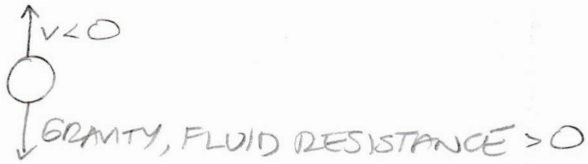
[2][b] $m\frac{dv}{dt} = mg + 4\sqrt{-v}$



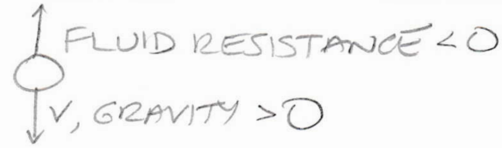
$2\frac{dv}{dt} = 2g + 4\sqrt{-v}$

8 $\boxed{\frac{dv}{dt} = g + 2\sqrt{-v}} \longrightarrow \boxed{g + 2\sqrt{-v} = 0}$ 3

2 $\boxed{v(0) = -16}$

3 $\boxed{\sqrt{-v} = -\frac{g}{2} < 0} \longrightarrow \boxed{\text{NO EQ SOL'N}}$ 2

[c] $m\frac{dv}{dt} = mg - 4\sqrt{v}$



$2\frac{dv}{dt} = 2g - 4\sqrt{v}$

6 $\boxed{\frac{dv}{dt} = g - 2\sqrt{v}} \longrightarrow \boxed{g - 2\sqrt{v} = 0}$ 3

2 $\boxed{v(0) = 0}$

3 $\boxed{v = \frac{g^2}{4}} \longrightarrow$ EQ SOL'N

[d] $\frac{dv}{dt} = 10 - 2\sqrt{v}$

3 $\boxed{\int \frac{1}{10-2\sqrt{v}}\,dv = dt}$

FOLD INTO +C

$\cancel{5}\boxed{-\sqrt{v} - 5\ln|10-2\sqrt{v}| = t + C}$ 6

$-\sqrt{0} - 5\ln|10-2\sqrt{0}| = 0 + C$

3 $\boxed{C = -5\ln 10}$

$-\sqrt{v} - 5\ln|10-2\sqrt{v}| = t - 5\ln 10$

3 $\boxed{\sqrt{v} + 5\ln|10-2\sqrt{v}| = 5\ln 10 - t}$

$\int \frac{1}{10-2\sqrt{v}}\,dv$ LET $\overset{3}{\boxed{u = 10-2\sqrt{v}}}$

$v = \frac{1}{4}(10-u)^2$

$dv = -\frac{1}{2}(10-u)\,du$

$= \boxed{\int -\frac{1}{2}\,\frac{10-u}{u}\,du}$ 6

$= -\frac{1}{2}\int\left(\frac{10}{u} - 1\right)du$

$= -\frac{1}{2}(10\ln|u| - u)$

$= -\frac{1}{2}(10\ln|10-2\sqrt{v}| - 10 + 2\sqrt{v})$

$= 5 - \sqrt{v} - 5\ln|10-2\sqrt{v}|$

[e] $f = g - 2\sqrt{v}$ IS $\boxed{\text{NOT CONT AROUND } (t,v)=(0,0)}$ 5

SINCE $\sqrt{v}$ DNE AS $v \to 0^-$

SO E+U TELLS US $\boxed{\text{NOTHING}}$ 3

[f] $\sqrt{0} + 5\ln|10-2\sqrt{0}| = 5\ln 10 - t$

$$\boxed{\begin{array}{c} 5\ln 10 = 5\ln 10 - t \\ t = 0 \end{array}}$$ 5

$v = 0$ ONLY WHEN $t = 0$

[3] $\boxed{\underbrace{(2s+2e^{2t-2s})}_{P}ds+\underbrace{(e^{2t-2s}-3s^2+6)}_{Q}dt=0}$ 9

$$\boxed{P_t=4e^{2t-2s} \qquad Q_s=-2e^{2t-2s}-6s} \; 3$$

$$\frac{Q_s-P_t}{P}=\boxed{\frac{-6e^{2t-2s}-6s}{2s+2e^{2t-2s}}=-3}\; 6 \qquad \boxed{\text{FUNCTION OF ONLY } t}\; 3$$

$$\mu=e^{\int -3\,dt}=\boxed{e^{-3t}}\; 3$$

3 $\boxed{\underbrace{(2se^{-3t}+2e^{-t-2s})}_{M}ds+\underbrace{(e^{-t-2s}-3s^2e^{-3t}+6e^{-3t})}_{N}dt=0}$

3 $\boxed{M_t=-6se^{-3t}-2e^{-t-2s}=N_s=-2e^{-t-2s}-6se^{-3t} \quad \text{EXACT}}$

$$f=\int(2se^{-3t}+2e^{-t-2s})ds$$

$$=3\;\boxed{s^2e^{-3t}-e^{-t-2s}+C(t)}$$

$$f_t=_3\boxed{-3s^2e^{-3t}+e^{-t-2s}+C'(t)=e^{-t-2s}-3s^2e^{-3t}+6e^{-3t}}$$

3 $\boxed{C'(t)=6e^{-3t} \quad \text{FUNCTION OF ONLY } t}$

3 $\boxed{C(t)=-2e^{-3t}}$

3 $\boxed{s^2e^{-3t}-e^{-t-2s}-2e^{-3t}=C}$

3 $\boxed{s^2-e^{2t-2s}-2=Ce^{3t}}$

[4] $(8xy + 2(4x^2-1)y^{-\frac{1}{2}}) - 3(4x^2-1)\frac{dy}{dx} = 0$

$$3(4x^2-1)\frac{dy}{dx} - 8xy = 2(4x^2-1)y^{-\frac{1}{2}}$$

9 $\boxed{\frac{dy}{dx} - \frac{8x}{3(4x^2-1)}y = \frac{2}{3}y^{-\frac{1}{2}}}$

3

$v = y^{1--\frac{1}{2}} = \boxed{y^{\frac{3}{2}}} \to \frac{dv}{dx} = \frac{3}{2}y^{\frac{1}{2}}\frac{dy}{dx}$

$\frac{dy}{dx} = \frac{2}{3}y^{-\frac{1}{2}}\frac{dv}{dx}$

3 $\boxed{\frac{2}{3}y^{-\frac{1}{2}}\frac{dv}{dx}} - \frac{8x}{3(4x^2-1)}y = \frac{2}{3}y^{-\frac{1}{2}}$

$$\frac{dv}{dx} - \frac{4x}{4x^2-1}y^{\frac{3}{2}} = 1$$

6 $\boxed{\frac{dv}{dx} - \frac{4x}{4x^2-1}v = 1 \quad \text{LINEAR}}$

3 3

$\mu = e^{\int -\frac{4x}{4x^2-1}dx} \boxed{= e^{\int -\frac{1}{2}\frac{1}{u}du}} = \boxed{e^{-\frac{1}{2}\ln|4x^2-1|}} = \boxed{(1-4x^2)^{-\frac{1}{2}}}$

3 $\boxed{u = 4x^2-1}$

3 $\boxed{(1-4x^2)^{-\frac{1}{2}}\frac{dv}{dx} + 4x(1-4x^2)^{-\frac{3}{2}}v = (1-4x^2)^{-\frac{1}{2}}}$

$\frac{d}{dx}(1-4x^2)^{-\frac{1}{2}}$

3 $\boxed{\begin{aligned} &= -\tfrac{1}{2}(1-4x^2)^{-\frac{3}{2}}(-8x) \\ &= 4x(1-4x^2)^{-\frac{3}{2}} \end{aligned}}$

$$(1-4x^2)^{-\frac{1}{2}}v = \int \frac{1}{\sqrt{1-4x^2}}dx + C$$

$$(1-4x^2)^{-\frac{1}{2}}v = \frac{1}{2}\sin^{-1}2x + C$$

3 $\boxed{(1-4x^2)^{-\frac{1}{2}}y^{\frac{3}{2}}} = \boxed{\frac{1}{2}\sin^{-1}2x + C}$ 5

$$4y^3 = (1-4x^2)(\sin^{-1}2x + C)^2$$

3 $\boxed{108 = \frac{3}{4}\left(\frac{\pi}{6} + C\right)^2}$

$$\pm 12 = \frac{\pi}{6} + C$$

3 $\boxed{C = -\frac{\pi}{6} \pm 12}$

3 $\boxed{4y^3 = (1-4x^2)\left(\sin^{-1}2x - \frac{\pi}{6} \pm 12\right)^2}$

$$144y^3 = (1-4x^2)(6\sin^{-1}2x - \pi \pm 72)^2$$