EXAM 2 - MATH 112 Friday, October 12

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Compute the following derivatives:

(a) $\left[6\sqrt[3]{x^2} - \frac{9}{\sqrt[3]{x}}\right]' =$

(b) $\left[x^3(2x-3)^5\right]' =$

(c) $\left[\frac{x+1}{3x^2-7x}\right]' =$

2. Find an equation for the tangent line to $f(x) = x^2(2x^3 + x + 5)^3$ at $x = -1$.

3. Suppose that an object moving on a straight line is located at $s(t) = \dfrac{5t+2}{t-1}$ meters from the origin at time $t > 1$ in seconds.

   (a) Find the velocity of the object at $t = 2$ seconds.

   (b) Find its acceleration at time $t = 3$ seconds.

4. Consider the function $f(x) = \dfrac{x}{x^2 - 9}$.

(a) Find the domain of f.

(b) Find the vertical and horizontal asymptotes of f.

Vertical Asymptotes (Lines):

Horizontal Asymptotes (Lines):

(c) Find the first derivative and its critical points.

(d) Create a sign table for the first derivative and draw conclusions about the monotonicity (intervals where it is increasing/decreasing) and the relative extrema (max/min) of f.

5. Consider the function $f(x) = -x^4 + 4x^3$.

(a) Find the first derivative and its critical points.

(b) Find the second derivative and its critical points.

(c) Create the **combined sign table** for the first and the second derivatives, making sure to give a summary of the monotonicity, relative extrema, concavity and inflection points of f at the last line of the table.

(d) Roughly sketch the graph of $y = f(x)$, clearly indicating (by labels) all important points.