

Exam 2 review problems

1. Use the table below to evaluate the following quantities

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
8	12	-2	0.25	16
10	9	-3	1	8
12	5	-4	4	0
14	1	-1	0	-2
16	-2	-0.5	9	5

(a) $h'(10)$ for $h(x) = xf(x)(1 - g(x))$

(b) $k'(12)$ for $k(x) = \frac{2f(x) - 1}{\sqrt{g(x)}}$

(c) $p'(14)$ for $p(x) = \frac{f(x)g(x)}{f(x) + g(x)}$

(d) $\left. \frac{d}{dx} \left(f(x^2g(x)) \right) \right|_{x=8}$

(e) $\left. \frac{d}{dx} \left(f \left(\frac{f(x)}{3g(x)} \right) \right) \right|_{x=8}$

(f) $\left. \frac{df^{-1}}{dx} \right|_{x=12}$

(g) $\left. \frac{d}{dx} \left(f^{-1}(g(x)) \right) \right|_{x=16}$

2. Find the derivative of the following functions.

(a) $w = (\cosh^2(t) + 1)^{100}$

(d) $h(x) = xe^{\tan(x)}$

(b) $f(x) = \frac{1+x}{2+3x+4x^2}$

(e) $y = e^{2x} \sin^2(3x)$

(c) $g(\theta) = \frac{1}{1+e^{-\theta}}$

(f) $r(t) = \ln \left(\sin \left(\frac{t}{k} \right) \right)$

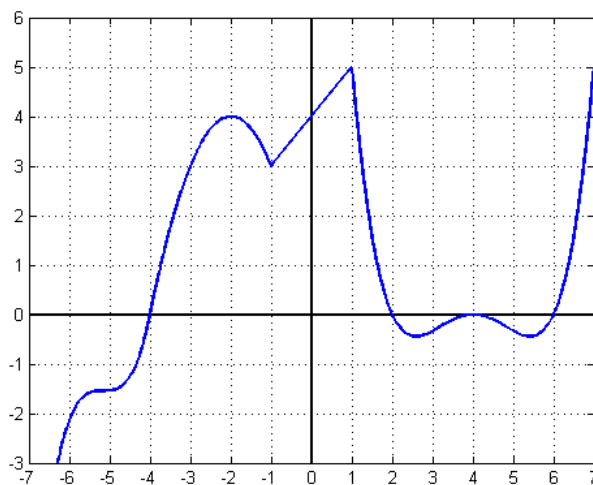
(g) $y = \arctan(\arcsin(x))$

3. For constants a, b, n, R , Van der Waal's equation relates the pressure P to the volume V of a fixed quantity of gas as a constant temperature T :

$$\left(P + \frac{n^2a}{V^2} \right) (V - nb) = nRT.$$

Find the rate of change of volume with respect to pressure, $\frac{dV}{dP}$.

4. Consider the function $f(x) = xe^x$.
- Use the tangent line at $x = 1$ to approximate $f(1.1)$. Without calculating $f(1.1)$, determine whether your approximation is greater than or less than the true value of $f(1.1)$.
 - Use the tangent line at $x = 1$ to approximate where $f(x) = 2$. Determine whether your approximation is greater than or less than the true solution.
5. For the following functions, find and classify the critical points and determine any inflection points.
- $f(x) = x^n e^{-bx}$, $n \geq 1$, $b > 0$.
 - $f(x) = \frac{a}{x^2} + x$, $a > 0$.
 - $f(x) = x^{2/3} + x^{1/3}$
 - $f(x) = |\tanh(x)|$
6. The graph of a function is shown below.



- If the graph depicts $y = f(x)$, estimate the location of the critical points of f and classify them as either local maximum, local minimum, or neither.
- If the graph depicts $y = f'(x)$, estimate the location of the critical points of f and classify them as either local maximum, local minimum, or neither.