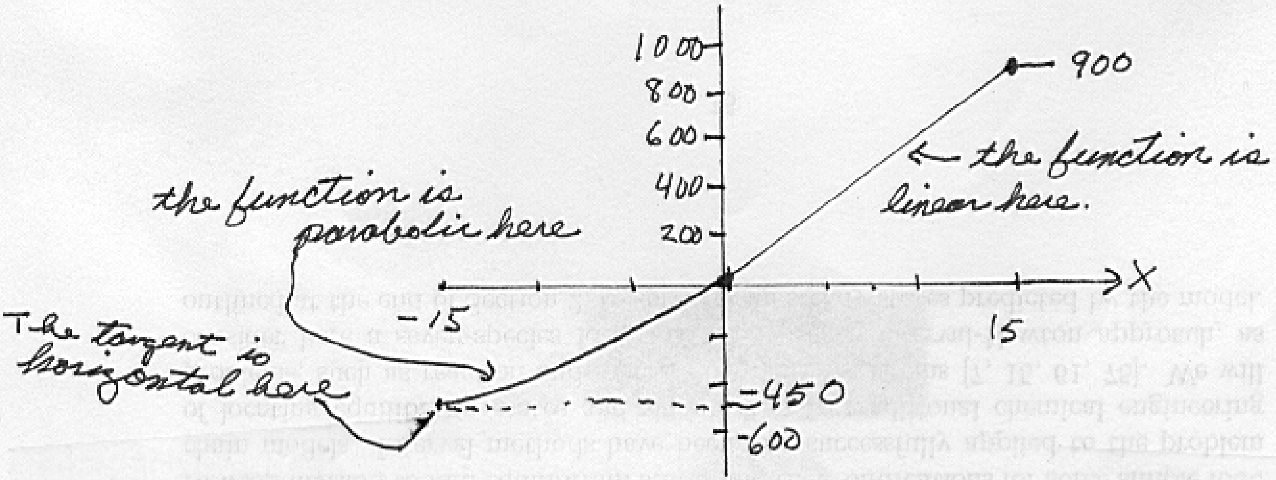
Math. 301-01, Tuesday, January 30, 2007, First exam answers, p. 1



(2) (a) $$\int (x^2+2x+1)\,dx = \frac{x^3}{3} + x^2 + x + C$$

(b) $$\frac{d}{dx}\int_{t=0}^{x} \sin\left(e^{t^2+t}\right)dt = \sin\left(e^{x^2+x}\right)$$

(c) $$\frac{d}{dt}\int_{x=0}^{t} \sin\left(e^{x^2+x}\right)dx = \sin\left(e^{t^2+t}\right)$$

(d) $$\frac{d}{dx}\left\{\int_{x^2}^{x^2+1} t^2e^t\,dt\right\} = \frac{d}{dx}\int_0^{x^2+1} t^2e^t\,dt - \frac{d}{dx}\int_0^{x^2} t^2e^t\,dt$$

$$= \left\{(x^2+1)^2 e^{x^2+1}\right\}(2x) - (x^2)^2 e^{x^2}(2x)$$

$$= \boxed{2xe^{x^2}\left\{(x^2+1)^2 e - x^4\right\}}$$

3 The equations of motion ~~are~~ is $s(t) = \frac{1}{2}at^2 + v_0 t + s_0$.

We need $v = 0$ for some $s \le 2500$. We have $s_0 = 0$, $v_0 = 67$, and $a = -3.45$, so

a $s(t) = -\frac{3.45}{2}t^2 + v_0 t$

$67\,mi/hr = 67 \cdot 5280 \frac{ft}{mi} / 3600\,sec/hr = 67\left(\frac{5280}{3600}\right) ft./sec.$

$\approx 98.27\,ft/sec$,

so $s(t) = -1.725t^2 + 98.27t$,

b so $v(t) = s'(t) = -3.45t + 98.27 = 0$ when $t = 28.48$ sec.

Thus, the distance travelled when the plane comes to a stop is:

$s(28.48) = -1.725(28.48)^2 + 98.27(28.48) \approx 1399.6\,ft.$

Thus, the plane can stop well within the 2500 ft. limit.