Math 2315 - Calculus 2
Calculus 1 Review Questions Part 1

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1. Compute the following limit: $\lim_{x\to 0} \dfrac{\tan(x^2)}{4x^2}$

2. Compute the following limit: $\lim_{x\to -\infty} \dfrac{3e^{-x} - 4e^{2x}}{2e^{-x} + 5e^{3x}}$

3. Find an equation of the tangent line to $y = 3\tan(2x) + 1$ at $x = \dfrac{\pi}{8}$.

4. Compute the following derivative: $\dfrac{d}{dz}\sin^2\left(\tanh^{-1}(2z)\right)$

5. Compute the following derivative: $\dfrac{d}{dr}\displaystyle\int_{r^2}^{\sin(r)} e^{2t} + t^2\,\mathrm{d}t$

6. Find an equation of the tangent line to $y^2 + x\cos(y) = 4 - x$ at $(x, y) = (2, 0)$.

7. Sketch a graph of $f(x) = \dfrac{x}{\sqrt{x^2+2}}$. In order to accomplish this, compute and state (a) the domain, (b) x-, y-intercepts, (c) vertical and horizontal asymptotes, (d) critical points, (e) intervals of increase and decrease, (f) inflection points, and (g) intervals of concavity.

8. Find the point on the curve $y = \cos(x)$ closest to the origin.

9. A rectangular tank with base 4 m $\times$ 2 m and height 3 m is being filled at a rate of 2 m^3/min. Determine the rate at which the height of the water in the tank is rising when the tank is half full.

10. Set up the integral(s), *but do not evaluate*, to compute the finite area bounded by the functions $y = 2x(3 - x)$, $y = -2x$, and $y = 4x - 12$.

11. Set up the integral(s), *but do not evaluate*, to compute the volume of surface of revolution of the region bounded by $y = \sin(x)$ and $y = \cos(x)$ for $\dfrac{\pi}{4} \le x \le \dfrac{5\pi}{4}$ and revolved around the line $x = -1$. You may use choose whichever method you wish for this problem.

12. Set up the integral(s), *but do not evaluate*, to compute the volume of surface of revolution of the region bounded by $y = \sin(x)$ and $y = \cos(x)$ for $\dfrac{\pi}{4} \le x \le \dfrac{5\pi}{4}$ and revolved around the line $y = 2$. You may use choose whichever method you wish for this problem.

13. Let $f(x) = \tanh^{-1}(\sin(x))$, $g(x) = \sinh^{-1}(\tan(x))$, and $h(x) = \cosh^{-1}(\sec(x))$. Compute the derivatives $f'(x)$, $g'(x)$, and $h'(x)$ and then *simplify as fully as possible*. Finally, make a clever observation.