University of Wyoming

MATH 2200-02 – Fall 2026

Quiz 4 – Solutions

Problem 1 (2 points)**.** Find the derivative $f'(x)$ of $f(x) = e^{x^3 \ln x}$.

Solution. By the chain rule, $\frac{d}{dx}\left(e^u\right) = e^u\, u'$ with $u = x^3 \ln x$ (defined for $x > 0$). By the product rule,

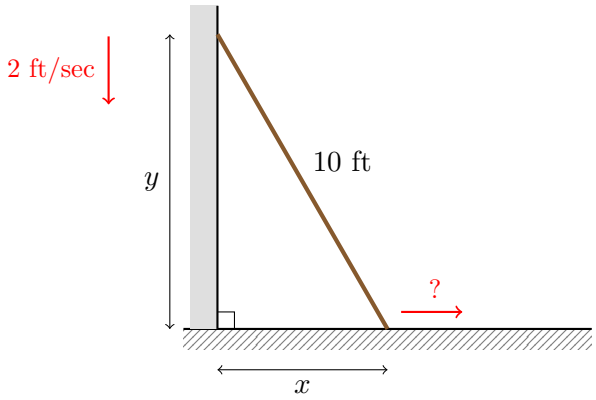
$$u'(x) = 3x^2 \ln x + x^3 \cdot \frac{1}{x} = 3x^2 \ln x + x^2 = x^2\,(3 \ln x + 1)\,.$$

Therefore

$$f'(x) = e^{x^3 \ln x}\, x^2\,(3 \ln x + 1) = x^{x^3}\, x^2\,(3 \ln x + 1)\,, \qquad x > 0,$$

where we used $e^{x^3 \ln x} = \left(e^{\ln x}\right)^{x^3} = x^{x^3}$. Either form is acceptable. □

Problem 2 (2 points)**.** A 10-ft ladder is leaning against a wall. If the top of the ladder slides down the wall at a rate of 2 ft/sec, how fast is the bottom moving along the ground when the bottom of the ladder is 5 ft from the wall?



Solution. Let $x = x(t)$ be the distance from the bottom of the ladder to the wall and $y = y(t)$ the height of the top of the ladder on the wall. Since the ladder, the wall, and the ground form a right triangle with hypotenuse 10 ft, the Pythagorean theorem gives

$$x^2 + y^2 = 100.$$

We are given $\frac{dy}{dt} = -2$ ft/sec (negative since y is decreasing), and we want $\frac{dx}{dt}$ when $x = 5$.

Differentiating both sides with respect to t:

$$2x\,\frac{dx}{dt} + 2y\,\frac{dy}{dt} = 0 \qquad \Longrightarrow \qquad \frac{dx}{dt} = -\frac{y}{x}\,\frac{dy}{dt}.$$

When $x = 5$, we have $y = \sqrt{100 - 25} = \sqrt{75} = 5\sqrt{3}$. Hence

$$\frac{dx}{dt} = -\frac{5\sqrt{3}}{5} \cdot (-2) = 2\sqrt{3} \approx 3.46 \text{ ft/sec}.$$

The bottom of the ladder is moving away from the wall at $2\sqrt{3} \approx 3.46$ ft/sec. □