$$f(x) = e^x \quad g(x) = x^2$$
$$f(g(x)) = e^{x^2}$$

9.2

25) $e^x = 1 + x + \frac{1}{2!}x^2 + \dots + \frac{1}{n!}x^n + \dots = \sum_{n=0}^{\infty} \frac{1}{n!} x^n$

(a) $e^{x/2} = 1 + \frac{x}{2} + \frac{1}{2!}\left(\frac{x}{2}\right)^2 + \dots + \frac{1}{n!}\left(\frac{x}{2}\right)^n + \dots = \sum_{n=0}^{\infty} \frac{1}{n!}\left(\frac{x}{2}\right)^n$

(b) $\cancel{e^{x/2} - 1 = 1 + \frac{x}{2} + \frac{1}{2!}\left(\frac{x}{2}\right)^2 + \frac{1}{3!}\left(\frac{x}{2}\right)^3 \dots + \frac{1}{n!}\left(\frac{x}{2}\right)^n - 1}$

$$\cancel{\frac{e^{x/2}-1}{x} = \frac{\frac{x}{2}}{x} + \frac{\frac{1}{2!}\left(\frac{x}{2}\right)^2}{x} + \dots \frac{\frac{1}{n!}\left(\frac{x}{2}\right)^n}{x}}$$
$$\cancel{= \frac{1}{2} + \frac{1}{2!}\frac{x}{4} + \frac{1}{3!}\frac{x^2}{8} + \dots +}$$

$$e^x - 1 = \cancel{1} + x + \frac{1}{2!}x^2 + \frac{1}{3!}x^3 + \dots \cancel{-1}$$

$$\frac{e^x - 1}{x} = \frac{x}{x} + \frac{1}{2!}\frac{x^2}{x} + \frac{1}{3!}\frac{x^3}{x}$$
$$= 1 + \frac{1}{2!}x + \frac{1}{3!}x^2 + = \sum_{n=1}^{\infty} \frac{1}{n!} x^{n-1}$$

(c) $\frac{d}{dx} \frac{e^x - 1}{x} = \frac{e^x \cdot x - (e^x - 1)}{x^2}$ $\qquad \frac{d}{dx} \sum_{n=1}^{\infty} \frac{x^{n-1}}{n!}$

$\sum_{n=0}^{\infty} \frac{1}{(n+1)!} x^n$ $\quad = \frac{xe^x - e^x + 1}{x^2}$ $\qquad \sum_{n=1}^{\infty} \frac{(n-1)x^{n-2}}{n!}$

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

9.2

1) $f(x) = \sqrt{1+x^2}$

$g(x) = (1+x)^{1/2}$ $\quad g(0) = 1$
$g'(x) = \frac{1}{2}(1+x)^{-1/2}$ $\quad g'(0) = \frac{1}{2}$
$g''(x) = -\frac{1}{4}(1+x)^{-3/2}$ $\quad g''(0) = -\frac{1}{4}$
$g'''(x) = \frac{3}{8}(1+x)^{-5/2}$ $\quad g'''(0) = \frac{3}{8}$
$g^4(x) = \frac{-15}{16}(1+x)^{-7/2}$ $\quad g^4(0) = -\frac{15}{16}$

$$1 + \frac{1}{2}x^1 + \frac{-\frac{1}{4}}{2!}x^2 + \frac{\frac{3}{8}}{3!}x^3 - \frac{\frac{15}{16}}{4!}x^4$$

$$\boxed{1 + \frac{1}{2}x^2 - \frac{1}{8}x^4} + \cancel{\frac{1}{16}x^6} -$$

11. $\frac{1}{1-x}$ $(1-x)^{-1}$