Maclaurin Series

The Maclaurin Series (expansion) is useful for approximating more complicated equations as polynomial equations.

The function and its derivatives must exist at $x = 0$.

General Form

$$f(x) = f(0) + \frac{f'(0)}{1!}x + \frac{f''(0)}{2!}x^2 + \frac{f'''(0)}{3!}x^3 + \cdots$$

Some standard Maclaurin Expansions…

$f(x)$	Maclaurin Expansion	Valid for
e^x	$1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots + \frac{x^r}{r!} + \cdots$	All x
$sinx$	$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots + (-1)^r \frac{x^{2r+1}}{(2r+1)!} + \cdots$	All x
$cosx$	$1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \cdots + (-1)^r \frac{x^{2r}}{(2r)!} + \cdots$	All x
$ln(x+1)$	$x - \frac{x^2}{2} + \frac{x^3}{3} - \cdots + (-1)^{r+1} \frac{x^r}{r} + \cdots$	$-1 < x \leq 1$
$(1+x)^n$		$-1 < x < 1$

Confirm these for yourself.
Find the first three non-zero terms of…

1. $cos2x$
2. $sin\frac{x}{2}$
3. e^{-3x}
4. $(1+x)^n$

Find general term for each of these expansions
State the range of values for which each of these expansions is valid.