1. Solutions to Midterm 1

(1) (a). $3x^2 + 6x$
(b). $\frac{3}{(1+x^2)}$
(c). $\cos(x) - \sin(x)$
(d). $\frac{-1}{x^2} + \frac{1}{x}$

(2) (a). $\cos(\frac{1}{\sqrt{1+x^2}})\frac{-x}{(1+x^2)^{1.5}}$
(b). $2xe^{\sin(x)} + x^2e^{\sin(x)}.\cos(x)$
(c). $(1+x^2)^{500} + 1000x^2(1+x^2)^{499}$
(d). $\frac{1}{2x\sqrt{\ln(x)}}$

(3) $5\pi ft/s$

(4) $\frac{811}{270}$

(5) Tangent Line : $(y-2) = -\frac{1}{2}(x-1)$

(6) Absolute maximum value $\pi/2$; absolute minimum value -1.

(7) Hints: By IVT there is point in $c \in (1,3)$ where $f(c) = 5$ now apply MVT for the interval $[0,c]$. For the second part just apply IVT to f in the interval $[0,3]$. Let $0 \leq b_1 \leq b_2 \leq 3$ be two points where $f(b_1) = f(b_2) = 5.5$. Then applying MVT in the interval $[0,b_1]$ there is a $c_1 \in [0,b_1]$ such that $f'(c_1) = 1/(2b_1) > 0$ but by MVT in the interval $[b_1,b_2]$ there is $c_2 \in [b_1,b_2]$ such that $f'(c_2) = 0$. This contradicts that f' is an increasing function as assumed in the hypothesis.