Name: _____

Write all of your responses on these exam pages, use the back if necessary. Show all your work, answers without supporting justification will not receive credit.

1. (*30 Points*): Find the following limits, do not use Bernoulli's (l'Hospital's) Rule.

   (a) $\lim_{h\to 0} \dfrac{(h-1)^3+1}{h}$

   (b) $\lim_{x\to 0^+} \tan^{-1}(1/x)$

(c) $\lim_{x \to 0} \cos(x^3 + 3x)$

2. (*20 Points*): Using the definition of the derivative find $f'(x)$ for $f(x) = \dfrac{2}{x^2}$.

3. (*50 Points*): Using the derivative rules find $f'(x)$ for the following functions,

   (a) $f(x) = 10^{\tan(\pi x)}$

   (b) $f(x) = \dfrac{x^4 - 1}{x^4 + 1}$

(c) $f(x) = \cos(x)^{\sin(x)}$

(d) $f(x) = x^2 \sec(\pi x)$

(e) $f(x) = \dfrac{\sin(x)}{x^3}$

(f) $f(x) = \sinh(x^2)\tanh(x)$

4. (*15 Points*): Find $\dfrac{dy}{dx}$ of $y^2 \sin(x) = \cos(xy)$.

5. (*20 Points*): Find the absolute minimum and absolute maximum of $f(x) = x + 2\cos(x)$ on $[-\pi, \pi]$.

6. (*30 Points*): Given the function $f(x) = -2x^3 - 3x^2 + 12x$,

   (a) Find $f'(x)$.

   (b) Find all the critical numbers to the function.

   (c) Find the intervals of increasing and decreasing of the function.

   (d) Find all local maximums and minimums of the function.

   (e) Find $f''(x)$.

   (f) Find all the places where the function could change concavity.

   (g) Find the intervals of concave up and concave down of the function.

   (h) Find all of the points of inflection.

Note that the next page is blank for you to continue your solutions to this exercise.

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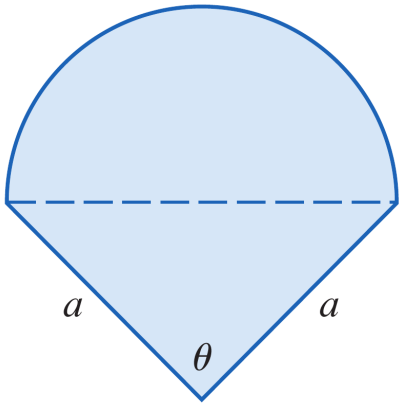
7. (*15 Points*): The figure shows an isosceles triangle with equal sides of length a surmounted by a semicircle. What should the measure of angle θ be in order to maximize the total area?



8. (*30 Points*): Find the following integrals,

(a) $\displaystyle\int \frac{\sec(x)\tan(x)}{1+\sec(x)}\,dx$

(b) $\displaystyle\int_1^9 \frac{\sqrt{x}-2x^2}{x}\,dx$

(c) $\displaystyle\int_0^{\pi/4} (1+\tan(x))^3 \sec^2(x)\, dx$

(d) $\displaystyle\int \sinh(1+4x)\, dx$