[2] $(\csc x)' = \boxed{-\csc x \cot x}$ $\frac{1}{2}$

$(-\csc x \cot x)' = \boxed{(\csc x \cot x)\cot x - \csc x(-\csc^2 x)}$ 2

$= \boxed{\csc x \cot^2 x + \csc^3 x}$ $\frac{1}{2}$

$(\csc x \cot^2 x + \csc^3 x)' = \boxed{(-\csc x \cot x)\cot^2 x + \csc x(2\cot x)(-\csc^2 x) + 3\csc^2 x(-\csc x \cot x)}$ 3

$= -\csc x \cot^3 x - 2\csc^3 x \cot x - 3\csc^3 x \cot x$

$= \boxed{-\csc x \cot^3 x - 5\csc^3 x \cot x}$ $\frac{1}{2}$

n	$f^{(n)}(x)$	$f^{(n)}(\frac{5\pi}{4})$
0	$\csc x$	$-\sqrt{2}$
1	$-\csc x \cot x$	$-(-\sqrt{2})(1) = \sqrt{2}$
2	$\csc x \cot^2 x + \csc^3 x$	$(-\sqrt{2})(1)^2 + (-\sqrt{2})^3 = -\sqrt{2} - 2\sqrt{2} = \boxed{-3\sqrt{2}}$ $\frac{1}{2}$
3	$-\csc x \cot^3 x - 5\csc^3 x \cot x$	$-(-\sqrt{2})(1)^3 - 5(-\sqrt{2})^3(1) = \sqrt{2} + 10\sqrt{2} = \boxed{11\sqrt{2}}$ $\frac{1}{2}$

$$-\sqrt{2} + \frac{\sqrt{2}}{1!}\left(x - \frac{5\pi}{4}\right) - \frac{3\sqrt{2}}{2!}\left(x - \frac{5\pi}{4}\right)^2 + \frac{11\sqrt{2}}{3!}\left(x - \frac{5\pi}{4}\right)^3$$

$$= \boxed{-\sqrt{2}}\ \boxed{+\sqrt{2}\left(x - \frac{5\pi}{4}\right)}\ \boxed{-\frac{3\sqrt{2}}{2}\left(x - \frac{5\pi}{4}\right)^2}\ \boxed{+\frac{11\sqrt{2}}{6}\left(x - \frac{5\pi}{4}\right)^3}$$

$\frac{1}{2}$ $\frac{1}{2}$ 1 1

[3][a] $1+e^{-x^2} = 1+\sum_{n=0}^{\infty}\frac{(-x^2)^n}{n!} = 1+1-\frac{x^2}{1!}+\frac{x^4}{2!}-\frac{x^6}{3!}+\cdots$

$= \boxed{2-x^2+\frac{1}{2}x^4-\frac{1}{6}x^6}+\cdots$ $1\frac{1}{2}$

$$\frac{1+e^{-x^2}}{\cos x} = \frac{2-x^2+\frac{1}{2}x^4-\frac{1}{6}x^6+\cdots}{1-\frac{1}{2}x^2+\frac{1}{24}x^4-\frac{1}{720}x^6+\cdots}$$

$$2 \quad +\frac{5}{12}x^4+\frac{2}{45}x^6$$

$1\frac{1}{2}$ $\boxed{1-\frac{1}{2}x^2+\frac{1}{24}x^4-\frac{1}{720}x^6}\ \Big)\ \boxed{2-x^2+\frac{1}{2}x^4-\frac{1}{6}x^6}$

$1\frac{1}{2}$ $\boxed{2-x^2+\frac{1}{12}x^4-\frac{1}{360}x^6}$

$\frac{5}{12}x^4-\frac{59}{360}x^6 \longleftarrow -\frac{60}{360}-\left(-\frac{1}{360}\right)$

1 $\boxed{\frac{5}{12}x^4-\frac{5}{24}x^6}$

$\frac{1}{2}$ $\boxed{\frac{2}{45}x^6} \longleftarrow -\frac{59}{360}-\left(-\frac{5}{24}\cdot\frac{15}{15}\right)$

$= -\frac{59}{360}+\frac{75}{360}$

$= \frac{16}{360}$

$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

$\boxed{2}+\boxed{\frac{5}{12}x^4}+\boxed{\frac{2}{45}x^6}$

[b] $\boxed{\frac{f^{(6)}(0)}{6!}x^6 = \frac{2}{45}x^6}$ $1\frac{1}{2}$

$f^{(6)}(0) = \boxed{\frac{2}{\cancel{45}_{\cancel{9}\,\cancel{3}}} \cdot \overset{2}{\cancel{6}} \cdot \cancel{5} \cdot 4 \cdot \cancel{3} \cdot 2 \cdot 1} = 2 \cdot 2 \cdot 4 \cdot 2 = \boxed{32}$

$\frac{1}{2}$ $\frac{1}{2}$

$$[4][a]\ f(x) = \boxed{\frac{d}{dx}\, x^2 \arctan 2x^3} \quad 1$$

$$= \frac{d}{dx}\, x^2 \sum_{n=0}^{\infty} \frac{(-1)^n (2x^3)^{2n+1}}{2n+1}$$

$$= \frac{d}{dx}\, x^2 \boxed{\sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n+1} x^{6n+3}}{2n+1}} \quad 2$$

$$= \frac{d}{dx} \boxed{\sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n+1} x^{6n+5}}{2n+1}} \quad \frac{1}{2}$$

$$= \sum_{n=0}^{\infty} \frac{d}{dx} \frac{(-1)^n 2^{2n+1} x^{6n+5}}{2n+1}$$

$$= \boxed{\sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n+1} (6n+5) x^{6n+4}}{2n+1}} \quad 1$$

[b] RADIUS OF CONVERGENCE $\boxed{-1 < 2x^3 < 1}$ $\frac{1}{2}$

$$-\frac{1}{2} < x^3 < \frac{1}{2}$$

$$-2^{-\frac{1}{3}} = \boxed{-\frac{1}{\sqrt[3]{2}} < x < \frac{1}{\sqrt[3]{2}}} = 2^{-\frac{1}{3}} \quad \frac{1}{2}$$

$$x = 2^{-\frac{1}{3}}: \boxed{\sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n+1}(6n+5)2^{-2n-\frac{4}{3}}}{2n+1}} \quad 2$$

$$= \boxed{\sum_{n=0}^{\infty} (-1)^n \frac{6n+5}{\sqrt[3]{2}(2n+1)}} \quad \frac{1}{2}$$

$$\frac{1}{2} \quad \boxed{\lim_{n\to\infty} \left| (-1)^n \frac{6n+5}{\sqrt[3]{2}(2n+1)} \right|} = \boxed{\lim_{n\to\infty} \frac{6+\frac{5}{n}}{\sqrt[3]{2}(2+\frac{1}{n})}} = \boxed{\frac{6}{2\sqrt[3]{2}}} \boxed{\neq 0} \quad \frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{2}$$

$$\text{SO } \boxed{\lim_{n\to\infty} (-1)^n \frac{6n+5}{\sqrt[3]{2}(2n+1)} \neq 0} \quad \frac{1}{2}$$

$$\text{SO } \boxed{\sum_{n=0}^{\infty} (-1)^n \frac{6n+5}{\sqrt[3]{2}(2n+1)} \text{ DIV}} \quad (\boxed{\text{DIVERGENCE}}) \quad \frac{1}{2} \quad \frac{1}{2}$$

$$x = -2^{-\frac{1}{3}}: \sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n+1}(6n+5)(-2^{-\frac{1}{3}})^{6n+4}}{2n+1}$$

$6n+4 = 2(3n+2)$ IS EVEN

$$2 \quad = \boxed{\sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n+1}(6n+5)\cancel{(-1)^{6n+4}}^{\,1}\, 2^{-2n-\frac{4}{3}}}{2n+1}}$$

$$\text{IoC} = \boxed{\left(-\frac{1}{\sqrt[3]{2}}, \frac{1}{\sqrt[3]{2}}\right)} \quad \frac{1}{2}$$

$$= \sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n+1}(6n+5)2^{-2n-\frac{4}{3}}}{2n+1} \boxed{\text{DIV}} \quad (\text{SAME AS ABOVE}) \quad \frac{1}{2}$$