Name: _____

Math 181-Quest 3 Dr. Rebin Muhammad ID: _____

Do not use any unapproved aids while taking this assessment. Read each question carefully and be sure to show all work in the space provided.

1. Suppose an oil spill in the ocean formed a circle and was growing at a rate of 78 feet^2/minute. When the oil slick reaches a radius of 31, how fast is the radius of the oil spill growing?

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2. Explain how to find the global minimum and global maximum values of the function $f(x) = 2\,x^3 - 39\,x^2 + 180\,x + 93$ on the interval $[2, 5]$.

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3. Explain how to find the following for the function $f(x) = x^3 + \frac{39}{2}\,x^2 + 120\,x - 1$.

   (a) The open intervals where $f(x)$ is increasing or decreasing.

   (b) The local extrema of $f(x)$.

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4. For each of the following functions, describe the open intervals where it is concave up or concave down, and any inflection points.

   (a) $f(x) = \frac{1}{5}x^5 - \frac{8}{3}x^3$

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5. The following chart describes the values of $f(x)$ and its first and second derivatives at or between a few given values of x, where $\nexists$ denotes that $f(x)$ does not exist at that value of x.

x	-10		-7		-5		-3		-1		1		4		7		10	
$f(x)$	1		-1		$\nexists$		0		$\nexists$		2		$\nexists$		2		1	
$f'(x)$	$-$		$-$		$+$		$+$		$+$		$+$		$-$		$-$		$-$	
$f''(x)$	$-$		$+$		$+$		$-$		$+$		$-$		$-$		$+$		$+$	

Assume that $f(x)$ has vertical asymptotes at each x-value where $f(x)$ does not exist, that $\lim_{x\to-\infty} f(x) = 3$, and that $\lim_{x\to\infty} f(x) = -1$.

Use this information to sketch a reasonable graph of $f(x)$.

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6. For each limit, explain if L'Hôpital's Rule may be applied. If it can, explain how to use this rule to find the limit.

(a)
$$\lim_{x \to 8} \frac{x^2 - 4\,x - 32}{x^2 + x - 72}$$

(b)
$$\lim_{x \to 0} \frac{-7\,\cos\left(9\,x\right) + 7}{-6\,x}$$

(c)
$$\lim_{x \to \infty} \frac{-6\,x - 2\,\log\left(x\right)}{3\,x - 9}$$

(d)
$$\lim_{x \to 0} \frac{-4\,\sin\left(8\,x\right) + 5}{-2\,x - 3}$$