Quiz 03 – Version A Solutions

1. (5 points) Find dy/dx for $y = e^{\sin(3x)}$.

Apply the chain rule to the exponential, then to $\sin(3x)$:

$$\frac{dy}{dx} = e^{\sin(3x)}\cos(3x)\cdot 3 = \boxed{3e^{\sin(3x)}\cos(3x)}.$$

Rubric (5 points):

- **2 points:** Differentiate the outer exponential to obtain the factor $e^{\sin(3x)}$.
- **2 points:** Differentiate sine to obtain the factor $\cos(3x)$, retaining its inner argument.
- **1 point:** Include the inner derivative 3 as a factor.

2. (5 points) Let $f(x) = x\sin x$. Find $f''(x)$ and evaluate $f''(\pi/2)$.

By the product rule,

$$f'(x) = \sin x + x\cos x.$$

Differentiate once more, applying the product rule again:

$$f''(x) = \cos x + (\cos x - x\sin x) = \boxed{2\cos x - x\sin x}.$$

Thus

$$f''(\pi/2) = 2\cos(\pi/2) - \frac{\pi}{2}\sin(\pi/2) = \boxed{-\frac{\pi}{2}}.$$

Rubric (5 points):

- **2 points:** Obtain $f'(x) = \sin x + x\cos x$ (1 point for each term, $\sin x$ and $x\cos x$).
- **2 points:** Differentiate both terms of f' correctly to obtain $\cos x + (\cos x - x\sin x)$ (1 point for differentiating the first term; 1 point for correctly differentiating the product term).
- **1 point:** Evaluate at $x = \pi/2$ ($\frac{1}{2}$ point for correct substitution of the exact trig values; $\frac{1}{2}$ point for the simplified result $-\pi/2$).

Grading notes: Accept equivalent correct expressions and methods. Award full credit for correct requested answers even if intermediate work is omitted. For partial credit, award the points supported by the work shown; correct subsequent work after an earlier error can earn its corresponding points. Deduct for the same error only once.