

TUES 01-03-06

AP CALCULUS "IN CLASS" GIFT 4.4

1. The sum of two non-negative numbers is 10. Find the numbers if the sum of the number and the cubed root of the number:
- a) is a maximum? *OTHER*
- b) is a minimum?

REPRESENT BOTH NUMBERS IN TERMS OF
A SINGLE VARIABLE.

ONE NUMBER = x

OTHER NUMBER = $10 - x$

MAX/MINIMIZE A FUNCTION:

$f(x) = 10 - x + \sqrt[3]{x}$

$g(x) = x + \sqrt[3]{10 - x}$

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DOMAIN
 $0 \leq x \leq 10$

ABS. MAX
ABS. MIN

$$f(x) = 10 - x + x^{\frac{2}{3}}$$

$$f'(x) = -1 + \frac{2}{3}x^{-\frac{1}{3}}$$

$$f'(x) = -1 + \frac{1}{3\sqrt[3]{x^2}}$$

CRITICAL #'S?

$x=0$ (f' IS UND.)

$$f'(x) = 0 = -1 + \frac{1}{3\sqrt[3]{x^2}}$$

$$1 = \frac{1}{3\sqrt[3]{x^2}}$$

$$3\sqrt[3]{x^2} = 1$$

$$\sqrt[3]{x^2} = \frac{1}{3}$$

$$\left(x^{\frac{2}{3}}\right)^{\frac{3}{2}} = \left(\frac{1}{3}\right)^{\frac{3}{2}}$$

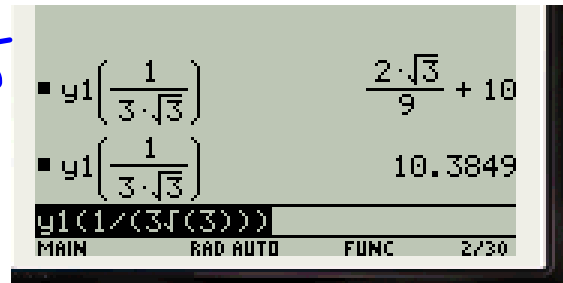
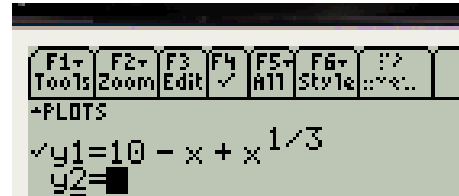
$$x = \sqrt{\left(\frac{1}{3}\right)^3}$$

$$x = \sqrt{\frac{1}{27}}$$

$$x = \frac{1}{3\sqrt{3}} \text{ IS A CRIT \#}$$

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TABLE

x	$f(x) = 10 - x + \sqrt[3]{x}$
0	10
$\frac{1}{3\sqrt{3}}$	$\frac{2\sqrt{3}}{9} + 10$ ≈ 10.385
10	$\sqrt[3]{10} \approx 2.154$



ABS. MAX IS $\frac{2\sqrt{3}}{9} + 10$ WHEN

THE TWO #'S ARE $\frac{1}{3\sqrt{3}}$ AND $10 - \frac{\sqrt{3}}{9}$

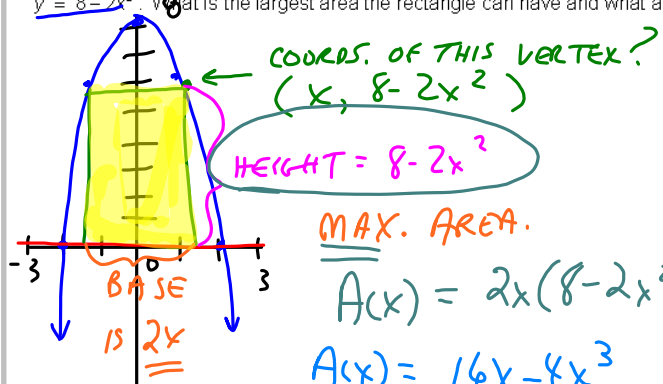
ABS. MIN. IS $\sqrt[3]{10}$

WHEN THE #'S

ARE 10, 0.



2. A rectangle has its ~~base on the x-axis~~ and its two upper vertices on the graph of $y = 8 - 2x^2$. What is the largest area the rectangle can have and what are its dimensions?



MAX. AREA.

$$A(x) = 2x(8 - 2x^2)$$

$$A(x) = 16x - 4x^3$$

$$A'(x) = 16 - 12x^2 = 0$$

$$16 = 12x^2$$

$$\frac{16}{12} = \frac{4}{3} = x^2$$

IS IT A MAX OR MIN? $x = \pm \sqrt{\frac{4}{3}} = \frac{2\sqrt{3}}{3}$

$$A''(x) = -24x$$

$$A''\left(x = \frac{2\sqrt{3}}{3}\right) \text{ IS NEG.}$$

Dimensions: $\frac{4\sqrt{3}}{3}$ BY $\frac{16}{3}$ \therefore A REC. MAX

MAX AREA $\frac{64\sqrt{3}}{9}$ SQ. UNITS

O.T.L.

· CORRECT TESTS

· P.214 1, 2, 3, 6, 9, 32