7.2

#8. $\int_0^2 \frac{x+1}{\sqrt{2+3x}}\,dx$

$= \int_0^2 \frac{x}{\sqrt{2+3x}}\,dx + \int_0^2 \frac{1}{\sqrt{2+3x}}\,dx$

↑ use the table or u-sub

↑ take the integral

$u = 2+3x$

$du = 3\,dx$

$\frac{1}{3}du = dx$

$x=0 \quad u=2$

$x=2 \quad u=8$

#5 on table

$a=2 \quad b=3$

$= \frac{2}{3^3}(3x-4)\sqrt{2+3x}\,\Big|_0^2 + \frac{1}{3}\int_2^8 u^{-\frac{1}{2}}\,du$

$= \frac{2}{3^3}\left(2\cdot 2\sqrt{2} - (-4\sqrt{2})\right) + \frac{1}{3}\cdot 2\,u^{\frac{1}{2}}\Big|_2^8$

$= \frac{2}{3^3}\left(4\sqrt{2} + 4\sqrt{2}\right) + \frac{2}{3}\left(2\sqrt{2} - \sqrt{2}\right)$

$= \frac{16\sqrt{2}}{27} + \frac{2\sqrt{2}}{3}$

$= \frac{34\sqrt{2}}{27}$

7.2

#32. $\int (\ln x)^4\,dx$ use #29 on the table or by parts

$u = (\ln x)^4$ $dv = dx$
$du = 4(\ln x)^3 \frac{1}{x}\,dx$ $v = x$

$= x(\ln x)^4 - 4\int (\ln x)^3\,dx$

$u = (\ln x)^3$ $dv = dx$
$du = 3(\ln x)^2 \frac{1}{x}\,dx$ $v = x$

$= x(\ln x)^4 - 4\left[x(\ln x)^3) - 3\int (\ln x)^2\,dx\right]$

$= x(\ln x)^4 - 4x(\ln x)^3 + 12\left(x(\ln x)^2 - 2\int (\ln x)\,dx\right)$

$u = \ln x$ $dv = dx$
$du = \frac{1}{x}\,dx$ $v = x$

$= x(\ln x)^4 - 4x(\ln x)^3 + 12x(\ln x)^2 - 24x\ln x + \int dx$

$= x(\ln x)^4 - 4x(\ln x)^3 + 12x(\ln x)^2 - 24x\ln x + x + c$

#34 $R(t) = \frac{3000}{\sqrt{4+t^2}}$

$P = \int R(t)\,dt = \int_0^5 \frac{3000}{\sqrt{4+t^2}}\,dt$

$P = 3000\int_0^5 \frac{1}{\sqrt{4+t^2}}\,dt$ using #9 on table

$= 3000\left(\ln\left|t+\sqrt{4+t^2}\right|\right)\Big|_0^5$ (20000

$= 3000\left(\left(\ln\left|5+\sqrt{29}\right|\right) - \ln 2\right)$

$= 3000\left(\ln\left(\frac{5+\sqrt{29}}{2}\right)\right)$

≈ 4942

if present is 20,000 then in 5yrs pop is 24,942 ppl.

7.4

#24

$$\int_2^{\infty} \frac{3}{x}\,dx$$

$$= \lim_{b\to\infty} 3\int_2^{b} \frac{1}{x}\,dx$$

$$= \lim_{b\to\infty} 3\ln x \Big|_2^{b}$$

$$= \lim_{b\to\infty} 3(\ln b - \ln 2)$$

$= \infty$ diverges ✓

#28. $$\int_{-\infty}^{0} \frac{1}{(4-x)^{3/2}}\,dx$$

$$= \lim_{a\to-\infty} \int_a^{0} (4-x)^{-\frac{3}{2}}\,dx$$

$$= \lim_{a\to-\infty} (-2)(4-x)^{-\frac{1}{2}}(-1)\Big|_a^{0}$$

$$= \lim_{a\to-\infty} 2\left(\frac{1}{2} - \frac{1}{\sqrt{4-a}}\right)$$

$= 1$

#44. $\displaystyle\int_{-\infty}^{\infty} \frac{xe^{-x^2}}{1+e^{-x^2}}\,dx$ if $x=0$ then $y=0$

$-\ \underset{0}{|}\ +$

$$= \lim_{a\to-\infty}\int_a^0 \frac{xe^{-x^2}}{1+e^{-x^2}}\,dx + \lim_{b\to\infty}\int_0^b \frac{xe^{-x^2}}{1+e^{-x^2}}\,dx$$

$$= \lim_{a\to-\infty}\frac{1}{2}\int_{1+e^{-a^2}}^{2} \frac{du}{u} - \lim_{b\to\infty}\frac{1}{2}\int_{2}^{1+e^{-b^2}} \frac{du}{u}$$

$u = 1+e^{-x^2}$

$du = (e^{-x^2})(-2x)\,dx$

$-\frac{1}{2}\,du = xe^{-x^2}\,dx$

$x=a \quad u=1+e^{-a^2}$

$x=0 \quad u=2$

$x=b \quad u=1+e^{-b^2}$

$$= \lim_{a\to-\infty}\frac{1}{2}\ln u \Big|_{1+e^{-a^2}}^{2} - \frac{1}{2}\lim_{b\to\infty}\ln u\Big|_{2}^{1+e^{-b^2}}$$

$$= \lim_{a\to-\infty}\frac{1}{2}\left(\ln 2 - \ln(1+e^{-a^2})\right) - \frac{1}{2}\lim_{b\to\infty}\left(\ln(1+e^{-b^2}) - \ln 2\right)$$

$$= \frac{1}{2}\ln 2 + \frac{1}{2}\ln 2$$

$$= \ln 2$$