

MATH 104 Workshop 4
The Derivative and Rules of Differentiation

If you did not attend the workshop, please submit answers to questions 2, 3, and 5.

1. Carefully state the definition of the derivative of a function $f(x)$ at a point $x = a$. Use this definition to compute $f'(2)$ for $f(x) = \sqrt{4x + 1}$. (Do not use the rules of differentiation to do this calculation.)
2. Find the equation of the straight line that is tangent to $y = 2^x$ and passes through the point $(1, 0)$.
3. Suppose two curves $y = f(x)$ and $y = g(x)$ intersect at a point (x_0, y_0) . How might you define the angle between these two curves at this intersection point?
4. Differentiate:
 - (a) $f(x) = \frac{x^2 + \sqrt{x} + 5}{2 - x}$
 - (b) $f(x) = e^{\cos(x^2)}$
 - (c) $f(x) = xe^{2x} \cos(4x)$
5. Find all values of a and b for which

$$f(x) = \begin{cases} \sin(x) & x \leq 0 \\ ax + b & x > 0 \end{cases}$$

is differentiable everywhere.