

Source:**1 | find taylor series**1.1 | $y = \cos(x)$

$$\begin{aligned}
P_n(x) &= f(0) + \frac{d}{dx}f(0)x + \frac{\frac{d^2}{d^2x}f(0)}{2!}x^2 + \frac{\frac{d^3}{d^3x}f(0)}{3!}x^3 + \dots \\
&= \cos(0) - \sin(0)x + \frac{-\cos(0)}{2!}x^2 + \frac{\sin(0)}{3!}x^3 + \dots \\
&= 1 - 0x - \frac{1}{2!}x^2 + \frac{0}{3!}x^3 + \dots \\
&= 1 - \frac{1}{2!}x^2 + \frac{1}{4!}x^4 + \dots \\
&= \sum_{k=0}^{\infty} \frac{(-1)^k}{(2k)!} x^{2k}
\end{aligned}$$

1.2 | $y = e^x$

$$\begin{aligned}
P_n(x) &= f(0) + \frac{d}{dx}f(0)x + \frac{\frac{d^2}{d^2x}f(0)}{2!}x^2 + \frac{\frac{d^3}{d^3x}f(0)}{3!}x^3 + \dots \\
&= e^0 + e^0x + \frac{e^0}{2!}x^2 + \frac{e^0}{3!}x^3 + \dots \\
&= 1 + x + \frac{1}{2!}x^2 + \frac{1}{3!}x^3 + \dots \\
&= \sum_{k=0}^{\infty} \frac{1}{k!} x^k
\end{aligned}$$