

1. (10 pts) Use **the definition of the derivative** to calculate the derivative of the function

$$f(x) = \frac{4}{x}.$$

2. (5 pts) Give an example of a continuous function that is not differentiable at $x = 1$ and $x = 2$.
3. (15 pts) In the following problems, *evaluate all derivatives fully but do not simplify*.

(a) Calculate $\frac{d}{dx} (cx^c + c^2x^{-c})$, where c is a non-zero constant.

(b) Let $f(r) = \frac{r^3 + 1}{-5 - r^4}$. Calculate $f'(r)$.

(c) Determine y' where $y = \frac{1}{\sqrt{2 - 3x}}$.

4. (10 pts) Give the slope of the tangent line to the curve $x^3 - 3xy + y^2 = -1$ at the point $(1, 2)$.
5. (10 pts) You are an aluminum can producer. If the cost of producing x aluminum cans is $C(x) = \sqrt{x} + 0.01\sqrt{x^3}$ dollars, then estimate the cost of producing the 101st aluminum can. (Justify your answer.)
6. (10 pts) A spherical snowball is melting so that its surface area is decreasing at $1 \text{ cm}^2/\text{min}$. At what rate is the snowball's radius decreasing when the snowball's diameter is 10 cm? The surface area of a sphere and its radius are related by the formula $SA = 4\pi r^2$.