3. Find the tangent slope to $y = \frac{7^x}{\sin(e^x)}$ at $x = 3$.

$$m = \frac{\sin(e^3)7^3 \ln 7 - 7^3 \cos(e^3)(e^3)}{\sin^2(e^3)}$$

4. Find the tangent line to the curve given by $xy + y = 7^x$ at $(x, y) = (0, 1)$.

$y = ((\ln 7) - 1)x + 1$

5. Find the linearization $L(x)$ to $f(x) = x^3 + 4x$ at $x_1 = 1$. Use it to approximate $f(1.01)$. Also give the differentials dx and dy.

$L(x) = 7(x - 1) + 5$
$f(1.01) \approx L(1.01) = 7(0.01) + 5 = 5.07$
$dx = 0.01; \quad dy = 7(0.01) = 0.07$

6. Estimate $\ln(1.01)$ and $\ln(0.98)$ using linearization at $x = 1$.

$L(x) = x - 1$
$\ln(1.01) \approx L(1.01) = 0.01$
$\ln(0.98) \approx L(0.98) = -0.02$

7. Let the functions $f(x)$ and $g(x)$ be given such that $f(2) = 1,\ \ f'(2) = 3,\ \ g(2) = -1,\ \ g'(2) = 5$.

a) If $y = f(x)g(x) + g(x) - \dfrac{g(x)}{f(x)}$ find the value of the derivative y' at $x = 2$.

$y' = -1$.

b) If $y = \sin(\pi g(x))$ find the value of the derivative y' at $x = 2$.

$y' = -5\pi$

8. A particle is moving along the curve given by $xy + 1 = 2y^3e^{(x-1)}$. At the point (1,1) the x-coordinate is increasing at the rate 5 m/s. Find the rate of change in the y-coordinate.

$y' = -1$

9. A light on a 3 ft pole shines on a 1 inch mouse running away at 2 ft/s. How fast is the tip of the mouse shadow moving when it is 4 ft away?

$y' = \frac{72}{35}$ ft/s

10. A cylindrical tank with radius 5 m is being filled at a rate of 3 m^3/min. How fast is the height of the water increasing?

$h' = \frac{3}{25\pi}$ m/min