Math 1712 - Spring 2012
Quiz 3 - SHOW YOUR WORK

NAME: _____ TA: _____

1. (10 points) Let $f(x) = 3x^4 - 4x^3$. a. Find the **intervals** where $f(x)$ is increasing and the intervals where $f(x)$ is decreasing; put your answer in interval notation b. Find all relative max and relative min; find both the x & y values. **SHOW YOUR WORK!**

A. Solve $f'(x) = 0$ and $f'(x)$ DNE
$f(x) = 3x^4 - 4x^3 \Rightarrow f'(x) = 12x^3 - 12x^2 = 12x^2(x-1) \Rightarrow x = 0 \;\&\; x = 1$
$f'(x)$ DNE has no solutions

B. Test $f'(x)$

_____$f' < 0$_____ **0** _____$f' < 0$_____ **1** _____$f' > 0$_____
decreasing **decreasing** **increasing**

a. The graph of $f(x)$ is decreasing on the intervals $(-\infty, 0)$ & $(0, 1)$

The graph of $f(x)$ is increasing on the interval $(1, \infty)$

b. The point $x = 1$ & $y = f(1) = -1$ is a relative minimum
no relative maximums

2. (10 points) The temperature of a patient with an intestinal illness is given by $T(t) = -0.1t^2 + 1.4t + 98.6$, $0 \le t \le 12$, where T is the temperature of the patient in degrees Farenheit at time t, in hours. Use the second derivative test to find the relative maximum of this function, explain why this is a relative maximum, and explain what the relative maximum means in terms of T & t. Use the correct units in your answers. Show your work.

$$T(t) = -0.1t^2 + 1.4t + 98.6 \Rightarrow T'(t) = -0.2t + 1.4 = 0 \Rightarrow t = \frac{1.4}{0.2} = 7 \text{ hours}$$

Since $T'(t) = -0.2 < 0$, $t = 7$ *hours* & $T(7) = 103.5^o$ is the relative maximum.

This means that the patient's highest temperature - 103.5^o - occurs at 7 hours.

3. (10 points) Let $h(x) = x^4 - 4x^3$. Find the intervals where the graph of $h(x)$ is concave up and the intervals where the graph of $h(x)$ is concave down. Put your answer in interval notation. Show your work.

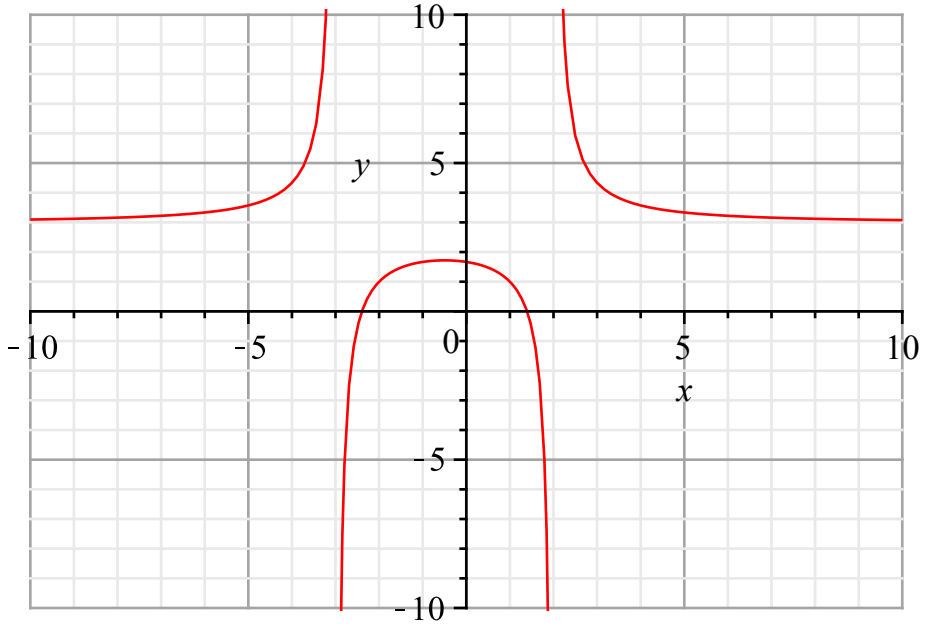
$h(x) = x^4 - 4x^3 \Rightarrow h'(x) = 4x^3 - 12x^2 \Rightarrow h''(x) = 12x^2 - 24x = 12x(x-2) = 0 \Rightarrow x = 0 \;\&\; x = 2$

Test $h''(x)$

$h'' > 0$	0	$h'' < 0$	2	$h'' > 0$
concave up		**concave down**		**concave up**

The graph of $h(x)$ is concave up on the intervals $(-\infty, 0)$ & $(2, \infty)$
The graph of $h(x)$ is concave down on the interval $(0, 2)$

EXTRA CREDIT : (5 points) Below is the graph of a function $y = f(x)$. Find the vertical and horizontal asymptotes. Identify them by their equations (e.g. $y = -4$ is a horizontal asymptote and $x = 7$ is a vertical asymptote). Also **sketch the asymptotes** on the graph as dotted lines.



The vertical asymptotes are $x = -3$ & $x = 2$. The horizontal asymptote is $y = 3$.