1. Determine the derivative of each of the following. Then, evaluate the derivative at the given x-value and then round to two decimal places if possible

a) $y = 4e^{3x}$ at $x = 2$

b) $y = 6xe^{2x^3-1}$ at $x = 2$

c) $y = 4^{2x} + 4^{-2x}$ at $x = -1$

d) $y = 2x \sin 3x$ at $x = \frac{\pi}{4}$

e) $y = \sin(\cos 2x)$ at $x = \frac{3\pi}{4}$

f) $y = 5^{\cos 3x}$ at $x = \frac{\pi}{12}$

g) $y = 3x^{3x}$ at $x = 2$

h) $y = (3x^2 - 2x + 1)^{5x-1}$ at $x = 1$

i) $y = (x+3)^{x-1}$ at $x = 2$

j) $y = (x^2 - 3x + 2)^{2x^2+5}$ at $x = 0$

k) $y = 10x^{4x^2}$ at $x = 2$

l) $y = \log_2(x^2 - 5x + 1)$ at $x = 6$

m) $y = \log_7(4x + 3)$ at $x = 0$

n) $y = \log(4x^3 - 7x + 1)$ at $x = 3$

2. The monthly revenue in thousands of dollars for the sale of x hundred units is given by $R(x) = 50x^2e^{-0.5x} + 60$. How many units should be produced for maximum revenue and what is the maximum revenue?

3. The percent of people spreading a rumour after t hours is $P(t) = 100(e^{-2t} - e^{-5t})$. What is the highest percent of people spreading the rumour?

4. Same question as #3, but $P(t) = 100te^{-2t}$

5. Determine the maximum value of the function $f(x) = 2xe^{-0.2x^2}$, $x > 0$

6. Determine the equation of the tangent line to $y = \frac{6e^x}{2 + e^{2x}}$ at $x = 0$ (give exact values)

7. Determine the equation of the tangent line to $y = x^2e^x$ at $x = 3$ (give exact values)

8. The number of bacteria in a culture is $N(t) = 5000(60 + te^{-t/60})$ where t is the number of minutes. Determine the largest number of bacteria in the culture (rounded)

9. Determine the maximum value of the function $y = 3^{4x} - 4^{3x}$ rounded to 4 decimal places

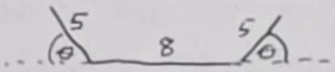
10. A population of bacteria is given by $N(t) = 80000(1.6)^{-t}$, where t is the number of years, At what rate is the population decreasing at 2 years?

11. Determine the equation of the tangent to $y = 3^{-x^2}$ at $x=2$

12. Determine the maximum and minimum values of $y = 2\cos x - \sin x$

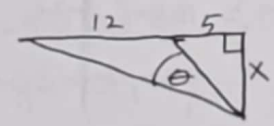
13. A thin rigid pole is carried horizontally around a 90° corner where the hallways are 5m wide and 7m wide, Determine the maximum length of the pole

14. Determine the maximum area of this trapezoid ⟶



15. Determine a) $\lim_{h\to 0} \frac{\sin(x+h) - \sin x}{h}$ b) $\lim_{h\to 0} \frac{\ln(x+h) - \ln x}{h}$

16. What value of x maximizes θ? ⟶



17. If $f(x) = \sin x \cos 3x$, evaluate $f''(\frac{\pi}{3})$ (exact value)

18. Determine the equation of the tangent line to $y = \csc 2x$ when $x = \frac{\pi}{8}$

19. Find the equation of the tangent line to $y = \frac{\ln x}{x}$ at $x=1$

20. Determine $f''(0)$ given $f(x) = e^{-x}\cos 2x$

21. Determine the minimum value of $f(x) = 2x^2 - \ln x$, $x > 0$ (exact and rounded to 2 decimal places)