4. Find the Taylor Series representation of $f(x)$, centered at the given value of $\cancel{a}$ c.

a) $f(x) = \cos x$, $\cancel{a}$ $c = \pi$

$f(x) = \cos x \qquad f(\pi) = \cos(\pi) = -1$

$f'(x) = -\sin x \qquad f'(\pi) = -\sin(\pi) = 0$

$f''(x) = -\cos x \qquad f''(\pi) = -\cos(\pi) = +1$

$f'''(x) = \sin x \qquad f'''(\pi) = 0$

$f^{IV}(x) = \cos x \qquad f^{IV}(\pi) = -1$

$f^{(5)}(x) = -\sin x \qquad f^{(5)}(\pi) = 0$

$f^{(6)}(x) = -\cos x \qquad f^{(6)}(\pi) = +1$

So,

$$f(x) = \cos x = -1 + 0\cdot(x-\pi) + \frac{1\cdot(x-\pi)^2}{2!} + \frac{0\cdot(x-\pi)^3}{3!} + \frac{-1\cdot(x-\pi)^4}{4!} + \frac{0\cdot(x-\pi)^5}{5!} + \frac{1\,(x-\pi)^6}{6!} + \cdots$$

$$= -1 + \frac{(x-\pi)^2}{2!} - \frac{(x-\pi)^4}{4!} + \frac{(x-\pi)^6}{6!} + \cdots$$

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