1989 BC 1

1a. $\int 6x+8 = f' = \frac{6x^2}{2} + 8x + c$

$= 3x^2 + 8x + c$

Eqn. of tangent $3x - y = 2$

$-y = -3x + 2$

$y = 3x + 2$

$\uparrow$ slope $= 3$

Point $(0, -2)$

$3 = 3(0)^2 + 8(0) + c$

$c = 3$

$f' = 3x^2 + 8x + 3$

$\int 3x^2 + 8x + 3 = \frac{3x^3}{3} + \frac{8x^2}{2} + 3x + c$

$y = x^3 + 4x^2 + 3x + c$

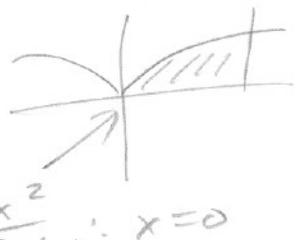
Point $(0, -2)$

$-2 = 0^3 + 4(0)^2 + 3(0) + c$

$c = -2$

$y = x^3 + 4x^2 + 3x - 2$

b. $\dfrac{\int_{-1}^{1} x^3 + 4x^2 + 3x - 2}{1 - -1} = \dfrac{\frac{x^4}{4} + \frac{4x^3}{3} + \frac{3x^2}{2} - 2x \Big]_{-1}^{1}}{2} = -.6\overline{6}$

2a 

$\int_0^1 \frac{x^2}{x^2+1} = .2146$

$0 = \frac{x^2}{x^2+1} \therefore x = 0$

$$\begin{array}{r} 1 \\ x^2+1 \overline{\smash{)}\, x^2} \\ \underline{x^2+1} \\ -1 \end{array}$$

$\int_0^1 1 - \frac{1}{x^2+1} = x - \tan^{-1} x \Big]_0^1$

$= 1 - \frac{\pi}{4}$

b. 

$2\pi \int_0^1 x\left(\frac{x^2}{x^2+1}\right) = 2\pi \int_0^1 \frac{x^3}{x^2+1} = .964$

$$\begin{array}{r} x \\ x^2+1 \overline{\smash{)}\, x^3 \; 0} \\ \underline{x^3 + x} \\ -x \end{array}$$

$2\pi \int_0^1 x - \frac{x}{x^2+1}$

1989 BC 3

a)

$f(x) = e^x \cos x$

$f' = e^x(-\sin x) + \cos x \, e^x$

$0 = e^x(-\sin x + \cos x)$

$-\sin x + \cos x = 0$

$\cos x = \sin x$

$x = \frac{\pi}{4}, \frac{5\pi}{4}$ Critical Pts

To find absolute max & min use critical points and check endpoints

0	$e^0 \cos 0 = 1$
2π	$e^{2\pi} \cos 2\pi = -e^{2\pi} = +535.49$ MAX
$\frac{\pi}{4}$	$e^{\frac{\pi}{4}} \cos\frac{\pi}{4} = e^{\frac{\pi}{4}} \frac{\sqrt{2}}{2} = 1.551$
$\frac{5\pi}{4}$	$e^{\frac{5\pi}{4}} \cos\frac{5\pi}{4} = e^{\frac{5\pi}{4}}\left(-\frac{\sqrt{2}}{2}\right) = -35.889$ MIN

c) $f'' = e^x(-\cos x - \sin x) + (-\sin x + \cos x)e^x$

$= e^x[-\cos x - \sin x - \sin x + \cos x]$

$= e^x(-2\sin x)$

$-2\sin x = 0$

$\sin x = 0$ can't use, an interval $[0, 2\pi]$

$x = 0, \pi$ POINTS OF INFLECTION

b)

	0	$\frac{\pi}{4}$		$\frac{5\pi}{4}$	2π
f'	$+$	0	$-$	0	$+$
	$+$	0	$-$	0	$+$

← to substitute values

You would have to substitute values

Increasing $[0, \frac{\pi}{4}]$

$[\frac{5\pi}{4}, 2\pi]$