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**Question 1 [10 points]:** Use the definition of the derivative to determine  $f'(x)$  if  $f(x) = \frac{3}{x^2 - 2}$ .  
(No credit will be given if  $f'(x)$  is found using derivative rules, though you may check your answer using the rules.)

**Question 2:**

(a)[5 points] Compute  $g''(1)$  if  $g(x) = \frac{2\sqrt{x} - \pi x}{\sqrt[3]{x^2}}$ .

(b)[5 points] Determine an equation of the tangent line to the curve  $y = \frac{\sin(\theta)}{2} - \frac{2}{\cos(\theta)}$  at the point where  $\theta = \pi$ .

**Question 3:**

(a)[3 points] Differentiate:  $q(t) = -(5t^3 + t) \sec(t)$  .

(b)[3 points] Differentiate:  $y = \frac{x}{\left(x + \frac{c}{x}\right)}$  where  $c$  is a constant.

(c)[4 points] Evaluate and simplify  $f'(1)$  if  $f(x) = \frac{e^x}{x^e}$  .

**Question 4:**

(a)[3 points] Differentiate:  $y = \cos(x^2) \sin^2(x)$  .

(b)[3 points] Differentiate:  $h(x) = \csc(1/x) - \tan(3e^x)$  .

(c)[4 points] Compute  $\frac{dy}{dx}$ :  $y = \sqrt{\cos^3(\sqrt{x})}$  .

**Question 5:**

(a)[5 points] Determine  $y'$  by implicit differentiation:  $y \sin(x^2) = x \sin(y^2)$ .

(b)[5 points] Determine all values of  $x$  at which tangent lines to the graph of  $f(x) = e^{\frac{x^3}{3} - x^2 - 8x}$  are horizontal.