Math 141
Professor Krishtal.

2.6 24) $\lim_{x\to-\infty} x+\sqrt{x^2+2x} = \lim_{x\to-\infty} \frac{x^2-x^2-2x}{x-\sqrt{x^2-2x}}$

$= \lim_{x\to-\infty} \frac{-2x}{x-\sqrt{x^2-2x}}$

$= \lim_{x\to\infty} \frac{-2}{1+\sqrt{\frac{x^2-2x}{x^2}}}$

$= \lim_{x\to-\infty} \frac{-2}{1+\sqrt{1+\frac{2}{x}}}$

$= -1$

$\lim_{x\to-\infty} x+\sqrt{x^2+2x} = \lim_{x\to-\infty} x+\sqrt{x^2+2x+1}$

$= \lim_{x\to-\infty} x+\sqrt{(x+1)^2}$

$= \lim_{x\to-\infty} x+(-(x+1))$ $\left(\because x\to-\infty,\ -(x+1)>0\right)$

$= -1$

32) $\lim_{x\to\infty} \tan^{-1}(x^2-x^4)$

$\because \lim_{x\to\infty} x^2-x^4 = \lim_{x\to\infty} x^2(1-x^2) = -\infty$,

$\lim_{x\to\infty} \tan^{-1}(x^2-x^4) \equiv \lim_{x\to-\infty} \tan^{-1} x$

$= -\frac{\pi}{2}$.

54 a) $30\,g/L \cdot 25\,L/min = 750\,g/min$.

$\therefore c(t) = \frac{750t}{5000+25t} = \frac{30t}{200+t}$

b) $\lim_{t\to\infty} \frac{30t}{200+t} = \lim_{t\to\infty} \frac{30}{\frac{200}{t}+1} = 30\,g/L$.

2.7 8) $y=\sqrt{2x+1}$ $(4,3)$

$$\lim_{h\to 0}\frac{f(4+h)-f(4)}{h} = \frac{\sqrt{2(4+h)+1}-3}{h}$$

$$= \frac{\sqrt{9+2h}-3}{h}$$

$$= \frac{9+2h-9}{h(\sqrt{9+2h}+3)}$$

$$= \frac{2}{\sqrt{9+2h}+3}$$

$$= \frac{1}{3}.$$

$y = mx + c.$

$3 = \frac{1}{3}(4) + c \Rightarrow c = \frac{5}{3}.$

$\therefore\ y = \frac{1}{3}x + \frac{5}{3}.$

14 $f(t) = t^4 + 5t$

$$\lim_{h\to 0}\frac{f(a+h)-f(a)}{h} = \lim_{h\to 0}\frac{(a+h)^4-5(a+h)-a^4+5a}{h}$$

$$= \lim_{h\to 0}\frac{a^4+4a^3h+6a^2h^2+4ah^3+h^4-5a-5h-a^4+5a}{h}$$

$$= 4a^3+6a^2h+4ah^2+h^3-5$$

$$= 4a^3-5.$$

$\therefore\ f'(a) = 4a^3-5$