Major Bowman
MA 104
Course Homework #1

1) $f(x) = x^3 + 2x^2 - x + 1$
$f'(x) = 3x^2 + 4x - 1$
$f''(x) = 6x + 4$
$f'''(x) = 6$
$f''''(x) = 0$

power rule

graph - mathematica

2) $y = \dfrac{x}{1+x^2}$ $\qquad y' = \dfrac{1\cdot(1+x^2) - (2x)x}{(1+x^2)^2} = \dfrac{1-x^2}{(1+x^2)^2}$

$y'(3) = \dfrac{1-9}{(1+9)^2} = -\dfrac{8}{100} = -\dfrac{2}{25}$

$\frac{3}{10} = -\frac{2}{25}(3) + b \rightarrow b = \frac{15+12}{50} = \frac{27}{50}$

a) $y = -\frac{2}{25}x + \frac{27}{50}$

b) mathematica

c) $y' = \dfrac{1-x^2}{(1+x^2)^2}$ $\qquad y' = \dfrac{-2x(1+x^2)^2 - (1-x^2)(2(1+x^2))(2x)}{(1+x^2)^4}$

$y' = \dfrac{-2x(1+x^2)^2 - 4x(1-x^2)(1+x^2)}{(1+x^2)^4}$

d. mathematica

Major Bauman
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3) a) $y = x^2 f(x)$ product rule

$$y' = 2x f(x) + x^2 f'(x)$$

b) $y = \dfrac{f(x)}{x^2}$ quotient rule

$$y' = \frac{f'(x) \cdot x^2 - f(x) \cdot 2x}{x^4}$$

c) $y = \dfrac{x^2}{f(x)}$ quotient rule

$$y' = \frac{2x f(x) - x^2 f'(x)}{(f(x))^2}$$

d) $y = \dfrac{1 + x f(x)}{\sqrt{x}}$ quotient rule + power + product

$$y' = \frac{(f(x) + x f'(x))\sqrt{x} - \frac{1}{2\sqrt{x}}(1 + x f(x))}{x}$$

4) a) $y = \dfrac{1}{g(x)}$ $\quad y' = \dfrac{0 \cdot g(x) - g'(x) \cdot 1}{[g(x)]^2}$

$$y' = \frac{-g'(x)}{[g(x)]^2}$$

b) $y(s) = \dfrac{1}{s + 2e^s}$ $\quad y' = -\dfrac{1 + 2e^s}{(s + 2e^s)^2}$

c) $y = x^{-n} = \dfrac{1}{x^n}$ $\quad y' = \dfrac{-n x^{n-1}}{x^{2n}} = (-n x^{n-1}) x^{-2n}$

$$= -n x^{-n-1}$$