ALL ITEMS WORTH 2 POINTS UNLESS OTHERWISE INDICATED

[2] $\displaystyle\sum_{n=1}^{\infty}(-1)^{n-1}\frac{1}{2^{n-1}(2n)} = \underline{\sum_{n=1}^{\infty}(-1)^{n-1}\frac{1}{2^n n}}\ 3 = \sum_{n=1}^{\infty}(-1)^{n-1}\frac{\left(\frac{1}{2}\right)^n}{n} = \underline{\ln\left(1+\frac{1}{2}\right)}\ 3$

$\displaystyle = \underline{\ln\frac{3}{2}}\ 1$

[3] $2y = 1 - \cos t \rightarrow \underline{\cos t = 1 - 2y}$

$$x = 1 - 2(\underline{2\cos^2 t - 1}) = 3 - 4\cos^2 t = \underline{3 - 4(1-2y)^2}$$

3

$$= 3 - 4(1 - 4y + 4y^2)$$

$$\underline{x = -16y^2 + 16y - 1}$$ 3

[4] $(8-16x)^{\frac{1}{3}} = 2(1-2x)^{\frac{1}{3}} = 2\sum_{n=0}^{\infty}\binom{\frac{1}{3}}{n}(-2x)^n$

$$= 2\left(1+\frac{1}{3}(-2x)+\frac{\frac{1}{3}\left(-\frac{2}{3}\right)}{2}(-2x)^2+\frac{\frac{1}{3}\left(-\frac{2}{3}\right)\left(-\frac{5}{3}\right)}{6}(-2x)^3+\frac{\frac{1}{3}\left(-\frac{2}{3}\right)\left(-\frac{5}{3}\right)\left(-\frac{8}{3}\right)}{24}(-2x)^4+\cdots\right) \quad 3$$

$$= 2-\frac{4}{3}x-\frac{8}{9}x^2-\frac{80}{81}x^3-\frac{320}{243}x^4-\cdots \quad 4$$

$$\tan^{-1}3x^2 = \sum_{n=0}^{\infty}(-1)^n\frac{(3x^2)^{2n+1}}{2n+1} = 3x^2-\frac{(3x^2)^3}{3}+\cdots = 3x^2-9x^6+\cdots$$

$$2-\frac{4}{3}x-\frac{8}{9}x^2-\frac{80}{81}x^3-\frac{320}{243}x^4$$

$$3x^2 \qquad -9x^6$$

$$6x^2-4x^3-\frac{8}{3}x^4-\frac{80}{27}x^5-\frac{320}{81}x^6 \quad 3$$

$$-18x^6$$

$$f(x) \approx 6x^2-4x^3-\frac{8}{3}x^4-\frac{80}{27}x^5-\frac{1778}{81}x^6$$

[5] $\boxed{\begin{aligned} x &= t \\ y &= 3t - t^2 \end{aligned}}$ 3

$t \in [-1, 4]$

$3x - x^2 = -4 \rightarrow 0 = x^2 - 3x - 4 = (x-4)(x+1)$

$x = 4, -1$

$T = 1 \rightarrow t = 4$

$T = 9 \rightarrow t = -1$

$\rightarrow t = mT + b \rightarrow m = \frac{4 - -1}{1 - 9} = -\frac{5}{8}$

$t = -\frac{5}{8}T + b$

$4 = -\frac{5}{8}(1) + b \rightarrow b = \frac{37}{8}$

$t = \frac{37 - 5T}{8}$

$\boxed{\begin{aligned} x &= \frac{37 - 5T}{8} \\ y &= 3\left(\frac{37 - 5T}{8}\right) - \left(\frac{37 - 5T}{8}\right)^2 \end{aligned}}$ 3

$T \in [1, 9]$

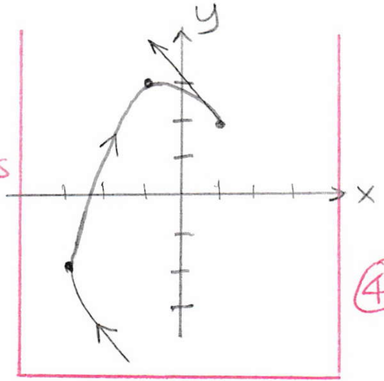
[6] $x = f(t)$ LOCAL MAX/MIN AT $t = -2, 2$

$y = g(t)$ $\qquad t = 0, 2$

3

4 $\quad (-3,-2) \qquad (-1,3) \qquad (1,2)$ ARROWS

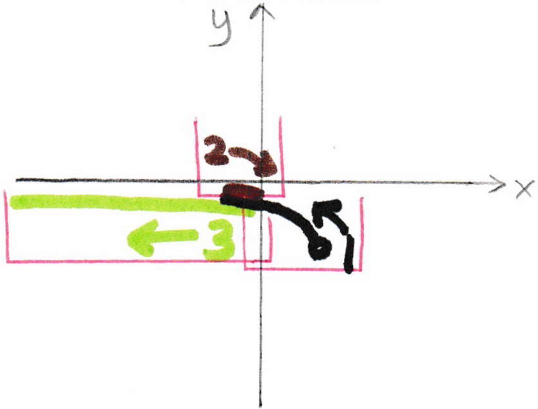
t	4	-2	0	2
x	4 DECR	INCR	INCR	DECR
y	4 INCR	INCR	DECR	INCR



4

[7] AS t GOES FROM $-\infty$ TO 1 TO 2 TO ∞

x ④ 2^- TO -1 TO 0 TO $-\infty$



[8][a] $x^2 \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)!} - 4 \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)!}$

$$= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+3}}{(2n+1)!} - \sum_{n=0}^{\infty} (-1)^n \frac{4x^{2n+1}}{(2n+1)!}$$

$$= \sum_{n=1}^{\infty} (-1)^{n-1} \frac{x^{2(n-1)+3}}{(2(n-1)+1)!} - \sum_{n=0}^{\infty} (-1)^n \frac{4x^{2n+1}}{(2n+1)!}$$

4 $$= \sum_{n=1}^{\infty} (-1)^{n-1} \frac{x^{2n+1}}{(2n-1)!} - \sum_{n=0}^{\infty} (-1)^n \frac{4x^{2n+1}}{(2n+1)!}$$

$$= \sum_{n=1}^{\infty} (-1)^{n-1} \frac{x^{2n+1}}{(2n-1)!} - \left[(-1)^0 \frac{4x^1}{1!} + \sum_{n=1}^{\infty} (-1)^n \frac{4x^{2n+1}}{(2n+1)!} \right]$$

$$= -4x + \sum_{n=1}^{\infty} \left[\frac{(-1)^{n-1}}{(2n-1)!} - \frac{(-1)^n 4}{(2n+1)!} \right] x^{2n+1}$$

$$= -4x + \sum_{n=1}^{\infty} (-1)^{n-1} \left[\frac{1}{(2n-1)!} + \frac{4}{(2n+1)!} \right] x^{2n+1}$$

$$= -4x + \sum_{n=1}^{\infty} (-1)^{n-1} \left[\boxed{\frac{(2n+1)2n}{(2n+1)2n}} \frac{1}{(2n-1)!} + \frac{4}{(2n+1)!} \right] x^{2n+1}$$

$$= -4x + \sum_{n=1}^{\infty} (-1)^{n-1} \frac{4n^2+2n+4}{(2n+1)!} x^{2n+1}$$ ← IF $n=0$, TERM $= \frac{(-1)^{-1} 4}{1!} x^1 = -4x$

$$= \sum_{n=0}^{\infty} (-1)^{n-1} \frac{4n^2+2n+4}{(2n+1)!} x^{2n+1}$$

[b] $2n+1 = 201 \longrightarrow n = 100$

$$(-1)^{99} \frac{4(100)^2 + 2(100) + 4}{\cancel{201!}} \cancel{x^{201}} = \frac{f^{(201)}(0)}{\cancel{201!}} \cancel{x^{201}}$$

3

$$f^{(201)}(0) = -40204$$

[9][a] X-INT : $y=0 \longrightarrow 12+4t-t^2=0 \longrightarrow (6-t)(2+t)=0$

$\longrightarrow t=6$ or -2 (1)

$\longrightarrow x=-45$ or 3 (1)

Y-INT : $x=0 \longrightarrow 3-2t-t^2=0 \longrightarrow (3+t)(1-t)=0$

$\longrightarrow t=-3$ or 1 (1)

$\longrightarrow y=-9$ or 15 (1)

$$2\pi\int_{-2}^{1}(3-2t-t^2)\sqrt{(-2-2t)^2+(4-2t)^2}\,dt \quad (7)$$

$$=2\pi\int_{-2}^{1}(3-2t-t^2)\sqrt{2^2[(1+t)^2+(2-t)^2]}\,dt$$

$$=4\pi\int_{-2}^{1}(3-2t-t^2)\sqrt{1+2t+t^2+4-4t+t^2}\,dt$$

$$=4\pi\int_{-2}^{1}(3-2t-t^2)\sqrt{2t^2-2t+5}\,dt \quad (3)$$

[b] $\frac{dx}{dt} = -2-2t = 0 \longrightarrow t = -1$ $\frac{dy}{dt}\Big|_{t=-1} = 4-2(1) = 2 \neq 0$ 1

$\longrightarrow x = 4$

[c] $\frac{dy}{dx} = \boxed{\frac{4-2t}{-2-2t}} = \frac{t-2}{t+1}$ 3

$$\frac{d^2y}{dx^2} = \frac{\boxed{\frac{1(t+1)-(t-2)(1)}{(t+1)^2}}}{\underline{-2-2t}} \quad 3$$

$$\left.\frac{d^2y}{dx^2}\right|_{t=-2} = \boxed{\frac{\frac{-1 - -4}{(-1)^2}}{2}} = \boxed{\frac{3}{2}} \quad 1$$

[d] $-\int_{-3}^{-2} g(t)\,f'(t)\,dt + \int_{6}^{-1} g(t)\,f'(t)\,dt - \int_{-2}^{-1} g(t)\,f'(t)\,dt$ 7

(AREA UNDER X-AXIS IN Q_4)

(AREA UNDER CURVE FROM LEFT X-INT TO VTL)

(AREA UNDER CURVE FROM RIGHT X-INT TO VTL)

$$= \int_{6}^{-1} g(t)\,f'(t)\,dt + \int_{-1}^{-2} g(t)\,f'(t)\,dt + \int_{-2}^{-3} g(t)\,f'(t)\,dt$$ 3

$$= \int_{6}^{-3} g(t)\,f'(t)\,dt$$

$$= \int_{6}^{-3} (12+4t-t^2)(-2-2t)\,dt$$ 3

$$= \int_{6}^{-3} (-24-24t-8t-8t^2+2t^2+2t^3)\,dt$$

$$= \int_{6}^{-3} (-24-32t-6t^2+2t^3)\,dt$$

3 $$= \left(-24t-16t^2-2t^3+\tfrac{1}{2}t^4\right)\Big|_{6}^{-3}$$

$$= 22\tfrac{1}{2} - (-504)$$ 1

$$= 526\tfrac{1}{2}$$ 1