7.1) 3, 4, 6, 26
66

3) $\int x\cos(5x)\,dx$ let $u=x$ $dv=\cos(5x)\,dx$

$du=dx$ $v=\frac{1}{5}(\sin(5x))$

$= x\left(\frac{1}{5}\sin(5x)\right)-\frac{1}{5}\int \sin(5x)\,dx$

$-\frac{1}{5}\left(-\frac{1}{5}\cos(5x)\right)$ $=$ $\boxed{\frac{1}{5}x\sin(5x)+\frac{1}{25}\cos(5x)+C}$

4) $\int y e^{\frac{2y}{10}}\,dy$ let $u=y$ $dv=e^{\frac{y}{5}}\,dy$,

$du=dy$ $v=\int e^{\frac{y}{5}}\,dy$ let $\omega=\frac{y}{5}$ · $d\omega=\frac{1}{5}dy$

$=5\int e^{\omega}\,d\omega = 5e^{\omega} = 5e^{\frac{y}{5}}$

$v = 5e^{\left(\frac{y}{5}\right)}$

$=5ye^{\frac{y}{5}}-5\int e^{\frac{y}{5}}\,dy$

$=5ye^{\frac{y}{5}}-5\left(5e^{\frac{y}{5}}\right)+C = \boxed{5e^{\frac{y}{5}}(y-5)+C}$

6) $\int (x-1)\sin(\pi x)\,dx$ $u=x-1$, $dv=\sin(\pi x)\,dx$

$du=dx$ $v=\frac{1}{\pi}(-\cos(\pi x))$

$=(x-1)\left(-\frac{1}{\pi}\cos(\pi x)\right)--\frac{1}{\pi}\int\cos(\pi x)\,dx$

$+\frac{1}{\pi}\left(\frac{1}{\pi}\sin(\pi x)\right)$ $=$ $\boxed{\frac{1}{\pi}\left[(1-x)\cos(\pi x)+\frac{1}{\pi}\sin(\pi x)\right]+C}$

26) $\int_4^9 \frac{\ln(y)}{y^{\frac{1}{2}}}\,dy$ $u=\ln(y)$ $dv=y^{-\frac{1}{2}}\,dy$

$du=\frac{1}{y}dy$ $v=+2y^{\frac{1}{2}}$

$\ln(9)=2\ln(3^2)=2\ln(3)$
$\ln(4)=\ln(2^2)=2\ln(2)$

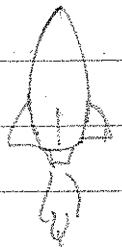
$:2y^{\frac{1}{2}}\ln(y)-2\int y^{\frac{1}{2}}\frac{1}{y}\,dy$ $=$ $2y^{\frac{1}{2}}\ln(y)-2\left(2y^{\frac{1}{2}}\right)\Big|_4^9$

$-2\int y^{-\frac{1}{2}}\,dy$

$=\left[2(3)(2\ln(3))-4(3)\right]-\left[2(2)(2\ln(2))-4(2)\right]$

$=12\ln(3)-12-8\ln(2)+8$

$\boxed{\int_4^9\frac{\ln(y)}{\sqrt{y}}\,dy=4\left(3\ln(3)-2\ln(2)-1\right)}$

6 

$$v(t) = -gt - V_e \ln\left(\frac{m-rt}{m}\right)$$
$$= -gt - V_e\left(\ln(m-rt) - \ln(m)\right)$$
$$H(t) = \int v(t)\,dt$$

$g = 9.8\ m/s^2$

$m = 30\,000\ kg$

$r = 160\ kg/s$

$V_e = 3000\ m/s$

$$H(t) = -\frac{1}{2}gt^2 - V_e\left[\overset{\text{A}}{\int \ln(m-rt)\,dt} - \overset{\text{B}}{\int \ln(m)\,dt}\right]$$

A $\int \ln(m-rt)\,dt \Rightarrow u = \ln(m-rt) \quad dv = dt \Rightarrow \underline{t\ln(m-rt)} + \int \frac{rt}{m-rt}\,dt$

$du = \left(\frac{1}{m-rt}\right)(-r) \quad v = t$

$$+\int \frac{rt - m + m}{m-rt}\,dt$$

$$+\int \frac{-1(m-rt)+m}{m-rt}\,dt$$

$$= \underline{t\ln(m-rt)} + \int\left(-1 + \frac{m}{m-rt}\,dt\right)dt$$

$$\underline{-t} + m\int \frac{1}{m-rt}\,dt$$

$u = m-rt, \quad du = -r\,dt$

$$+m\int \frac{1}{u}\,\frac{du}{-r}$$

$$-\frac{m}{r}\ln|u|$$

$$\boxed{\text{A} = t\ln(m-rt) \underline{-t} \underline{-\frac{m}{r}\ln|m-rt|}}$$

B $\int \ln(m)\,dt \Rightarrow \ln(m)\int dt = t\ln(m)$

$$\boxed{H(t) = -\frac{1}{2}gt^2 - V_e\left[t\ln(m-rt) - t - \frac{m}{r}\ln|m-rt| - t\ln(m)\right]\Bigg|_0^{60}}$$

$$= -\frac{1}{2}g(60^2 - 0) - V_e\left[(60\ln(m-60r) - 0) - (60-0) - \frac{m}{r}\left(\ln(m-60r) - \ln(m)\right) - (60\ln(m) - 0)\right]$$

$$= -1800g - V_e\left[\ln(m-60r)\left(60 - \frac{m}{r}\right) + \ln(m)\left(\frac{m}{r} - 60\right) - 60\right]$$

$$= -1800(9.8) - 3000\left[\ln(30000 - 60(160))\left(60 - \frac{30000}{160}\right) + \ln(30000)\left(\frac{30000}{160} - 60\right) - 60\right]$$

$$= -17600$$

$$H \quad -17600 - 3000\left[\ln(20^{400})(-127.5) + \ln(30^{000})(+127.5) - 60\right]$$

$$-17600 - 3000\left[\qquad -10.8 \qquad\right]$$

$$\boxed{H(60) = 14884.1\ m}$$