ww set 2
1-5

1) $x^2+4x+3 \overline{)\, x^3}$ quotient $x - 4 + \frac{13x+12}{x^2+4x+3}$

$-(x^3+4x^2+3x)$

$-4x^2-3x$

$-(-4x^2-16x-12)$

$0x^2+13x+12$

$$x-4 + \frac{13x+12}{(x+3)(x+1)} = \boxed{x-4 + \frac{A}{x+3} + \frac{B}{x+1}}$$

2) $$-6\int_2^3 \frac{1}{x^2-1}dx = \int_2^3 \frac{-6}{(x+1)(x-1)}dx = \int \frac{A}{(x+1)} + \frac{B}{(x-1)}dx$$

$-6 = A(x-1)+B(x+1)$ $\quad x(A+B) = 0x \quad A=-B$

$(B-A) = -6$

$B - -B = -6 = 2B \quad \boxed{B=-3 \\ A=3}$

$u = x+1$
$du = dx$
$\frac{1}{u}du \ldots$

$$\int_2^3 \left(\frac{3}{x+1} - \frac{3}{x-1}\right)dx = \left[3\ln|x+1| - 3\ln|x-1|\right]_2^3$$

$$3\ln\left|\frac{x+1}{x-1}\right|_2^3 = 3\left[\ln\left|\frac{4}{2}\right| - \ln\left|\frac{3}{1}\right|\right] = \boxed{3\ln\left(\frac{2}{3}\right)}$$

3) $$\int_1^\infty 2xe^{-x^2}dx = \lim_{t\to\infty}\int_1^t 2xe^{-x^2}dx \quad u=-x^2 \quad du=-2x\,dx \quad \int -e^u du = -e^u + C$$

$$\lim_{t\to\infty}\left(-e^{-x^2}\right)\Big|_1^t = \lim_{t\to\infty}\left[-e^{-t^2} + e^{-1}\right] = \lim_{t\to\infty}\left[\frac{1}{e} - \cancel{\frac{1}{e^{t^2}}}^{0}\right] = \boxed{\frac{1}{e}}$$

4) $$\int_0^8 \frac{7}{\sqrt{x}}dx = \lim_{t\to 0^+}\left(7\int_t^8 x^{-1/2}dx\right) = \lim_{t\to 0^+}\left(7\left(2x^{1/2}\right)\right)\Big|_t^8 = \lim_{t\to 0^+}\left[14\left(\underbrace{8^{1/2}}_{2\sqrt{2}} - \cancel{t^{1/2}}^{0}\right)\right] = \boxed{28\sqrt{2}}$$

5) $r(t) = 1000te^{-t/2}$ (people/day)

$$S(t) = 1000\int_0^\infty te^{-t/2}dt = \lim_{x\to\infty}\int_0^x 1000\,te^{-t/2}dt \Rightarrow \begin{matrix} u=t & dv = e^{-t/2}dt \\ du=dt & v=-2e^{-t/2}\end{matrix}$$

$$\lim_{x\to\infty}(1000)\left[-2te^{-t/2} + 2\int e^{-t/2}dt\right] = \lim_{x\to\infty}(1000)\left[-2te^{-t/2} + 2\left(-2e^{-t/2}\right)\right]$$

$$= \lim_{x\to\infty}(-2000)\left[e^{-t/2}(t+2)\right]_0^x = \lim_{x\to\infty}(-2000)\left[\cancel{e^{-x/2}}^{0}\cancel{(x+2)}^{2} - e^0(0+2)\right] = (-2000)(-2)$$

$$\boxed{S(t) = +4000}$$