

Simplify your final answer. Show all relevant work for each problem. Little to no work, even with a correct answer, will receive little to no credit.

1. Use the following information to sketch the graph of  $f(x)$ .

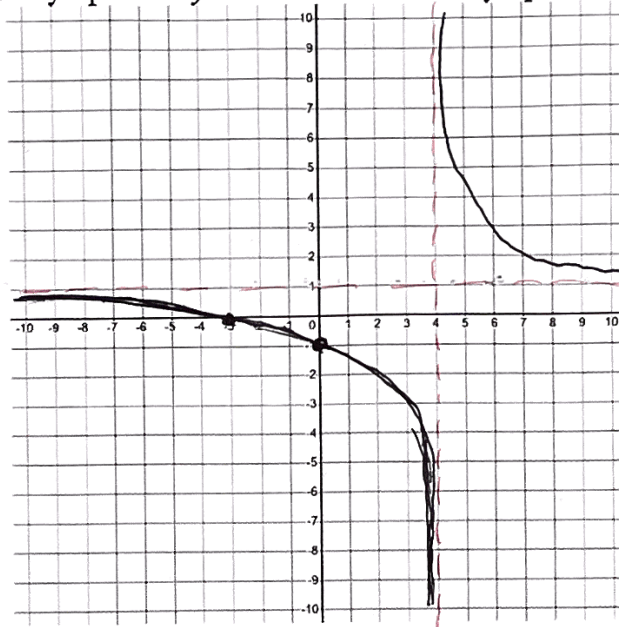
The points  $(-3,0)$  and  $(0, -1)$  are on the graph of the function  $f(x)$ .

$f'(x) < 0$  on the intervals  $(-\infty, 4)$  and  $(4, \infty)$ .

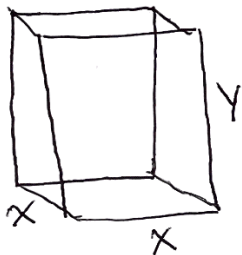
$f''(x) > 0$  on the interval  $(4, \infty)$ .

$f''(x) < 0$  on the interval  $(-\infty, 4)$ .

$f(x)$  has a horizontal asymptote at  $y = 1$  and a vertical asymptote at  $x = 4$ .



2. A rectangular box has a square base. If the sum of the height and the perimeter of the square base is 18 in, what is the maximum possible volume of the box? (Be sure to check that your answer does give a maximum.)



$$V = x^2 y$$

$$V = x^2 (18 - 4x) \quad \left[0, \frac{9}{2}\right]$$

$x$	$V$
0	0
3	54 ← Max
$\frac{9}{2}$	0

$$18 = y + 4x$$

$$V = 18x^2 - 4x^3$$

$$\Rightarrow 18 - 4x = y$$

$$V' = 36x - 12x^2$$

$$V' = 12x(3 - x)$$

$$12x(3 - x) = 0$$

$$\Rightarrow x = 0, x = 3$$

The maximum possible volume is  $54 \text{ in}^3$ .