find maximum or minimum value (area).

To find the max or min vertex of a cubic first sketch a graph then locate the max or min value on a graphing calculator by "tracing" along the cubic function curve.