

### Differentiation - Product Rule

Find  $f'(x)$ .

1.  $f(x) = x^2 \sin x \longrightarrow f'(x) = 2x \sin x + x^2 \cos x$

2.  $f(x) = x^3 \cos x \longrightarrow f'(x) = 3x^2 \cos x + x^3 (-\sin x) = 3x^2 \cos x - x^3 \sin x$

3.  $f(x) = x \tan x \longrightarrow f'(x) = (1) \tan x + x \sec^2 x = \tan x + x \sec^2 x$

4.  $f(x) = x^4 \sec x \longrightarrow f'(x) = 4x^3 \sec x + x^4 \sec x \tan x$

5.  $f(x) = x^5 e^x \longrightarrow f'(x) = 5x^4 e^x + x^5 e^x$

$$6. f(x) = \sqrt{x} e^x \longrightarrow f'(x) = \frac{1}{2} x^{-1/2} e^x + \sqrt{x} e^x = \frac{e^x}{2\sqrt{x}} + \sqrt{x} e^x$$

$$7. f(x) = x \ln x \longrightarrow f'(x) = (1) \ln x + x \left( \frac{1}{x} \right) = \ln x + 1$$

$$8. f(x) = \frac{\ln x}{x} = \frac{1}{x} \ln x = x^{-1} \ln x \longrightarrow f'(x) = -x^{-2} \ln x + x^{-1} \left( \frac{1}{x} \right) = -\frac{\ln x}{x^2} + \frac{1}{x^2}$$

$$9. f(x) = \frac{e^x}{x^3} = \frac{1}{x^3} e^x = x^{-3} e^x \longrightarrow f'(x) = -3x^{-4} e^x + x^{-3} e^x = -\frac{3e^x}{x^4} + \frac{e^x}{x^3}$$

$$10. f(x) = e^x \sin x \longrightarrow f'(x) = e^x \sin x + e^x \cos x$$