Math 30 – Workshop #18

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1. Differentiate the following functions:

   (a) $f(x) = x^2 \sin(x^2)$

   (b) $g(x) = \ln(x + e^{\cos x})$

   (c) $h(x) = \dfrac{\sqrt[3]{x}}{\ln x}$

   (d) $j(x) = \tan^2(x^2) + \ln(e^x + 1)$

   (e) $l(x) = e^{\sqrt{\ln(5-x)}}$

2. Find an equation for the tangent line to graph of the curve given by $x^2y + x\sqrt{y} = (x+y)^2 - 3$ at the point $(2, 1)$.

3. Find all points on the graph of $y = x^2e^{-3x}$ where the tangent line is horizontal.

4. Use a tangent line approximation to estimate $\sqrt[5]{33}$.

5. Sketch a graph that satisfies all of the following criteria.

   - $f(-4) = 0$ and $f(x)$ does not equal zero anywhere else
   - $f'(x) > 0$ on the intervals $(-\infty, -1)$ and $(2, \infty)$
   - $f'(x) < 0$ on the interval $(-1, 2)$
   - $f'(-1) = 0$ and $f'(2) = 0$

6. Sketch a graph that satisfies all of the following criteria.

   - $f(-4) = 0$
   - $\lim\limits_{x \to 2} f(x) = -\infty$
   - $f'(x) > 0$ on the intervals $(-\infty, -1)$ and $(2, \infty)$
   - $f'(x) < 0$ on the interval $(-1, 2)$
   - $f'(-1)$ is undefined and $f'(2)$ is undefined